2019

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M. Miller

S. Kojetin

L. M. Scibora

reclined position [75° hip flexion, to facilitate femoral nerve stimulation] pre-exercise, after the 2-hr run and post-time trial as follows: voluntary isometric quad strength was measured on the Biodex with the knee flexed 60°, and with superimposed peripheral magnetic stimulation [PMS] of the femoral nerve to determine central activation [CAR]. PMS was also applied in a 3-second pulse train on a relaxed muscle to measure peripheral fatigue. Changes in strength and in metabolic measures were analyzed with repeated measures ANOVA.
RESULTS: Following running, voluntary strength declined by ~16% in both sexes [effect of time p<0.001; sex X time p=0.206]. CAR also decreased in both men and women [effect of time p=0.020, time X sex p=0.762]. PMS-stimulated forces, our measure of peripheral fatigue, were unchanged after running: there was no effect of time [p=0.10] in men or women [time X sex, p=0.322]. Substrate use and RPEs did not differ between sexes.
CONCLUSIONS: We found that both sexes fatigued similarly after a 2-hr run plus a 2-km time trial, and that all of the fatigue was central in nature. While women may be more fatigue-resistant than men, those differences might not be apparent until a greater duration of running is engaged in, e.g. ultramarathon distances.

1590 Board #4 May 30 1:30 PM - 3:30 PM

The Effects Of Swimming On Bone Density In Female Collegiate Swimmers.

Margaret Miller, Sarah Kojetin, Lesley M. Scibora. *University of St. Thomas, St. Paul, MN.*

(No relationships reported)

Swimming provides numerous health benefits, but as a non-weight bearing activity research suggests it provides no constructive benefits on bone strength at dual energy x-ray absorptiometry (DXA)-measured hip and lumbar spine sites. However, little research has focused on skeletal sites stressed during swimming such as the upper arm.
PURPOSE: To determine potential site-specific bone strength adaptations at the humerus among collegiate swimmers compared to sedentary controls.
METHODS: Bone geometry and strength were assessed by peripheral quantitative computed tomography (pQCT) in ten collegiate female swimmers (BMI 23 kg/m^2; mean 13.9±1.5 pool hours/week) and ten sedentary controls (BMI 24 kg/m^2; <150 minutes/week of physical activity) ages 18-23 years. Total volumetric bone mineral density (vBMD, mg/mm^3) and total bone area (ToA, mm^2) were assessed at the distal (4%) tibia. Cortical bone area (CoA, mm^2), cortical density (vBMD), cortical thickness (CoTh, mm), bone bending strength (polar strength-strain index (SSIp, mm^3) were measured at the midshaft (66%) tibia, humerus (50%), and radius 33% sites. Using DXA areal BMD (g/cm^2) was assessed at the hip, humerus and radius sites.
RESULTS: There were no significant between-group differences in DXA outcomes at any site. PQCT-derived outcomes are presented in Table 1. At the 66% tibia site the control group had a 14.8% greater CoA and 6.1% greater CoD compared to swimmers (both *p*<0.05). However, no significant bone strength differences were found at the humerus, radius, or distal tibia sites.

Table 1: pQCT-derived Outcomes.

	Swim	Control	Significance (*p*<0.05)
Radius 33%			
Cortical Area (CoA, mm^2)	78.4±3.4	85.0±3.6	0.215
Cortical Density (vBMD, mg/cm^3)	1191.3±8.6	1163.6±9.1	0.051
Cortical Thickness (CoTh, mm)	3.1±0.1	3.5±0.1	0.097
SSIp (mg/mm^4)	215.4±13.2	227.0±14.0	0.574
Humerus 50%			
Cortical Area (CoA, mm^2)	178.0±6.8	172.5±7.2	0.596
Cortical Density (vBMD, mg/cm^3)	1170.5±12.3	1173.0±13.0	0.890
Cortical Thickness (CoTh, mm)	4.1±0.1	4.0±0.2	0.856
SSIp (mg/mm^4)	886.0±55.2	868.5±58.4	0.835
Tibia 66%			
Cortical Area (CoA, mm^2)	270.1±13.5	313.2±14.2	0.045
Cortical Density (vBMD, mg/cm^3)	1074.4±8.0	1143.1±8.4	0.000
Cortical Thickness (CoTh, mm)	4.6±0.2	5.0±0.2	0.179
SSIp (mg/mm^4)	2121.5±134.2	2178.6±134.3	0.764
Tibia 4%			
Total Area (ToA, mm^2)	139.4±25.4	141.6±26.9	0.953
Total Density (vBMD, mg/cm^3)	507.0±35.5	538.1±38.5	0.571

CONCLUSION: Our results showed that swimming does not appear to improve bone microarchitecture or strength, even at loaded sites such as the humerus. This data suggests that swimming should be supplemented with weight-bearing and resistance exercises to preserve bone strength. Future research should investigate whether site-specific bone adaptations occur at skeletal sites not yet measured.

1591 Board #5 May 30 1:30 PM - 3:30 PM

Sex Differences in Recovery from Extreme and Severe Intensity Exercise

Andrew M. Alexander, Shane M. Hammer, Kaylin D. Didier, Lillie M. Huckaby, Camryn N. Webster, Thomas J. Barstow, FACSM. *Kansas State University, Manhattan, KS.*
Email: andrewa06@ksu.edu

(No relationships reported)

Previous protocols investigating neuromuscular fatigue have typically discarded the first 2 of 6 electrical stimulation sets in recovery and have reported the average of the remaining force values. However, our lab has recently shown that central (as measured by maximal voluntary contraction force, MVC; and voluntary activation, VA) and peripheral fatigue (as measured by potentiated twitch force, Q_{tw}) had significantly recovered within 90 s following extreme intensity exercise and would otherwise be missed using contemporary protocols.
PURPOSE: The purpose of this study was to test the hypothesis that MVC, VA, and Q_{tw} immediately following task failure of extreme intensity exercise would be significantly lower than those measured 2 min into recovery in both men and women, while remaining suppressed following severe exercise.
METHODS: Two men (26 ± 5 yrs; 109 ± 9 kg; 179 ± 1 cm) and two women (23 ± 2 yrs; 55 ± 3 kg; 159 ± 1 cm) performed 2 intermittent isometric knee extension tests to exhaustion at 40% (severe intensity) and 70% (extreme intensity) MVC in random order. Neuromuscular measurements were made every 30 s beginning immediately after task failure for a total of 6 sets. The last two MVC, VA, and Q_{tw} were averaged and compared to the first measurement immediately following task failure using paired t-tests.
RESULTS: Q_{tw} and MVC significantly decreased following severe and extreme exercise (p<0.01). However, VA was not different across severe or extreme exercise. VA was not different across recovery following severe or extreme exercise. MVC was not different following severe, however, had increased following extreme (p=0.02) exercise. Q_{tw} was significantly recovered after severe (p<0.01) and extreme (p<0.02) exercise. Further, qualitative analysis suggests women may be able to recover MVC and Q_{tw} faster than men following extreme exercise, while these differences may not be evident following severe exercise.
CONCLUSIONS: These current data suggest central fatigue (as measured by VA) does not significantly impact exercise tolerance during severe or extreme exercise. Importantly, these data suggest that the measurements typically used to represent the condition of the muscle are taken too far post-exercise such that much of the recovery of the muscle has already occurred, especially following extreme exercise.