The lungs have an intimate relationship with the heart. They are hemodynamically linked in series, accepting nearly all of the cardiac output, share a common surface area, compete for space in the thoracic cavity, are exposed to similar intrathoracic pressures and are neurally and humorally linked. Thus, as the heart remodels and function changes in patients with forms of chronic heart failure, the lungs become an important part of the heart failure syndrome. The interdependence is enhanced with exercise. This symposium will highlight current knowledge on the influence of heart failure on the pulmonary system and their interdependence at rest and during exercise.

2032 Chair: Sophie Lalande. The University of Texas at Austin, Austin, TX.

(No relevant relationships reported)

Combined pre- and post-capillary pulmonary hypertension (CpcPH) develops in 10-40% of heart failure (HF) patients and is a powerful predictor of short-term mortality. However, the mechanisms that underpin the pathophysiological development of CpcPH in HF remain elusive. In addition, the impact of CpcPH on the pulmonary haemodynamic response to exercise in HF requires further investigation. Purpose: To determine 1) the relationship between systemic oxygen levels and the presence of CpcPH; and 2) the impact of CpcPH on the pulmonary haemodynamic response to exercise in HF patients. Methods: Thirty-nine HF patients undergoing right-heart catheterisation were studied. Blood was drawn for the determination of PaO2, SaO2, PvO2, SvO2, and vasoactive neurotransmitters. Pulmonary arterial and wedge pressure (PAP; PWP), transpulmonary pressure gradient (TPG; PAP - PWP) and cardiac output (Q) were assessed at rest and throughout exhaustive incremental exercise. Results: Post-catheterization, patients were classified as having no PH (n = 11), isolated post-capillary PH (IpcPH) (n = 11), or CpcPH (n = 17). At rest: PaO2 and PvO2 were lower in CpcPH compared to no PH and IpcPH (65 ± 9 vs 78 ± 11 mmHg and 75 ± 14 mmHg; 29 ± 4 vs 36 ± 3 mmHg and 33 ± 2 mmHg; P < 0.05). Also, SaO2 and SvO2 were lower in CpcPH vs no PH (93 ± 3 % vs 96 ± 3%; 51 ± 11 % vs 68 ± 4%; P < 0.05). TPG was inversely related to PaO2, PvO2, SaO2, and SvO2 in the CpcPH only (r = -0.55; P < 0.05). Similarly, plasma endothelin-1 correlated with PaO2, PvO2, SvO2 (r = -0.495) and TPG (r = -0.662) (P < 0.05) in CpcPH only. With exercise: At peak exercise, mean PAP (mPAP) and mean PWP (mPWP) were greater in CpcPH compared to no PH and IpcPH. The slope of the mPAP-Q and mPWP-Q relationship during exercise was greater in CpcPH vs IpcPH vs no PH (mPAP-Q: 4.2 ± 3.2 vs 4.1 ± 3.9 vs 2.6 ± 1.7 mmHg/L/min; mPWP-Q: 4.2 ± 1.4 vs 3.3 ± 1.2 vs 2.9 ± 1.5 mmHg/L/min); however, only the differences between no PH and IpcPH were statistically significant. Conclusion: 1) Systemic hypoaxemia may play a role in the development of CpcPH in HF, potentially via a hypoxia-induced increase in endothelial release of the vasoconstrictor endothelin-1; and 2) the development of CpcPH is associated with greater pulmonary vascular pressures and a steeper pulmonary vascular pressure-to-Q relationship in response to exercise in HF patients.
afferent feedback which can lead to high ventilation to carbon dioxide production (VE/VCO2) slope. Low peak oxygen consumption (VO2 peak) and high VE/VCO2 slope are strongly associated with mortality in patients with HF. PURPOSE: This study examined the influence of muscle mass on low VO2 and the change in VE/VCO2 with afferent neural block during exercise in HF. METHODS: 17 participants (9 HF (60±6 yrs, mean±SD) and 8 controls (CTL) (63±7 yrs)) completed 3 experimental sessions. Session 1: peak exercise test on a cycle ergometer to volitional fatigue and dual energy x-ray absorptiometry. Sessions 2 and 3: 5 min of steady-state exercise on a cycle ergometer (65% of peak power) randomized to a lumbar injection of fentanyl (afferent blockade) or placebo. Ventilation (VE) and gas exchange (oxygen consumption, VO2; carbon dioxide production, VCO2) were measured. RESULTS: Peak work and VO2 were lower in HF (p<0.05). Leg fat was greater in HF (34.4±3.0 vs. 26.3±1.8% of body mass, respectively, p<0.05). VCO2 slope was reduced in HF during afferent blockade compared with CTL (−18.8±2.7 vs. −1.4±0.2%, respectively, p<0.02). The reduction in VE/VCO2 was positively associated with leg muscle mass (r2=0.58, p<0.01) and negatively associated with leg fat mass (r2=0.73, p<0.01) in HF. In addition, the reduction in VE/VCO2 was also positively associated with arm, trunk and total muscle mass (p<0.01). Importantly, there was a strong relationship between peak VO2 and the reduction in VE/VCO2 slope in HF (r2=0.81, p<0.001), but not CTL. CONCLUSIONS: HF patients with the highest fat mass, least leg muscle mass and lowest peak VO2 had the greatest improvement in VE/VCO2 with afferent blockade. Both muscle mass and fat mass are important contributors to ventilatory abnormalities and strongly associated to improvements in VE/VCO2 slope with locomotor afferent inhibition in HF. This indicates a strong link between muscle atrophy, skeletal muscle afferent activation and ventilatory control in HF.

RESULTS: To successfully complete the APT candidates must achieve a 45 min cutoff with a finishing time of 41.8 ± 2.1 min, the non-passers had a mean time of 47.7 ± 2.7 min. Non-passers were 77% female and 23% male. The VO2peak values of the passing and non-passing groups were 49.4 ± 7.2 and 42.6 ± 9.6 mL/kg·min⁻¹, respectively; the study range was 62.1 to 30.8 mL/kg·min⁻¹. HR, whether expressed as a fraction of the subject’s maximum rate (passers = 81.2 ± 17.1 and non-passers = 79.9 ± 12.7% of HR reserve) or as the fraction of the HR reserve (passers = 68.0 ± 7.9 and non-passers = 67.7 ± 15.3% of HR reserve) were not different between the groups. Regression of VO2peak on completion time yielded a negative relationship (R²=0.45). In contrast, the HR responses and completion time were consistent among the participants (R² = 0.01 for both % of HRpeak and % of HR reserve). CONCLUSION: To successfully complete the APT candidates must achieve a HR reserve of 68% or less while maintaining a walking speed of 1.8 m s⁻¹. These data suggest that monitoring HR during load carriage may be used to identify candidates with adequate and inadequate pre fire season readiness.
Stair climbing in structural fires is a common task for firefighters. Firefighters also frequently have to ascend the stairs while carrying various equipment. The physical factors related to performance on a timed stair climb task are unclear. As a result, there is a lack of evidence to guide training programs for firefighter recruits that target the development of physical factors associated with performance on this task.

PURPOSE: To determine the physical factors that are associated with performance during a timed stair climbing task in firefighter recruits.

METHODS: 17 male firefighter recruits (20.4 ± 0.5 yrs, 178.5 ± 5.5 cm, 83.7 ± 8.7 kg) voluntarily participated to complete a battery of physical fitness and performance tests including: estimated body fat percentage (%Fat) via skinfold assessment; estimated one-repetition maximum squat (Squat) and bench press (Bench); seated weighted ball chest pass (Pass); 2-minute maximal push-up test (Push); estimated maximal aerobic capacity (VO\textsubscript{2max}) via a submaximal step-test; functional movement quality via a movement efficiency screen (MES); and time to complete a 5-story tower climb (Tower\textsubscript{tmax}). Heart rate (HR) was recorded immediately after the step-test (HR\textsubscript{step}), tower-climb (HR\textsubscript{tower}), Squat, Bench, and Pass data were normalized to body mass (kg). Push data were normalized to the maximum number possible (80). Bivariate correlations were used to determine the relationship between Tower\_time and all the physical fitness and performance factors measured. RESULTS: Statistically significant (P < 0.05) correlations were identified between Tower\_time and %Fat (r = -0.563, P = 0.019), Bench (r = -0.571, P = 0.017), Pass (r = -0.549, P = 0.023), Push (r = -0.532, P = 0.028), VO\textsubscript{2max} (r = -0.560, P = 0.019), HR\textsubscript{step} (r = -0.611, P = 0.009), and HR\textsubscript{tower} (r = -0.638, P = 0.002). Non-significant (P ≥ 0.05) correlations were identified for Squat (r = 0.448, P = 0.072) and MES (r = 0.353, P = 0.165). CONCLUSIONS: Performance during a maximal tower climb task was related to fitness (%Fat and VO\textsubscript{2max}), as well as upper body strength (Bench), power (Pass), and endurance (Push), but not lower body strength (Squat) or functional movement quality (MES). Further, those who performed better on the tower climb had a lower HR after the step-test and a higher HR after the tower climb test.

Sudden cardiac death is the cause of nearly half of on duty fatalities among firefighters. Although firefighters endure strenuous occupational duties, they often have sub-standard levels of fitness, and are at risk for cardiovascular disease (CVD). It is unclear if muscular strength provides a protective effect, independent of cardiorespiratory fitness (CFR). PURPOSE: The purpose of this study was to examine the influence of isokinetic strength on CVD risk factor characterization in overweight and obese career firefighters, prior to and after accounting for CFR. METHODS: Forty-four overweight and obese male firefighters [Mean ± SD; Age: 36.9 ± 7.1 yrs; Stature: 180.1 ± 7.0 cm; Body mass: 107.9 ± 19.8 kg; BMI: 33.1 ± 4.7 kg/m\textsuperscript{2}] performed three maximal concentric isokinetic leg extensions on a calibrated isokinetic dynamometer at slow (1.05 rad·sec\textsuperscript{-1}; PT\textsubscript{slow}) and fast (4.19 rad·sec\textsuperscript{-1}; PT\textsubscript{fast}) velocities, in a randomized order. Peak torque was normalized to body mass for both velocities. Cardiac risk was determined based on published cutoffs for systolic blood pressure, total cholesterol, high-density lipoproteins, low-density lipoproteins, triglycerides, and trunk fat/limb fat ratio. Firefighters were characterized into three cardiovascular risk profiles (≤1 [n=14], 2 [n=16], ≥3 [n=14] risk factors). A non-exercise prediction model including age, percent body fat from dual-energy X-ray absorptiometry, and self-reported exercise status from a questionnaire was used to calculate CFR. Two separate one-way analyses of variance (ANOVA) were used to evaluate potential differences in PT\textsubscript{slow} and PT\textsubscript{fast} between the two groups. Two separate analyses of covariance (ANCOVA) were used to examine whether PT\textsubscript{slow} and PT\textsubscript{fast} adjusted for CFR, differed between the three groups. An alpha level was set at \(P \leq 0.05\) for all analyses. RESULTS: There were no differences between groups for PT\textsubscript{slow} or PT\textsubscript{fast} prior to (P = 0.319; P = 0.337) or after (P = 0.054; P = 0.191) accounting for CFR, respectively. CONCLUSIONS: These findings suggest that isokinetic muscular strength does not provide a protective
effect from CVD risk factor characterization in this sample of overweight and obese male firefighters. FUNDING: Supported in part by a Junior Faculty Award from UNC-Chapel Hill.

2056 Board #7 June 1 9:30 AM - 11:30 AM The Influence of Age and Adiposity on Functional Balance Performance in Career Firefighters Jacob A. Mota1, Timothy J. Barnette1, Gena R. Gerstner2, Andrew J. Tweedell3, Craig R. Kleinberg2, Hayden K. Giuliani1, Eric D. Ryan1. 1University of North Carolina at Chapel Hill, Chapel Hill, NC. 2Army Research Laboratory, Aberdeen Proving Ground, MD. 3Under Armour, Baltimore, MD. (Sponsor: Abbie Smith-Ryan, FACSM) (No relevant relationships reported)

Slips, trips, and falls (STF) are one of the primary causes of non-fatal injuries in firefighters, incurring a large economic burden. Laboratory based measures of functional balance may help identify key risk factors for STF injuries.

PURPOSE: The purpose of the current investigation is to examine the impact of age and adiposity [body mass index (BMI) and percent fat (%BF)] on a functional balance assessment in career firefighters.

METHODS: Forty-nine healthy career firefighters (mean ± SD age = 35 ± 8 yrs; stature = 178.72 ± 7.99 cm; mass = 93.76 ± 21.85 kg; BMI = 29.11 ± 5.34 kg/m²; %BF = 25.22 ± 5.34%) volunteered to participate in this study. Data were collected over two separate visits. The first visit required participants to arrive to the laboratory following a four-hour fast prior to a dual energy x-ray absorptiometry scan to estimate %BF and be familiarized with the functional balance assessment. On the subsequent visit, participants completed the assessment for time while wearing their personal protective equipment and a self-contained breathing apparatus. The task required firefighters to step down from a raised platform, walk across a narrow beam, pass beneath an overhead obstacle (at 75% of their height), and step up to a final raised platform. The task was repeated while walking backwards as fast as possible. Each participant performed five trials that were digitally recorded to account for minor (i.e. foot contact with the ground) and major errors (i.e. overhead obstacle falls) with a minute rest between each to create a performance index (PI). Pearson product-moment correlation coefficients were used to examine the relationship between PI and age, BMI, and %BF with an alpha level set at 0.05.

RESULTS: There was a significant relationship between PI and age (r = 0.406; P = 0.004) and %BF (r = 0.401; P = 0.004), but not BMI (r = 0.242; P = 0.093).

CONCLUSION: The results from the present study demonstrated that increased age and %BF were associated with poorer functional balance performance. These findings may highlight key risk factors that may contribute to an increased risk of STF injuries. Lastly, %BF may be a more sensitive measure of adiposity than BMI when identifying STF risk factors. GRANT FUNDING: National Institute of Occupational Safety and Health (T42OH008673) (No relevant relationships reported)}
with a hand-held dynamometer. Ability to perform ADL functions were self-reported. Date of death was identified by the National Death Index and exit interviews. Separate covariate-adjusted hierarchical logit models were used to examine the association between HGS and each ADL outcome. Discrete covariate-adjusted Cox models were used to analyze the association between HGS and all-cause mortality independent of, and in combination with, each ADL outcome.

RESULTS: Every 5-kilogram increase in HGS was associated with decreased odds for the following ADL limitations: 9% (95% confidence interval (CI): 0.89, 0.93) for bathing, 6% (CI: 0.89, 0.96) for stair climbing, 9% (CI: 0.89, 0.93) for walking, 6% (CI: 0.92, 0.96) for dressing, 12% (CI: 0.84, 0.91) for eating, and 4% (CI: 0.94, 0.98) for toileting. The presence of a bathing, transferring, walking, dressing, or eating ADL limitation was associated with a 1.20 (CI: 1.19, 1.21), 1.04 (CI: 1.03, 1.05), 1.21 (CI: 1.20, 1.22), 1.02 (CI: 1.01, 1.03), 1.14 (CI: 1.13, 1.15), and 1.14 (CI: 1.13, 1.15) higher hazard for mortality, respectively. CONCLUSIONS: HGS was associated with reduced odds for each ADL limitation, which in turn, decreased the hazard for mortality in older adults. These findings provide insights into how preserving strength decelerates the disabling process by identifying which ADL functions are most impacted by muscle strength and the subsequent time to mortality for each ADL limitation.

2061 Board #4 June 1 9:30 AM - 11:30 AM

Defining Gender-specific Cut-off Points Of Lower Extremity Muscle Strength For Predicting All-cause Mortality Among Us Older Adults

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(No relevant relationships reported)

Aging-related loss of muscle strength is an important predictor of mortality; but few studies have defined appropriate cut-off point of muscle strength in relation to mortality in a nationally representative population. PURPOSE: We aimed to explore the optimal cutoff values of lower extremity muscle strength (LMS) for predicting all-cause mortality in a nationally representative sample of US older adults from the National Health and Nutrition Examination Survey (NHANES). METHODS: Data sources included the NHANES1999-2002 with public-use 2011 linked mortality files, which comprised 2,209 men and 2,240 women aged 50 years and older with complete data of knee extension strength measurements. Weighted multivariable logistic regression models were used to account for multistage stratified and clustered sampling. All models were adjusted for age, race, BMI, muscle mass, cigarette smoking, alcohol use, education, leisure time physical activity, sedentary time, and comorbidities. Receiver operating characteristic curves (ROC) and Youden’s J statistic were used to identify the gender-specific cutoff points. The validation of the optimal cutoff points for predicting all-cause mortality was internally assessed using bootstrap sampling method. RESULTS: Overall, there were nonlinear “L” shaped associations between LMS and all-cause mortality in men and women, separately. ROC curves showed that LMS appeared to provided additional predictive values beyond traditional risk factors with (c statistics: 0.94 (0.93-0.95) in men and 0.96 (0.94-0.98) in women) and without muscle mass (c statistics: 0.93 (0.92-0.95) in men and 0.96 (0.95-0.97) in women) in predicting all-cause mortality. Ten candidate gender-specific cutoff points of LMS, which had the highest Youden’s J Index, were identified. In the multivariable logistic regression models the cutoff points were determined at 266newtons for men and 221newtons for women, which were the lowest cutoff points significantly associated with all-cause mortality. Internal validation using the bootstrap method with 500 sex-stratified replications revealed no apparent overfitting problem. CONCLUSIONS: Optimal cutoff points of LMS independent of muscle mass may help us to better assess and promote musculoskeletal fitness in terms of health outcome in older adults.

2062 Board #5 June 1 9:30 AM - 11:30 AM

Strength Training versus Aerobic Exercise in Relation to Cause-Specific Mortality

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(No relevant relationships reported)

BACKGROUND: Physical activity guidelines recommend that all adults engage in at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity physical activity (MVPA) per week, and also state that adults should engage in muscle-strengthening activity (MSA) two or more times per week. While many studies have examined the association between aerobic MVPA and mortality, few have examined the association between MSA independent of or in combination with aerobic MVPA and mortality.

PURPOSE: To examine the role of MSA in relation to mortality independent of, and in combination with, MVPA.

METHODS: Data from 72,440 men and women enrolled in the Cancer Prevention Study-II Nutrition Cohort who completed a lifestyle and medical survey (including information on MVPA and MSA) in 2001 were available for analysis. Multivariable Cox proportional hazards regression modeling was used to compute hazard ratios (HR) and 95% confidence intervals (CI) to examine the association between MSA (none versus any) and total mortality. In addition, effect modification by MVPA (<8.75, 8.75-<17.5, and 17.5+ MET-hours per week) and body mass index (BMI, kg/m2: normal weight 18.5-24.9, overweight 25.0-29.9, obese 30.0+) was examined.

RESULTS: During 12 years of follow-up (2001-2013), 18,023 deaths occurred. After adjusting for MVPA and other potential confounders, engaging in any MSA was associated with a modest, albeit statistically significant, lower risk of total mortality compared to no MSA (HR=0.93, 95% CI 0.89-0.98). Associations were similar when examining cardiovascular disease and cancer-specific mortality. There was no evidence of effect modification by MVPA (interaction p=0.66). The association between MSA and mortality was limited to normal weight individuals (HR=0.88, 95% CI 0.83-0.94), with no association among overweight (HR=0.97, 95% CI 0.90-1.05) or obese (HR=1.03, 95% CI 0.91-1.17) individuals (p for interaction=0.05).

CONCLUSIONS: Engaging in any MSA as part of a physical activity regimen is associated with a modest mortality benefit, regardless of aerobic MVPA participation. MSA may have a greater reduction in risk of normal weight vs overweight or obese individuals.

Background: Older survivors experience physical deterioration from aging and cancer treatment. Strength training (ST) may mitigate symptoms but is underutilized. The extent to which physical limitations from chronic conditions (“multimorbidity”) affect ST participation in older survivors is not well known. The purpose of this paper is to: 1) describe ST participation among older cancer survivors (≥55 years) by cancer site and; 2) assess the relationship of multimorbidity and ST in older cancer survivors.

Methods: We analyzed data from older survivors (n=485), identified from the Pennsylvania Cancer Registry, who were mailed a BRFSS-based questionnaire. Per ACSM guidelines, we operationalized ST participation as ≥2 sessions/week. We created age-groups (e.g., 55-64, 65-74, 75+) and a composite score of 7 common conditions (e.g., COPD, heart disease) to assess multimorbidity. Logistic regression estimated the association of demographic and behavioral risk factors (e.g., multimorbidity) with ST participation.

Results: Most respondents were female (62%), older (mean 69 years; range 55-95 years) and represented diverse cancer sites, including breast (n=106), gynecologic (n=99), prostate (n=119), colorectal (n=90) and lung (n=71) cancer survivors. ST participation was generally low; 75% of survivors reported no ST. Among those who reported doing ST, survivors reported a mean ST frequency of 2.8 times/week (SE 2.8; CI 2.5-3.8), varying by cancer site/age. Gynecologic (OR=0.10, p<0.05; CI 0.107-1.01) and prostate cancer survivors (OR=0.10, p<0.05; CI 0.01-0.95) were less likely to report doing ST than breast cancer survivors. We observed that older survivors with 3 comorbid conditions were less likely (OR=0.23, p=0.10; CI 0.43-1.32) than survivors with fewer conditions to do ST, controlling for covariates.

Conclusion: Uptake of recommended ST is suboptimal in older survivors. Older gynecologic and prostate survivors, and those with greater multimorbidity (i.e. score>3) may have greater difficulty achieving recommended ST than survivors of other sites or with less comorbidity. Designing interventions for survivors with unique barriers, such as gynecologic and prostate cancer survivors and those with greater multimorbidity, may help these older survivors to use ST to improve symptoms and quality of life.
2064  Board #7  June 1 9:30 AM - 11:30 AM  
**Muscle Strength And Prevalence Of Diabetes, A Cross-sectional Study Among Japanese Men**  
Rumi Miyamoto1, Susumu S. Sawada, FACSM2, Yoko Gando2, Munehiro Matsushita1, I-Min Lee, FACSM3, Steven N. Blair, FACSM3, Shingo Muranaga1, Yumiko Osawa1, Kaori Ishii1, Kohichiro Oka1, Kameda Medical Center, Kamogawa, Chiba, Japan. 1National Institutes of Biomedical Innovation, Health and Nutrition, Tokyo, Japan. 2Dokkyo Medical University, Tochigi, Japan. 3Harvard Medical School, Boston, MA. 4University of South Carolina, Columbia, SC. 5Waseda University, Saitama, Japan.  

Purpose: To investigate the relationship between muscle strength measured by a very simple one-leg-stand-up (from a 40cm high seat) test and the prevalence of diabetes among Japanese men.

Methods: This cross-sectional analysis was conducted in 1,674 Japanese men [median (interquartile range) age 61 (55-67) years] who completed health examinations and a one-leg-stand-up test. Smoking and drinking habits were collected via a self-administered questionnaire. The prevalence of diabetes, defined as fasting plasma glucose ≥126 mg/dL and/or hemoglobin A1c ≥6.5% and/or self-reported physician-diagnosed diabetes, was evaluated. Odds ratios and 95% confidence intervals for the prevalence of diabetes were obtained using logistic regression models to assess the relationship between muscle strength and the prevalence of diabetes.

Results: In total, 187 participants had diabetes, and 467 participants could not stand up from a 40cm high seat. Using men who could stand up as reference, the age-adjusted odds ratio of diabetes for men who could not stand up was 1.44 (1.06-1.94). After adjustment for age, smoking and drinking, the multivariable odds ratio was 1.43 (1.05-1.93). With additional adjustment for body mass index, the multivariable odds ratio was 1.26 (0.92-1.71).

Conclusion: Low muscle strength measured by a very simple fitness test was associated with a higher prevalence of diabetes among Japanese men. This association was mediated in part by body mass index.

2065  Board #8  June 1 9:30 AM - 11:30 AM  
**Muscular Strength and Cardiorespiratory Fitness on Osteopenia in Older Adults**  
Hyun Soo Kim, Nathan Meier, Duck-chul Lee, FACSM. Iowa State University, Ames, IA. (Sponsor: Duck-chul Lee, FACSM)  

Purpose: To examine the independent associations of muscular strength (MS) and cardiorespiratory fitness (CRF) with the prevalence of osteopenia in older adults.

Methods: This cross-sectional study consisted of 127 men and 177 women aged ≥65 years old (mean age 74) from the Physical Activity and Aging Study (PAAS). MS was assessed by 1-repetition maximum (1-RM) leg press (lbs) and CRF was assessed by time (minutes) to complete a 400-meter walk test. Both MS and CRF were categorized into four groups based on the sex-specific quartiles of each MS and CRF. Bone mineral density was assessed by dual-energy X-ray absorptiometry (DXA), and osteopenia (pre-osteoporosis stage) was defined as t-score below -1.0 following the World Health Organization guidelines. Odds ratios (ORs) and 95% confidence intervals (95% CIs) were calculated using logistic regression to determine the independent associations of MS and CRF with the prevalence of osteopenia.

Results: The prevalence of osteopenia was 45.4% in this study. Compared to the lower MS quartile 1 (lowest 25%), ORs (95% CIs) of osteopenia in MS quartiles 2, 3, and 4 were 0.75 (0.36-1.58), 0.33 (0.15-0.73), and 0.25 (0.11-0.59), respectively, after adjusting for age, sex, heavy alcohol consumption (>14 drinks per week for males; >7 for females), smoking status, physical activity, and BMI. However, we found that CRF was not significantly associated with the prevalence of osteopenia after adjusting for the confounders including MS in this study (trend P = 0.19). In the stratified analysis by CRF, we found that higher MS was significantly associated with lower prevalence of osteopenia in both low CRF (lower 50%) (trend P = 0.02) and high CRF (higher 50%) (trend P = 0.03) after adjusting for age, sex, heavy alcohol consumption, smoking status, and leisure time physical activity.

Conclusion: Higher MS, independent of CRF, was associated with a lower prevalence of osteopenia in older adults. However, prospective studies are required to make causal inferences between MS, independent of and combined with CRF, and the development of osteopenia and osteoporosis in older adults.

Abstracts were prepared by the authors and printed as submitted.
2069 Board #3 June 1 9:30 AM - 11:30 AM

Describing Weight Regain Methodologies of Male Competitive Natural Bodybuilders
Venny Lalu, Diane DellaValle. Marywood University, Scranton, PA.

(No relevant relationships reported)

PURPOSE: Research focusing on bodybuilding training and nutrition strategies is limited and no research has attempted to examine weight regain strategies in these athletes. Due to this limited research, contemporary bodybuilding protocols are often based on anecdote and self-trial. This study will provide information for future research that may lead to evidence based strategies for coaches and athletes. The purpose of this cross-sectional study was to describe demographic characteristics and weight regain methodologies of male, competitive, natural bodybuilders.

METHODS: Recruitment was conducted via social media posts. Participants were invited to complete an online survey that included health and demographic information, dietary supplement use, and recreational and performance enhancing drug use. Bodybuilding training and competition information included weight regain methodology, and training phase-related weight loss and gain information. Body Mass Index (BMI) was calculated based on self-reported height and weight.

RESULTS: Participants included 24 male natural bodybuilders (Age 28.3±6.6 years, 100% male; 77.8% white). The average BMI of the sample was 25.9±6.6. Participants reported using an average of 5.9±2.9 supplements during the offseason, 6.2±2.9 during contest preparation, and 5.4±2.8 during the recovery period. The majority of the sample (85.2%) reported being amateur competitors, and 48.1% of participants reported previously competing in 1-2 bodybuilding competitions. Participants reported an average contest preparation length of 152.3±95.3 days, and an average competitive season of 40.4±42.5 days. 62.9% of participants reported losing ≥25 lbs during contest preparation while weight gain varied from ≤10lbs to ≥35lbs. Participants reported using the reverse dieting method of weight regain most often in the past (48.1%).

CONCLUSION: This study is the first to describe the weight regain methods of male, natural bodybuilders and allows for further exploration of this understood population’s nutritional strategies. The current study allows for future research to be conducted which may inform coaches and athletes of the safest and most effective methods for constructing individualized dietary and training protocols.

2070 Board #4 June 1 9:30 AM - 11:30 AM

Physical Performance is not Improved with Vitamin D Repletion
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(Sponsor: Sherry Barkley, PhD, FACSM)

(No relevant relationships reported)

Vitamin D insufficiency is associated with impaired physical performance in physically active adults. Vitamin D repletion could have a positive effect on neuromuscular function, which could increase physical performance. PURPOSE: This study assessed the role of vitamin D repletion on markers of anaerobic performance in physically active adults. METHODS: 16 physically active participants (5 insufficient/deficient participants with vitamin D<75 nmol/L, 11 sufficient participants with vitamin D>75 nmol/L) participated in a double blind study to assess anaerobic fitness (vertical jump, hand grip strength, 10 meter sprint, and Wingate bike test). Anaerobic fitness was assessed pre and post 8 weeks supplementation. Vitamin D insufficient/deficient participants were given doses sufficient to reach 120 nmol/L while sufficient participants received a placebo. All liquid supplements were prepared by a local pharmacy.

RESULTS: The vitamin D group significantly increased vitamin D status (64.2 to 135.6 nmol/L, p<0.01) compared with the placebo (115.4 to 110.2 nmol/L). Vitamin D repletion was not found to significantly improve any of the anaerobic performance tests (p>0.05). CONCLUSION: This investigation demonstrated a lack of effectiveness for vitamin D repletion on markers of anaerobic performance in physically active adults. Supported by NIH grant P20GM103443.
METHODS: Ironman triathletes (n=152) were surveyed at Ironman Wisconsin and Ironman World Championships to determine their in-race nutrition strategy and years of experience in triathlon. Multivariate regression was performed to determine the relationship between years participating in triathlon, calories per hour consumed on the bike, and overall ironman finish time. RESULTS: The overall regression model was statistically significant (F(8, 284) = 2.27, p < .05). Tukey’s HSD post-hoc test revealed that the number of years in triathlon was not a significant predictor of finish time (p = .836), however the number of years in triathlon was uniquely significant in the prediction of calories consumed per hour on the bike (p < .05). CONCLUSIONS: Although there was no relationship between number of years in triathlon and overall finish time, there was a significant relationship between number of years in triathlon and prediction of calories consumed per hour on the bike. This suggests that the more experienced Ironman triathletes consumed more calories per hour on the bike.

Quantification of body composition changes with seasonal Vitamin D changes is not well-described. PURPOSE: To: 1) assess longitudinal changes in total body fat, lean, and bone tissue mass over 10-months and 2) explore relationships between Vitamin D, body composition, diet and sun exposure. METHODS: Male collegiate basketball players underwent dual energy x-ray absorptiometry (DEXA) scans on four occasions: December 2016 (Start); April 2017 (End); July 2017 (Start Weights); October 2017 (End Weights) to quantify total body fat, lean, and bone mass. Blood was collected on 3 occasions (End; Start Weights; End Weights) and analyzed for serum 25-hydroxy vitamin D (25-DH). Food frequency questionnaires completed twice (Start and End Weights) with subjective reporting of sun exposure and weight-training. RESULTS: 11 (7 African-American) completed testing (age 20±1years; BMI 24.0±1.7kg/m²). Non-significant (NS) changes noted in total body fat percentage, which was lowest at End (16.1±2.1; 15.5±1.8; 16.6±2.2; 15.8±2.0%) and lean mass which was highest at End Weights (70.4±9.5; 71.4±9.1; 74.3±9.3kg) while bone mineral density (BMD) increased steadily over time (1.33±0.10; 1.34±0.13; 1.35±0.12; 1.36±0.12g/cm²). Serum 25-OH-D levels were deficient (~20ng/mL at End 18.9±7.3ng/mL) but replete at Start Weights (32.2±12.8ng/mL and End Weights (32.2±7.7ng/mL). African-American players spent less hours per week in the sun vs Caucasian players (6.5±2.3 vs. 11.2±3.7 hours/week; p=0.02) and ingested less Vitamin D (25-OH-D) levels significantly associated with: End Weight minus Start Weight (Mdn= 952.5, r=0.3, or skill-based and racquet sports (Mdn= 4), U= 117.5, p=0.001, r= 0.4). CONCLUSION: The results of this study will help inform the development of a validated food choice questionnaire for athletes and provide information to assist those working with athletes from a variety of sports and countries to deliver suitable advice for fuelling performance and recovery. Supported with funding from the event organisers and caterers of the 2017 Universiade athletes’ village dining hall.

Fitness induced adaptations, such as changes in oxygen uptake (VO₂), respiration, and cardiac autonomic regulation are known to occur at rest and during exercise following endurance training. For example, submaximal intensities are associated with reductions in VO₂ per workload, reductions in heart rate (HR), and reductions in ventilation (V̇E) while maximal intensities are associated with increases in VO₂ and V̇E. However, less is known about the breath-by-breath dynamics of VO₂ and V̇E during exercise with changes in cardiac autonomic regulation in relation to fitness. PURPOSE: To investigate the influence of gender, body fat (BF) and maximal VO₂ (VO₂max) on the breath-by-breath dynamics of VO₂ and V̇E, as well as HR variability (HRV), during an incremental treadmill test to exhaustion. METHODS: Breath-by-breath VO₂ and V̇E, as well as continuous R-R intervals were collected throughout an incremental treadmill test for N=39 individuals (Males: n=20; height=177±8 cm, weight=79±18 kg; BF=18±5%; V̇E=54±9 L/min – Females: n=19; height=164±16 cm, weight=74±21 kg; BF=33±12%; V̇E=36±10 L/min/kg/min). Individual time-series were fit using polynomial regression models. The residuals from these models were used to detect the trend. The standard deviation of normal intervals (SDNI), root mean square of successive differences (MSSD), and sample entropy (SampEn) of the residuals were calculated and relations among these variables with gender, BF, and VO₂max were analyzed using multivariate analysis of variance. RESULTS: There were statistically significant differences in the variability around the increase in physiological demands of incremental exercise (SDNI, rMSSD) based on Gender (p=0.001; p=0.004), BF (p<0.001; p=0.002), and VO₂max (p=0.05; p=0.04). However, the complexity (SampEn) surrounding the increase in VO₂ and V̇E and HRV dynamics during incremental exercise were not different based on gender, BF, or VO₂max. CONCLUSIONS: The variability surrounding the increasing physiological demands (specifically, VO₂ and V̇E) of incremental exercise appear to be differentially affected by gender, BF, and fitness. Better understanding these relationships may provide important information about how chronic stimuli, such as training or disease, impact the dynamics of the system. Funded by NICHD R01HD078346
The oxygen pressure profile in the interstitial space (PO_{js}) drives O_2 diffusion into the myocyte thus supporting oxidative phosphorylation. Although crucial for metabolic recovery and the capacity to perform repetitive tasks, the time course of skeletal muscle PO_{2,j} during recovery from contractions remains unknown. **PURPOSE:** To resolve the temporal profile and determine model parameters of PO_{2,j} off kinetics after cessation of contractions in healthy skeletal muscle. We tested the hypothesis that PO_{2,j} would recover to resting values and display considerable on-off asymmetry (fast on and slow off kinetics) reflective of slower microcirculatory O_2 delivery relative to muscle O_2 utilization dynamics in recovery. Microvascular PO_{2,j} (PO_{mv,j}) was also evaluated to test the hypothesis that a significant transmural gradient (ΔPO_{2,j}=PO_{mv,j}-PO_{2,j}) would be sustained during recovery. **METHODS:** PO_{mv,j} and PO_{2,j} were determined via phosphorescence quenching (Oxyphor probes G2 and G4, respectively) in the exposed rat spinotrapezius muscle during and after contractions (1 Hz, 6 V, 3 min per transition; n=12). **RESULTS:** Muscle PO_{2,j} rose progressively (p<0.05) from an initial contraction value of 11±2.5 to 17±2.2 mmHg at the end of the recovery period, which was not different from resting PO_{2,j} (17±1.9 mmHg; p=0.05). PO_{2,j} off kinetics were slower than on kinetics (mean response time: 49.3±12.4 vs. 19.2±2.5 s, respectively; p<0.05). A significant transmural ΔPO_{2,j} observed at the end of contractions (17.7±2.7 mmHg) was maintained throughout the recovery period (end-recovery: 19.3±4.5 mmHg; p=0.05). **DISCUSSION:** Consistent with our hypotheses, skeletal muscle PO_{2,j} is recovered back to resting values with slower off kinetics compared to the on-transient in line with the on-off asymmetry for capillary hemodynamics. Maintenance of a substantial transmural ΔPO_{2,j} during recovery supports that the microvascular-interstitium interface provides considerable resistance to O_2 transport. As dictated by Fick’s law (VO_{2}=DO_{2}*ΔPO_{2,j}), modulation of O_2 flux during and following contractions (VO_{2,j}) must be achieved via corresponding changes in effective diffusing capacity (DO_{2,j}; mainly capillary red blood cell hemodynamics and distribution) in the face of unaltered ΔPO_{2,j}. Funding: NIH HL-2108328

**RESULTS:** Despite HC walking at a greater speed (1.5 mph vs 1.2 mph) at the time of measurement, the CON PER displayed faster on- and slow off-kinetics compared to WG in both CON (35 ± 6 vs 76 ± 6 s; p<0.05) and L-NAME (33 ± 4 vs 74 ± 5 s; p<0.05). **CONCLUSIONS:** In the face of increased vascular resistance, the CON PER displayed faster kinetics while recovering to baseline PO_{2,j} compared to WG in CON and L-NAME (p<0.05). Off-kinetics were faster in the PER compared to WG in CON (35 ± 6 vs 76 ± 6 s; p<0.05) and L-NAME (33 ± 4 vs 74 ± 5 s; p<0.05). **METHODS:** PO_{2,j} was determined via phosphorescence quenching (Oxyphor G4) in the exposed rat PER and WG (n=5) during and following electrically stimulated muscle contractions (1 Hz, 8 V, both 3 min) under control (CON), sodium nitroprusside (SNP, NO donor) and L-NAME (n= 3 PER, 5 WG) conditions. **PURPOSE:** The recovery of skeletal muscle from repetitive tasks is dependent, in part, on adequate O_2 delivery and blood-mitochondrial O_2 diffusion. Key steps in this pathway include the microvascular and interstitial space (is) and novel use of specific phosphorescence probes allow measurements of O_2 partial pressures (PO_{2,j}) at those sites near the myocytes. Given the disparate contribution of nitric oxide (NO) between fiber types we sought to resolve how NO impacts PO_{2,j} in recovery following rhythmic muscle contractions. **PURPOSE:** To determine the contribution of NO bioavailability to the temporal profiles of PO_{2,j} off kinetics in two fast-twitch muscles with different oxidative capacities (citrate synthase: peroneal (PER) ~20 vs white gastrocnemius (WG) ~8–11 µmol/min/g). We tested the hypothesis that the more oxidative PER would display faster kinetics while recovering to baseline PO_{2,j} levels compared to the WG. In addition, NO synthase inhibition via L-nitroarginine methyl ester (L-NAME) would slow recovery off kinetics whereas this process would be speeded by increased NO. **METHODS:** PO_{2,j} was determined via phosphorescence quenching (Oxyphor G4) in the exposed rat PER and WG (n=5) during and following electrically stimulated muscle contractions (1 Hz, 8 V, both 3 min) under control (CON), sodium nitroprusside (SNP, NO donor) and L-NAME (n= 3 PER, 5 WG) conditions. **RESULTS:** PER PO_{2,j} was higher than WG for CON at baseline (18.1 ± 1.8 vs 11.3 ± 1.2 mmHg), end contractions (11.5 ± 1.2 vs 5.2 ± 0.9 mmHg), and following recovery (19.6 ± 2.1 vs 10.1 ± 0.9 mmHg; p<0.05 for all). SNP elevated PO_{2,j} at all time points in both muscles compared to CON and L-NAME (p<0.05). PO_{2,j} recovered to baseline levels in both muscles in CON and L-NAME (p<0.05) but not SNP (p<0.05). Off-kinetics were faster in the PER compared to WG in CON (35 ± 6 vs 76 ± 6 s; p<0.05). L-NAME did not alter PER off-kinetics but prolonged recovery in WG (101 ± 8 s; p<0.05). **CONCLUSIONS:** Consistent with our hypothesis, PO_{2,j} returned to baseline levels faster in the CON PER than WG. This likely reflects greater O_2 delivery in PER. However, NO synthase inhibition via L-NAME did not diminish the magnitude nor rate of recovery in PER indicating that the interstitial-mitochondrial pressure head for O_2 delivery may be preserved via other pathways in more oxidative muscles in health.
Previous investigations reported greater convective and diffusive $O_2$ conductance in whole-leg muscles during knee extension exercise (KE) compared to conventional cycling (CE). One reason for this is thought to derive from different muscle recruitment patterns in KE and CE. However, it is unknown whether the different muscle recruitment patterns might account for the disparate $O_2$ conductances during KE and CE or not. PURPOSE: Using time-resolved near-infrared spectroscopy (NIRS) during ramp incremental CE and KE, we tested the hypothesis that compared to CE, KE would have (1) lower amplitude (from baseline to exhaustion) of deoxy-$[Hb+Mb]$ (reflecting a greater $O_2$ delivery-to-utilization), (2) greater amplitude and value at task failure (i.e. reaching $V_{O2\max}$) of total-$[Hb+Mb]$ (diffusive $O_2$ potential) in quadriceps (vastus lateralis [VL] and rectus femoris [RF]). We also hypothesized that muscle recruitment pattern will determine muscle oxygen- and deoxygenation characteristics. METHODS: Eight subjects completed ramp incremental CE (20 W/ min) and KE (10 W/min) to the limit of tolerance. Pulmonary $V_O_2$ was measured breath-by-breath. Deoxy- and total-$[Hb+Mb]$ were quantified in the VL and RF muscle by time-resolved NIRS. VL and RF muscle activation levels were estimated by electromyography. RESULTS: In VL muscle, despite greater activation for CE than KE, the amplitude of deoxy- and total-$[Hb+Mb]$ from baseline to task failure were not different between exercise modes. However, in RF muscle, deoxy-$[Hb+Mb] \left( 17.0 \pm 11.3 \text{ vs. } 39.5 \pm 13.8 \text{ mM, } P = 0.05 \right)$ and total-$[Hb+Mb] \left( 5.3 \pm 4.0 \text{ vs. } 23.8 \pm 8.5 \mu M, P = 0.05 \right)$ were lower for KE compared to CE despite greater activation for KE than CE. In addition, total-$[Hb+Mb]$ values at task failure were not a function of exercise mode in either VL or RF muscle. CONCLUSION: These results do not support the notion that different recruitment patterns for CE versus KE underlie the different patterns of muscle deoxygenation and hemoglobin response across quadriceps muscles. Indeed, the total-$[Hb+Mb]$ responses suggest that perfusive and diffusive $O_2$ delivery in VL and RF muscles are determined more by structural and functional factors (e.g. arteriolar vasodilation regulation and capillary hematocrit control) as opposed to muscle recruitment patterns per se. Supported by JSPS-15K16476, 16K13011.
RESULTS: The sample was randomly split (a computer-generated randomization sequence into two groups with the ratio 1:2). The first subset of the 30 items (N=150) was performed by children (KMO=0.877, p=0.000). EFA resulted in a 12-item, 3-subscale that included each a 4-factor scale. EFA item loadings ranged from 0.68 to 0.85, and Cronbach’s alpha ranged from 0.81 to 0.87. Based on the EFA results, CFA was performed to cross-validate and confirm the 4-factor structure model (N=300). Results showed that the model index were x2=0.000, RMSEA=0.06, GFI=0.94, NFI=0.91, TLI= 0.93, CFI=0.95. The final three subscales of the SOQ-CAS was named competitoris, win orientation, and goal orientation.

CONCLUSIONS: The SOQ-CAS was a reliable and valid measure of sports orientation of Chinese adolescent students. It can be used for the assessment of daily exercise or physical education. The future research will focus on exploring the Motor Quotient (MQ) assessment by SOQ-CAS.

ACKNOWLEDGEMENT: Supported by NPOPS Grant 15CTY011, and Fundamental Research Funds for the Central Universities SWU1709240.

Table 1. Factor structures by Exploratory Factor Analysis and Reliability (N=150)

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2087 Board #4 June 1 9:30 AM - 11:30 AM Effects Of Chronic Hypobaric Hypoxia, Biological Maturation And Training On The Hemoglobin Mass In Children And Adolescents

Erica Mabel Mancera-Soto1, Diana Marcela Ramos-Caballero1, Edgar Cristancho1, Walter Schmidt1,2. “Universidad Nacional de Colombia, Bogotá, Colombia. Bayreuth University, Bayreuth, Germany. (Sponsor: William Byrnes, FACSM)

No relevant relationships reported

Hemoglobin mass (Hbmass) is an important factor for endurance performance and athletes born and living at altitude are described to possess elevated Hbmass values due to lifelong hypoxic exposure. It may be hypothesized that this adaptation already occurs in early life. To date, however, there exists only few data on the training influences on Hbmass during childhood and no data exists describing chronic hypoxic effects in children and adolescents. PURPOSE: To investigate the effects of age, sex, training status and altitude on Hbmass in children and adolescents in a cross-sectional study. METHODS: 436 children, 197 females and 237 males, homogenously distributed over the age from 9 to 18 years participated in the study. 189 of them were born and lived permanently at 960m, 247 at 2600m. 168 did not practice any training and 268 were endurance trained with a mean endurance training volume of 14.0h ±5.8week. Hbmass was determined using the optimized CO-rebreathing technique and VO2max by an incremental step-test on a treadmill. Analyses of variance and multiple regression analyses were performed to estimate the effects of sex, body mass, age, sexual development (scale according to Tanner), training status, and altitude on Hbmass. RESULTS: Overall, ANOVA yielded highly significant effects for sex, age, body mass, altitude and training status (all p<0.01); and regression analysis (r=0.91) showed highest effects of sex (+121.5g, b=0.31 in males) and body mass (9.5g/kg, b=0.57). Because Hbmass of girls reached a plateau at approx. 14 years and boys increased Hbmass until the age of 17. Regression analysis revealed significant effects for females and males and the following effects were found: Males: r=0.93; Hbmass = 11.8*kg + 15.4*years + 60.9 (for trained status) + 35.1 (for altitude residents) + 13.7*(stage of Tanner) - 254.2; females: r=0.84; Hbmass = 6.8*kg + 9.8*years + 54.6 (trained) + 36.9 (altitude) -24.8. Absolute and relative VO2max was closely related to Hbmass (absolute values: r=0.85, β=3.57*kg + 308; relative values: r=0.70, y=3.56*x+6.1). CONCLUSION: Beside the well-known effects of body mass, age and sex also growing-up at altitude and endurance training have remarkable effects on Hbmass in children and adolescents. VO2max is closely related to Hbmass. Like in adults, a change by 1% gram changes VO2max by 3.5ml/min.

2088 Board #5 June 1 9:30 AM - 11:30 AM Effect Of Cardiorespiratory Fitness, Fatigue And Muscular Strength On Gait Biomechanics In Obese Children


No relevant relationships reported

PURPOSE: The purpose is to explore the effects of cardiorespiratory fitness, fatigue, adiposity, and muscular strength in predicting altered gait biomechanics in 8-11 year old obese children.

METHODS: Thirty children, 15 girls and 15 boys, mean age 9 ± 0.8 years, and mean BMI percentile 96 ± 1.4, were recruited from University of Iowa Obesity Clinic. The 15 m Progressive Aerobic Cardiovascular Endurance Run (PACER) protocol was used to estimate aerobic fitness (VO2max) and to fatigue the subjects. Adiposity, measured as percent body fat, was estimated by air displacement plethysmography (Bod Pod). Right leg isometric strength was assessed on a leg press device. Three-dimensional gait analysis (Optotak, Kistler) using a link-based model was performed pre- and post-fatigue to calculate joint moments. Paired t-tests were used to compare pre- and post-fatigue moments, and a stepwise regression model including moments as dependent variable and fitness, adiposity and strength, as the three independent variables was used for pre- and post-fatigue. P-value < 0.05 was considered significant.

RESULTS: Subjects completed an average of 17.5 ± 8.5 PACER laps (range: 4 - 45). Mean aerobic fitness as estimated by PACER was low (34.1 ± 6.0 mL·min⁻¹·kg⁻¹). Mean adiposity was 32.2 ± 7.6 % body fat and mean right lower limb strength, was 0.77 ± 0.4 to 0.97 ± 0.4 Nm/kg, p=0.01. The stepwise regression model for knee extensor moments pre-fatigue selected strength and adiposity as predictor variables (R²=0.35) and post-fatigue selected strength (R²=0.29). Knee and hip adductor moments selected adiposity as a predictor variable for pre-fatigue (R²=0.63 and 0.22 respectively). None of the models included cardiorespiratory fitness.

CONCLUSIONS: Increase in hip and knee moments after fatigue suggests biomechanical deficiencies, which may lead to increased joint stress or to injury.
2089 Board #6
June 1 9:30 AM - 11:30 AM
Effects Of A 5-day Sports/Fitness Camp On Walking Efficiency In Children With Cerebral Palsy
Adam R. Blanchard1, Katherine Dimitropoulou1, Paul Weiland1, Kelly Boscarino1, Amber Newell1, Heakunny Kim1. 1Columbia University Medical Center, New York, NY. 2Chapter 126 Sports & Fitness, Bristol, CT.

No relevant relationships reported

Physical activity (PA) participation and fitness in children with cerebral palsy (CP) are decreased compared to typically developing children. Exercise improves fitness and walking ability but little is known for its impact on walking efficiency. PURPOSE: The purpose of this pilot feasibility study was to examine the influence of a 5-day community sports and fitness camp at an adaptive fitness facility on walking energy consumption (walking efficiency) in children with CP. METHODS: Six boys with CP (mean±SD, age, 11.3±4.7 yrs, height, 136.9±27.5 cm; weight, 44.9±26.8 kg) participated in supervised sports and PA for 3 hr/day on 5 consecutive days. Activity energy expenditure (AEE; J·kg−1·s−1) and oxygen consumption (VO2; mL·min−1·kg−1) were assessed by Actiheart monitor during five, 10meter walks on day 1 and 5. The PA Questionnaire for Adolescents assessed baseline PA levels. Paired samples t-tests evaluated differences in AEE and VO2, pre- to post- camp; and independent-samples t-test evaluated between-group differences between high and low baseline PA with changes in AEE and VO2. RESULTS: Although non-significant (low N), median effect size was seen in the reduction of AEE during walking on day 5 (2.5±0.5 J·kg−1·s−1) compared to baseline (2.9±0.5 J·kg−1·s−1; p=0.28; Cohen’s d=0.66). Similarly, submaximal VO2 was lower on day 5 (8.2±2.0 mL·min−1·kg−1) compared to baseline (9.3±1.1 mL·min−1·kg−1; p=0.28; Cohen’s d=0.35). A strong effect size was seen in that children with low PA (n=3) reduced their VO2 greater (A-1.6±2.3 mL·min−1·kg−1) than children with high PA (n=3) (Δ0.6±0.9 mL·min−1·kg−1; p=0.31; Cohen’s d=0.92) on day 5 compared to day 1. CONCLUSIONS: This study was a feasibility study to test the measures and intervention procedures for the development of an evidence-based camp. Findings show that children with CP may improve walking efficiency after participating in a 5-day community sports/fitness camp held at an adaptive fitness facility. Our next step is to design an appropriately powered intervention to confirm these results and to determine the best frequency, intensity, time, and type of sports/PA performed in the camp.

2090 Board #7
June 1 9:30 AM - 11:30 AM
Differences In Lean Mass And Strength In Adolescent ACLR Female Athletes: A Case-Control Study
Christiana J. Raymond-Pope1, Donald R. Dengel, FACSM1, Jonathan S. Fitzgerald2, Bradley J. Nelson3, Tyler A. Bosch4. 1University of Minnesota, Minneapolis, MN. 2University of North Dakota, Grand Forks, ND. (Sponsor: Donald R. Dengel, FACSM)

No relevant relationships reported

PURPOSE: To compare differences in total and segmental lean mass (LM), muscle strength and leg force production between adolescent female athletes with and without anterior cruciate ligament repair (ACLR). METHODS: Twenty-four females, 12 ACLR and 12 healthy controls (CON), were matched by age (16.4±0.9 vs 16.4±1.0 yrs), body mass index (23.2±2.1 vs 23.2±2.7 kg/m²), and sport. Total, segmental, and regional body composition were measured by 3 DXA scans (1 total body, 2 lateral leg). Muscle peak torque for knee extension/flexion (60, 120°/sec) was measured using isokinetic dynamometry. Lower limb force, power and jump height were measured using a squat jump on dual force plates. Paired t-tests assessed total, regional and segmental lean mass, peak torque and lower limb force production differences within (Involved/Non-involved) and between groups (ACLR/CON). Linear regression assessed the total-leg LM vs peak force relation of each leg and of ACLR vs CON. RESULTS: No body composition differences were observed between ACLR and CON groups (p=0.07-0.70). However, ACLR INV legs had significantly lower total LM (7.1±8.0 vs 7.4±1.0 kg, p=0.004), anterior upper leg LM (1.5±0.3 vs 1.6±0.2 kg, p=0.007), and posterior upper leg LM (1.9±0.2 vs 2.0±0.2 kg, p=0.036). Peak torque was significantly lower in ACLR INV vs NINV legs (p=<0.003) and vs CON (p=0.01-0.019) for extension at 60° and 120°/sec (p=<0.05), with no differences between ACLR NINV vs CON legs (p=0.3-0.90). Peak force was significantly lower in ACLR INV vs NINV legs (296±45 vs 375±55 N, p=0.001) and between ACLR INV legs vs CON legs (296±45 vs 372±88 N, p=0.015), but no significant (p=0.736) difference between ACLR NINV vs CON legs. The slope between total LM and peak force was smaller for ACLR participants (INV: m=0.02, r=0.36, p=0.25; NINV: m=0.03, r=0.50, p=0.10) compared to CON (INV: m=0.06, r=0.63, p=0.03; NINV: m=0.06, r=0.62, p=0.03). CONCLUSION: One year post-ACLR female athletes have significant differences in the quantity and quality of leg muscle, compared to matched CON athletes, for both involved and non-involved legs. Importantly, muscle function (strength and force production) is limited in both ACLR legs relative to the amount of lean mass, which may provide evidence for increased risk of ACL tear in the involved and non-involved legs.

2091 Board #8
June 1 9:30 AM - 11:30 AM
Predictors of Initial Acceleration and Maximum Speed Phases of Sprint Running in Children and Adolescents
Lorena Correas-Gómez1, José Ramón Alvero-Cruz2, Jesús Barrera-Expósito3, Elvis A. Camero4. 1University of Málaga, Málaga, Spain. 2Nuestra Señora de la Victoria “Martiricos” High School, Málaga, Spain. 3Translational Research Institute for Metabolism and Diabetes, Florida Hospital, Orlando, FL.

No relevant relationships reported

Sprint capacity is a key factor to succeed in many sports modalities and to identify successful predictors must be relevant to optimize speed training and talent detection. Jump tests, muscle strength, and anthropometric variables have been widely associated with sprint performance in adults. However, seeking the best sprinters among young individuals must be influenced by other variables such as sports training, body size, and maturation. Thus, the potential of jump and strength tests to explain sprinting phases (acceleration and maximum speed) might be affected during developmental ages. PURPOSE: To examine relations between the phases of sprinting performance (30m) and body composition (BC), maturation, strength, and jump tests in children and adolescents. METHODS: A database of 456 measures of participants aged 8-18y was analyzed (244 boys, age=14.8±2.3y, BMI=21.6±3.9kg/m²). Photocell electricals were used to measure sprint time (S0-30m, S0-15m, and S15-30m). An electronic mat read flight time to calculate vertical height after squat jump (SJ), counter-movement jump (CMJ), and CMJ with arms (CMAJ); the difference between SJ and CMAJ was also calculated (VJ-d). Lower limbs strength was tested with a portable dynamometer (LLS). Fat-free mass (FFM) was assessed by anthropometry and bioelectrical impedance analysis. Sports participation (SP) was recorded by questionnaire. A stepwise regression analysis was used to explore the relationship between sprint phases and BC, SP, jump and strength. RESULTS: CMJA was the best predictor of S30m speed (R²=0.724, P<0.001) and acceleration phase (S0-15m, R²=0.566, P=0.001). Maximum speed phase was better explained by SJ (S15-30m, R²=0.530, P<0.001). The model including FFM, gender, VJ-d, and maturity predicted S30m (R²=0.780, SEE=0.28m/s) and S15-30m (R²=0.698, SEE=0.31m/s). For S0-15m, the predictors were CMJA, impedance index, and SP (R²=0.610, SEE=0.26m/s). CONCLUSION: In accordance with other studies, sprinting performance was partially dependent on FFM and maturity. As expected, participation in organized sports seems to affect positively S30m and acceleration performance but did not explain maximal speed phase. Overall, the results highlight the relevance of BC and jump tests as a plausible model to track sprint performance in children and adolescents.

E-10 Free Communication/Slide - Athlete Assessment
Friday, June 1, 2018, 9:30 AM - 11:30 AM
Room: CC-Mezzanine M100D
Chair: Erin H. Hartigan. University of New England, Portland, ME.

No relevant relationships reported

PURPOSE: Simple tools of measurement like mean and peak power output, eccentric utilization ratio (EU), and simple anthropometrics could potentially have predictive value in determining the accelerative and decelerative strategies of athletes. The objective of the present study is to determine the efficacy of these measurements in the identification of pathological preferential movement strategies which may limit performance or heighten injury risk. METHODS: 31 NCAA Division 1 athletes were recruited and asked to perform five trials of a simple drop-jump task. Subjects met inclusive criteria if they were cleared for full participation, and were assessed based on body composition, mean and peak power output, EL: body segment lengths, and handheld dynamometer muscle forces. A motion capture system was used to measure peak joint flexion ranges of motion. RESULTS: A stepwise linear regression was...
applied to identify potentially influential factors in the accelerative and decelerative preferential strategies between male and female athletes. Preliminary findings suggest that torso length to femur length ratio (r = 0.02) and torso to femur length ratio (r = 0.00) were potentially related to peak trunk, and peak knee flexion values respectively in males. In females, it appears that EUR may hold value in identifying peak trunk flexion (r = 0.67, p = 0.004), hip flexion (r = 0.64, p = 0.013), and combined lower extremity flexion (r = 0.52, p = 0.027) strategies in females. CONCLUSIONS: Preliminary findings of the present study suggest that these variables may be potentially related to peak knee valgus during return to sport testing. Females may tend to rely more heavily on storage and return of eccentric energy via the contractile component of the posterior chain in order to increase athleticism and create greater joint integrity in decelerative tasks.

Pre-Season Measures of Neurologic Function and Subsequent Head Impact Exposure in Youth Football

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(Paper no relationships reported)

Repetitive head impacts in football create a risk for concussion, as well as sub-concussive brain injury. Nearly 70% of US football players are younger than high school age, yet little is known about intrinsic characteristics of youth players that may make them more likely to experience repetitive head impacts, resulting in an increased injury risk. PURPOSE: To examine the association between select measures of neurologic function and head impact exposure of youth football players. METHODS: During a 5-year period (2012-2016), 66 middle school football players (12.9 ± 0.6 yr) were evaluated before their respective seasons (97 player-seasons) using objective, clinical assessments of neurologic function. Participants were assessed for rapid number naming speed (King-DeWick Test; KD; sec), simple reaction time (RT; sec), and standing balance (BA) performed during an eyes-open, dual-task condition. Head impact frequency, severity (linear acceleration; rotational acceleration) and location associated during each practice and game were measured using the Head Impact Telemetry (HIT) system. Predictive modeling was performed to examine the relation of KD, RT and BA values with several head impact exposure outcome variables. RESULTS: The overall predictive model was significantly related to individual head impact frequency in practices (P = 0.002). Among the discrete variables, faster RT and KD times were both found to be significantly related to increased individual head impact frequency in practices (P = 0.001, P = 0.032, respectively). Faster KD times were also significantly associated with higher 5th percentile linear acceleration values (P = 0.014). There were no significant relations (P = 0.145-0.840) between any measure of neurologic function and the other head impact exposure measures examined. CONCLUSION: Faster reaction time and rapid number naming speed assessed during the pre-season were related to increased head impact frequency and or severity of youth football players. While these associations are likely complex, it is possible that these specific measures of neurologic function are surrogate indicators of players’ intrinsic ability and/or desire to initiate contact. Identifying players who are more likely to experience repetitive head impacts may be useful for efforts aimed at modifying injury risk.

Kinematic Differences of the Single Leg Cross Over Triple Hop and Modified T-Test

David Mangone, Brandon Henley, Joshua Flores-Vitti, Kathryn Young, Richard Feinn, Karen Myrick, Juan C. Garbalosa. Quinnipiac University, Hamden, CT.

(Paper no relationships reported)

Return to sport (RTS) testing has been advocated as a means of reducing the high injury rates of the anterior cruciate ligament (ACL). The effectiveness of RTS testing has recently come into question. Potentially, the use of RTS tests that mime game-like test, the order of which was randomized. The COH subject jump forward on one limb while crossing two parallel lines, 1.25 cm apart over three times on each limb. The MTT consisted of having the subject run through a T shaped obstacle course 4 times, alternating sides. Adequate rest was afforded between trials to ensure non-fatigue. The location of retroreflective markers located on specific bony landmarks located on the subjects lower extremity was recorded while the athletes completed the tests using a 16 camera motion analysis system recording at 240 Hz. Using a multilevel multivariate analysis the three dimensional joint angles of the hip and knee at the time of maximum knee valgus were compared for angular differences (Δ) between the jump and cut performances using the marker data.

RESULTS: Compared to MTT, athletes during COH were significantly more flexed at (Δ = 9.0 degrees ± 2.6, p = 0.001) and tended to be more internally rotated (Δ = 2.2 degrees ± 1.0, p = 0.008) at the knee. No differences were noted in the frontal plane position of the hip and knee or the transverse plane position of the knee. CONCLUSIONS: The COH and MTT do not appear to produce similar lower extremity kinematics. The MTT appears to place more stress on the lower extremity and may be a better test to determine RTS.

Correlation of Hop Distance and Loading Symmetry during Return to Sport Testing in Healthy Subjects

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(Paper no relationships reported)

The hop distance symmetry is used frequently to determine readiness to return to sport (RTS) following anterior cruciate ligament reconstruction (ACL). It is unknown if loading symmetry is able to provide novel insights in determining readiness to RTS. PURPOSE: To determine if hop distance symmetry index (LSI) is correlated with loading LSI when completing RTS hop testing. METHODS: 33 healthy participants (16 male, 17 female; age: 21.8 ± 3.6, height: 1.74 ± 0.79m, weight: 68.6 ± 5.30 kg) were fit with a pair of Novel Electronics, St. Paul, MN), single sensor insoles (100 Hz). Each participant completed the Marx Activity Scale and 7 single hops (SH), 3 triple hops (TH) and 3 crossover hops (CH) per limb. The LSI (Sx/NxSx=100) was calculated for hop distance as well as peak load (GRF), loading rate (LR) and impulse (I) for the final hop of each trial and condition. The LSI was calculated for each trial pair and then averaged across trials for each task. Pearson’s correlation coefficients (R) were calculated between all symmetry metrics (distance and loading) and Marx score. A linear regression was completed to determine if the loading symmetry metrics predicted the hop distance symmetry. All tests were run in SPSS with a p-value = 0.05 indicating significance. RESULTS: The hop distance and loading LSI measures either had no or weak correlations (Table 1). The Marx score was weakly correlated with the CH hop distance (R = 0.36, p = 0.049) and the SH LR (R = 0.36, p = 0.05). The regression analysis yielded no significant models for the SH, TH, or CH to predict the hop distance LSI. CONCLUSIONS: The load symmetry metrics and hop distance symmetry were weakly correlated and the load symmetry metrics were not able to predict hop distance symmetry. These results indicate that the loading symmetry and hop distance symmetry provide different information. Therefore, future work should determine which of these measures could be used as predictors of secondary ACL injury risk.

Wobble Board Dynamic Assessment in Subjects with Chronic Ankle Instability

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(Paper no relationships reported)

Chronic ankle instability (CAI) has been shown to cause balance impairments during standing and dynamic postural-control tasks. Although computerized wobble boards (WBs) are used to train postural stability and to assess dynamic balance performances, little is known about their ability to detect balance deficits in subjects with unilateral CAI. PURPOSE: To determine the WB ability in detecting impairments in subjects with unilateral CAI. METHODS: After a familiarization phase, 16 (8 female, 8 male) subjects (age = 23.5 ± 1.7 years; weight = 66.6 ± 14.5 kg; height = 167.7 ± 11.3 cm) performed a single limb task on a WB and Y balance test (YBT). WB performance (Balance Board WSP, Italy; diameter = 40cm) was assessed as the time spent in the target zone (diameter = 6.5cm) displayed on a screen during a
single leg 30 seconds trial with a 1-minute sitting rest in between. For YBT, normalized reach distances for anterior (A), postero medial (PM), postero lateral (PL) directions and composite (COMP) values were recorded according to the protocol. ANOVA (p<.05) was used to evaluate limb differences (injured; uninjured) in relation to gender. RESULTS: For WB, females showed better (p<.05) performances than males, regardless of limb. Significantly (p<.0001) better performances were found in the uninjured (WB=20±3.4s; A=89±4.99; PM=101±8.13; PL=107±7.13; COMP=104±10.9) compared to the injured (WB=66±4.3s; A=96±11.1%; PM=98±10.7%; PL=101±31.49; COMP=100±21.1%) ones, regardless of gender. CONCLUSIONS: WB test showed to be an effective tool for detecting balance deficits between injured and uninjured limb in subjects with unilateral CAI. The single outcome from the WB provided an accurate, precise and fast method for quantifying balance deficits in individuals with CAI. Hence, WBs have the capability to fill the gap caused by limitations between subjective-based clinical assessment and laboratory-based testing. Their affordable, portable and user-friendly nature make WBs suitable to be used outside of laboratory settings and helpful in clinical decision-making. Gender differences during the WB test could be due to anthropometric, neuromuscular and neurophysiologic factors. Therefore, future studies should investigate the influence of anthropometric factors on WB performances.

Concussions are an unfortunate consequence of sports participation. They affect motor control, neurocognitive performance, and recent reports indicate they increase the risk of lower extremity musculoskeletal injury (LEMI) upon return to sport. The increased risk of secondary LEMI may indicate the need to establish a test that is predictive of LEMI risk following return to sport. PURPOSE: Assess the between-session reliability and the effects of adding a cognitive load to static and dynamic postural stability testing. METHODS: Twelve healthy, physically active subjects (Age: 22.3 ± 2.9 years, Height: 174.4 ± 7.5 cm, Weight: 154.5 ± 28.0 lbs) participated. Subjects underwent static and dynamic postural stability testing with and without the addition of a cognitive task (Stroop task) on two separate days. Static postural stability was assessed with a single-leg balance task under eyes open (with and without the addition of the Stroop task) and eyes closed conditions. Variability of each ground reaction force component was averaged across three trials for each of the static postural stability conditions. Dynamic postural stability testing consisted of forward jump over a hurdle with a one-legged landing performed with and without the addition of the Stroop task. A stability index was calculated based on the resultant ground reaction force and each of its components. Interrater correlation coefficients (ICC, 2,1) were calculated to determine the between-session reliability of each testing condition. Comparisons were made across the static conditions and between the dynamic postural stability tasks. RESULTS: The addition of a cognitive load proved to have moderate to excellent between-session reliability for the majority of variables calculated during static (ICC values 0.74 – 0.81) and dynamic postural stability testing (ICC values 0.77 – 0.80; ML=0.800, V=0.774, DPSI=0.781). No significant differences were observed between the postural stability tasks (with or without the Stroop task). CONCLUSION: Postural stability tasks with the addition of a cognitive load proved to have moderate to excellent reliability in a healthy population. These results provide new evidence on the feasibility of dual-task postural stability testing when examining risk of LEMI following return to sport.

**Reliability and Performance Changes with the Addition of a Cognitive Task to Static and Dynamic Postural Stability Testing**

**PURPOSE:** Assess the between-session reliability and the effects of adding a cognitive load to static and dynamic postural stability testing.

**METHODS:** Twelve healthy, physically active subjects (Age: 22.3 ± 2.9 years, Height: 174.4 ± 7.5 cm, Weight: 154.5 ± 28.0 lbs) participated. Subjects underwent static and dynamic postural stability testing with and without the addition of a cognitive task (Stroop task) on two separate days. Static postural stability was assessed with a single-leg balance task under eyes open (with and without the addition of the Stroop task) and eyes closed conditions. Variability of each ground reaction force component was averaged across three trials for each of the static postural stability conditions. Dynamic postural stability testing consisted of forward jump over a hurdle with a one-legged landing performed with and without the addition of the Stroop task. A stability index was calculated based on the resultant ground reaction force and each of its components. Interrater correlation coefficients (ICC, 2,1) were calculated to determine the between-session reliability of each testing condition. Comparisons were made across the static conditions and between the dynamic postural stability tasks.

**RESULTS:** The addition of a cognitive load proved to have moderate to excellent between-session reliability for the majority of variables calculated during static (ICC values 0.74 – 0.81) and dynamic postural stability testing (ICC values 0.77 – 0.80; ML=0.800, V=0.774, DPSI=0.781). No significant differences were observed between the postural stability tasks (with or without the Stroop task). CONCLUSION: Postural stability tasks with the addition of a cognitive load proved to have moderate to excellent reliability in a healthy population. These results provide new evidence on the feasibility of dual-task postural stability testing when examining risk of LEMI following return to sport.

**Reliability of Evaluating the Single Leg Squat Using Multiple Assessment Methods**

**Purpose:** The Single Leg Squat (SLS) test is a physical assessment to identify movement deficits that may predispose individuals to musculoskeletal injury (MSKI). The SLS is used clinically and in research to develop corrective exercise strategies for improving movement efficiency and modify potential MSKI risk factors. Our purpose was to compare the reliability of individual criteria and overall performance of the SLS test between three assessment methods: real-time scoring (RT); post-testing video analysis (PTVA); and post-testing analysis by using PhysiMax (PM) software.

**Methods:** Male U.S. Marines (N=61; PTVA n=35, PM n=22, RT n=8) entering the School of Infantry-West performed the SLS prior to beginning training. Squats were scored using RT, PTVA, and PM software. Nine individual SLS criteria were evaluated dichotomously: 0 indicated no deficiency and 1 indicated a deficiency was present. Overall SLS performance was scored as excellent, average or poor. Interrater (IRR) and intrarater (IAR) reliability were measured using % agreement (%), Cohen’s Kappa (κ), and intraclass correlation coefficients (ICC).

**Results:** Individual SLS criteria reliability was poor for several items, namely Hip Drop (IRR-RT: 44.4%; κ=0.15; PTVA: 22.5%; κ=0.02; and IAR-PTVA: 83.4%; κ=0.31; PM: 77.2%; κ=0.15) and Trunk Inward Rotation (IRR-RT: 55.5%; κ=0.05; PTVA: 63.4%; κ=0.26; and IAR-PTVA: 57.9%; κ=0.16; PM 81.8%; κ=0.07). For SLS overall performance, IRR % agreement was weaker for PTVA (47.9%) compared to RT (62.5%); however ICC’s were both poor (PTVA: 0.20 ICC, 95% CI: -0.03-0.41; RT: 0.35 ICC, 95% CI: -0.42-0.82). SLS overall performance IAR % agreement for PTVA and PM was similar (57.9% vs. 59.1%) but ICC’s were good for PM (0.63 ICC, 95%CI: 0.30-0.83) and poor for PTVA (0.34 ICC, 95%CI: ±0.12-0.68).

**Conclusion:** Although the SLS has been clinically validated to identify movement deficits, individual item IRR and IAR appear to be generally poor regardless of the assessment method. Overall performance evaluations also had low agreement, but PM software showed the best IAR-ICC, demonstrating good reliability which should be investigated further. However, our results may be limited by small sample sizes. Further research is needed with a larger sample to better compare SLS assessment reliability between RT, PTVA and PM.
Pain can be improved by the adoption and maintenance of physical activity (PA) but whether PA per se causes reductions in pain is uncertain. Pain is often greater in those with elevated symptoms of psychiatric disorders, including anxiety, mood and somatoform disorders. It is plausible that the severity of psychiatric symptoms mediates relationships between PA and pain as PA often reduces these symptoms. PURPOSE: To assess relationships among PA, pain and psychiatric symptoms known to increase the risk of pain. METHODS: College-aged women (N=1033; 19.7 ± 2.9 years) completed the 7-Day PA Recall and indicated if they had (11.4%), or had not, been experiencing pain for more than a month. The Psychiatric Diagnostic Screening Questionnaire assessed symptoms of somatization, panic, generalized anxiety (GAD) and major depressive (MDD) disorders, which were hypothesized as possible mediators of the relationship between PA and pain. Structural equation models were tested using robust maximum likelihood and Bayes estimation in Mplus 8.0.

RESULTS: The hypothesized causal model had good fit (Χ²(10) = 14.75, P = 0.141, CFI=0.996, SRMR=0.018, RMSEA=0.021) and accounted for a significant (P=0.004) amount of variance (R²; SE) in pain (53.1%, 19%). Direct paths (β; SE) from PA to: MDD (0.163, 0.045), GAD (0.175, 0.049), panic (0.100, 0.046), and somatization (-0.175, 0.049) were significant (P-values ≤ 0.028). The path from PA to pain was not direct (P=0.770), but indirect (P-values ≤ 0.016) and through significant paths (P-values ≤ 0.005) to pain from panic (0.130, 0.046) and somatization (0.156, 0.044). There were no direct or indirect effects from pain to PA in a reciprocal causal model. CONCLUSION: The findings support that, among college-aged women, PA is associated with pain indirectly through its associations with symptoms of somatization and panic disorder.

Chronic musculoskeletal pain (CMP) is a prevalent condition among Veterans of the Persian Gulf War (GV). We have previously demonstrated augmented sensitivity to painful stimuli in GV with CMP. Exercise training is an effective method for reducing pain symptoms in patients with CMP; however, the influence of exercise training on pain sensitivity to experimental stimuli is unknown. PURPOSE: To examine the effect of whole-body resistance exercise training (RET) on pain sensitivity among GV with CMP. It was hypothesized that, compared to a wait-list control (WLC) condition, sensitivity to painful stimuli would significantly decrease over time in participants assigned to RET. METHODS: GV who met criteria for widespread CMP were randomly assigned to a 16-week, whole-body resistance exercise training program (n=21; 49±5 years) or a wait-list control group (n=19; 50±7 years). Pain sensitivity was measured by recording perceptual ratings (0-20) of pain intensity and unpleasantness in response to a series of noxious thermal stimuli (45ºC, 47ºC, 48.9ºC) at baseline, 6, 11, and 17 weeks. Separate three-way repeated measures MANOVA models with time (baseline, 6, 11, and 17 weeks) and temperature (45ºC, 47ºC, 48.9ºC) as the within-subjects factors, and group (RET, WLC) as the between-subjects factor were used to examine the effect of RET on pain intensity and unpleasantness ratings. RESULTS: Whole body strength improved across the 16-week training period (average 1-RM change from baseline across 10 upper & lower body exercises = 28.95%). Mean pain ratings across measurement time-points for 45ºC, 47ºC, and 48.9ºC stimuli corresponded to 3.7, 5.5, and 10 for unpleasantness, respectively. Aside from a significant main effect of temperature in the intensity, A = 0.14, F (2,29) = 90.79, p < .001, and unpleasantness, A = 0.17, F (2,29) = 72.14, p < .001, MANOVA models, there were no significant main or interaction effects.

CONCLUSIONS: Resistance exercise training does not affect pain sensitivity in GV with CMP. Importantly, this finding suggests that resistance exercise has a low risk of exacerbating pain sensitivity and is a safe strategy for increasing upper and lower body strength in this population.

Supported by US Department of Veterans Affairs grant #I01CX000383

### Table 1: Changes across groups at six months

<table>
<thead>
<tr>
<th></th>
<th>β</th>
<th>p-value</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stanford Presenteeism Scale</td>
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<td>0.37</td>
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<tr>
<td>Health Work Questionnaire</td>
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<tr>
<td>Total Score</td>
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<td>0.905</td>
<td>0.03</td>
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<tr>
<td>Productivity</td>
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<td>0.675</td>
<td>0.16</td>
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<tr>
<td>Concentration/Focus</td>
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<td>0.269</td>
<td>0.39</td>
</tr>
<tr>
<td>Supervisor relations</td>
<td>0.04</td>
<td>0.944</td>
<td>0.02</td>
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<tr>
<td>Non-work Satisfaction</td>
<td>0.82</td>
<td>0.092</td>
<td>0.49</td>
</tr>
<tr>
<td>Work Satisfaction</td>
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<td>0.02</td>
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<tr>
<td>Impatience/Irritability</td>
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<td>0.073</td>
<td>0.64</td>
</tr>
<tr>
<td>SF-36</td>
<td></td>
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<tr>
<td>General health</td>
<td>5.61</td>
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<tr>
<td>Physical functioning</td>
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<td>Limitations (physical health)</td>
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<td>Limitations (emotional problems)</td>
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<td>Emotional well-being</td>
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<tr>
<td>Social functioning</td>
<td>11.92</td>
<td>0.024</td>
<td>0.62</td>
</tr>
<tr>
<td>Pain</td>
<td>8.85</td>
<td>0.036</td>
<td>0.48</td>
</tr>
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</table>

Note: β = adjusted group effect, d = Cohen’s d
A female ultrarunner’s ability to cope with stressful situations during competition is crucial for optimal development. Therefore, the ability to cope under these circumstances is essential for creating a strong mental capacity that leads to competitive success. PURPOSE: To quantify the pain coping skills of female ultra runners. METHODS: Following written informed consent, 76 female ultra runners (mean age 38.9 ± 9.4) completed the Sports Inventory for Pain (SIP; Meyers et al., 1992): direct coping (COP), cognitive (COG), catastrophizing (CAT), avoidance (AVD), body awareness (BOD), and total coping responses (TCR). Data were grouped by distance (<50 miles, 50-99 miles, 100+ miles), experience in years (novice-3, 4-9, 10+), age (20-39 years, 40+ years), number of ultra competitions completed (1-2, 3-4, 5+), ethnicity (Caucasian, other), present injury status (yes, no), and competitive injuries (0, 1-2, 3+). To make the data more meaningful, raw SIP scores were converted to normalized standard scores (T-scores) with a mean of 50 and a standard deviation of 10. RESULTS: MANOVAs (Wilks’ criterion) indicated no significant effects across distance (F(11,105) = 1.256, P = 0.252), experience (F(11,104) = 0.840, P = 0.609), age (F(11,105) = 0.511, P = 0.798), ultra competitions completed (F(11,104) = 1.004, P = 0.449), ethnicity (F(11,104) = 0.393, P = 0.880), current injury status (F(11,105) = 1.625, P = 0.153), and competitive injuries (F(11,104) = 0.856, P = 0.59). Coping skills among this group reflected above-average response, with T-scores ranging from 43 to 57. There is a trend for ultrarunners to respond more positively in COP, COG, CAT, AVD, BOD, and TCR when compared to normative values across other athletic populations. CONCLUSION: While the limited sample size may have affected the results, observed power was deemed adequate (1-β = 0.153), and competitive injuries (0, 1-2, 3+) did not differ between groups in the VL or BR following both exercise modalities or following the ice bath (p ≥ 0.05). A significant main effect for time was observed for VL PPT’s with values increasing 18.2 ± 14.3% following 30-min of running (p < 0.001), 14.8 ± 14.6% following handgrip (p < 0.001), and 19.7 ± 22.0 following the ice bath. In the BR EIH occurred following handgrip (26.5 ± 23.2% increase; p < 0.001) and the ice bath (17.6 ± 21.5% increase; p < 0.001), but not the treadmill run (10.4 ± 19.2, p = 0.057). CONCLUSIONS: Training status and exercise type had no effect on EIH or CPM when PPT were assessed in the VL. Interestingly running was not a sufficient stimulus to evoke EIH in the BR. While familiarity with the exercise modality appeared to play no role in the EIH response, the exercise modality did play a role in systemic pain modulation with isometric exercise yielding a more robust response.

Athletes have been shown to be less sensitive to pain than sedentary individuals. However, it is unclear whether their ability to modulate pain via conditioned pain modulation (CPM) differs. Exercise-induced hypoalgesia is a phenomenon related to CPM where pain sensitivity decreases following a bout of exercise. Little data exist on whether the EIH response differs between athletes and non-athletes. The study examined the effects of aerobic training status of sensitivity to pain following a familiar (running) and unfamiliar (handgrip) exercise. METHODS: The pressure pain response of highly aerobically trained (N=13; T) and untrained participants (N=10; UT) were tested before and after performance of an isometric hand grip exercise to failure, a 30-min run at 110% of gas exchange threshold, and placing their foot in an ice bath (2°C) for 1-min. Pressure pain thresholds (PPT) were assessed in the vastus lateralis (VL) and brachioradialis (BR) using a pressure algometer. The difference between post and pre measures was defined the EIH response (exercise conditions) and CPM response (ice bath). RESULTS: The groups differed on VO2peak (T: 72.2 ± 6.6; UN: 44.0 ± 8.0 ml·kg⁻¹·min⁻¹; p < 0.001). PPT did not differ between groups in the VL or BR following both exercise modalities or following the ice bath (p ≥ 0.05). A significant main effect for time was observed for VL PPT’s with values increasing 18.2 ± 14.3% following 30-min of running (p < 0.001), 14.8 ± 14.6% following handgrip (p < 0.001), and 19.7 ± 22.0 following the ice bath. In the BR EIH occurred following handgrip (26.5 ± 23.2% increase; p < 0.001) and the ice bath (17.6 ± 21.5% increase; p < 0.001), but not the treadmill run (10.4 ± 19.2, p = 0.057).

CONCLUSIONS: Training status and exercise type had no effect on EIH or CPM when PPT were assessed in the VL. Interestingly running was not a sufficient stimulus to evoke EIH in the BR. While familiarity with the exercise modality appeared to play no role in the EIH response, the exercise modality did play a role in systemic pain modulation with isometric exercise yielding a more robust response.
Chronic pain is a debilitating disease that affects more people than any other chronic disease. Currently, there is not a singular treatment known to cure or assure relief from chronic pain. Accordingly, the management of patients’ discomfort is an integral part of treating chronic pain. Such treatment, however, is not effective for many patients. PURPOSE: We determined if mindful laughter provided by comic relief can influence pain tolerance and muscle soreness in young healthy participants. METHODS: Forty participants underwent a randomized controlled cross-over designed experiment. Each participant was exposed to a comedy video eliciting mindful laughter and a boring documentary. Delayed onset muscle soreness was induced in one leg at a time by eccentric exercises to mimic chronic pain. Pain tolerance was tested using the blunt force application. RESULTS: Watching the comedy video elicited a significantly greater irregular breathing pattern compared with watching the documentary video (p=0.001). After watching the comedy, the participants’ positive affect was increased (A2±1) while it was largely decreased (A-11±2) after watching the documentary video (p=0.001). Pain tolerance was decreased by 17.5% after viewing the documentary video (p=0.001), but did not change significantly after watching the comedy. There were no significant changes in the visual analogue pain/soreness score from viewing either video. CONCLUSION: Thirty-minutes of watching a comedy eliciting laughter favorably influenced pain tolerance in healthy humans.

Smokers typically exhibit lower body weights than non-smokers despite poorer metabolic and physiologic profiles. Nicotine, an appetite suppressant found in cigarettes and cigars, may play a role in weight control. Physical activity also contributes to lower body weights; however, this simultaneously reduces all-cause mortality, risk of coronary artery disease, and other chronic conditions. PURPOSE: To investigate if smoking status has an impact on weight loss and physical activity motivation in patients 1-17 years after Roux-en-Y gastric bypass (RYGB). METHODS: A total of 509 individuals who had previously undergone RYGB (1-17 years post) were included in the study. Smoking status was assessed during the pre-surgery meals. Participants were divided into three groups based on pre-to-post-surgery change in physical activity: decrease, stable and increase. RESULTS: Measurements regarding physical activity (Baecke questionnaire), body composition (bioelectrical impedance analysis), cardiorespiratory fitness (Astrand) and quality of life (SF-36) were performed pre-surgery and two years post-surgery. Linear regressions between change in physical activity and change in health outcomes were conducted. RESULTS: Increasing physical activity was associated with larger excess weight loss (β=3.17; 95%CI=1.40-4.93; P=0.001) and greater increases in VO2max (β=2.01; 95%CI=0.51-3.51; P=0.009) and %fat-free mass (β=1.05; 95%CI=0.50-1.60; P=0.001) compared to stable- and declining physical activity. Decreasing physical activity was associated with a decrease in VO2max (β=-3.91; 95%CI=6.40- -1.43; P=0.002). The increase-group showed greater increases in all quality of life subscales compared to stable- and decrease-group (P=0.05), except for physical functioning. Change in physical activity was not related to changes in absolute fat-free mass. CONCLUSIONS: Increasing physical activity from pre- to post-surgery was associated with greater excessive weight loss and greater improvements in body composition, cardiorespiratory fitness and quality of life. Therefore, increasing physical activity after bariatric surgery seems essential for bariatric success in terms of health outcomes.
CONCLUSION: These data suggest that exercise capacity, ventilation-perfusion matching, and ventilatory efficiency are similar in NO and O2 HF. However, the translation of resting alveolar-capillary function to these interdependent measures of exercise capacity may be confounded by obesity.

2114 June 1 10:15 AM - 10:30 AM

Obstructive Sleep Apnea Negatively Impacts Objectively Measured Physical Activity

Trent A. Hargens, FACSM, Ryan A. Martin, Courtney L. Strosnider, Gabrielle Giersch, Christopher J. Womack, FACSM. James Madison University, Harrisonburg, VA. (No relevant relationships reported)

Obstructive sleep apnea (OSA) is a disorder that results daytime sleepiness and fatigue. Additionally, OSA increases the risk for cardiovascular disease and diabetes, which is exacerbated by sedentary behavior. Obesity and OSA are frequent co-morbid conditions, so the impact of OSA, independent of obesity, on physical activity (PA) is not clear.

PURPOSE: To examine the effect of OSA on objectively measured PA via actigraphy.

METHODS: Overweight-to-obese individuals were recruited and screened for the presence of OSA via portable diagnostic device and divided into an OSA group [n = 35; Age = 45.2 ± 12.0; body mass index (BMI) = 33.0 ± 5.7 kg/m2] and a Control group (n = 24; Age = 35.0 ± 11.7; BMI = 30.5 ± 4.3 kg/m2). Daytime sleepiness was assessed with the Epworth Sleepiness Scale questionnaire. Body composition was assessed with dual-energy X-ray absorptiometry. Subjects wore an accelerometer for a minimum of 4 and maximum of 7 days, including at least 1 weekend day.

RESULTS: The OSA group’s mean OSA severity (Apnea-Hypopnea Index = 20.4 ± 17.6) classifies as “moderate OSA”. There were no group differences in BMI, percent fat, or daytime sleepiness. Waist (106.4 ± 11.7 vs. 98.5 ± 9.1) and neck circumference (41.9 ± 3.3 vs. 38.8 ± 2.7) were higher in the OSA group. The OSA group was significantly older than the control group. Pearson correlation analysis showed that age was not related to any PA variable except for the total number of moderate or greater PA bouts (PA for ≥10 consecutive minutes) and the average number of bouts per day. The OSA group had fewer steps (6409.0 ± 2317.6 vs. 7856.8 ± 2942.7; P = 0.04), moderate intensity minutes (29.9 ± 15.1 vs. 42.4 ± 25.5; P < 0.01), moderate-to-vigorous minutes (33.0 ± 3.0 vs. 46.0 ± 5.4; P < 0.03), total number of bouts (3.2 ± 3.4 vs. 5.9 ± 5.0; P = 0.02), and number of bouts per day (0.5 ± 0.5 vs. 1.0 ± 0.8; P = 0.01). When adjusted for age, the PA bout data was no longer significant.

CONCLUSION: Individuals screened as likely possessing OSA were less physically active than individuals without OSA when measured through objective means. We found no group differences in daytime sleepiness, BMI or percent fat, suggesting other mechanisms than obesity and sleepiness for this difference.

2115 June 1 10:30 AM - 10:45 AM

Patterns of Prolonged, Uninterrupted Sedentary Bouts in the First Month after Acute Coronary Syndrome

Andrea T. Duran1, Carol Ewing Garber, FACSM1, Joseph E. Schwartz2, Keith M. Diaz1, Carol Ewing Garber, FACSM. 1Teachers College, Columbia University, New York, NY; 2Columbia University Medical Center, New York, NY. (No relevant relationships reported)

Total volume of sedentary behavior (SED) and its accrual in prolonged, uninterrupted bouts are crucial health risk behaviors to target in U.S. adults. Acute coronary syndrome (ACS) survivors engage in high volumes of SED post-hospitalization, but the accrual of prolonged, uninterrupted bouts is unclear.

PURPOSE: To characterize patterns of SED time accrued in prolonged, uninterrupted bouts and their trajectories of change in ACS patients over the first month post-discharge.

METHODS: Participants (n=162) with confirmed ACS (myocardial infarction or unstable angina) from a university hospital in Manhattan were examined. SED was objectively measured for 28-days post-discharge via ActiGraph accelerometer. SED bout characteristics were quantified at the day-level and averaged over the 28-day period. Group-based modeling at the day-level was used to characterize the trajectories of change in SED bouts (% of total SED time accrued in ≥ 30 min) over the 28-days.

RESULTS: Participants spent a mean (SD) of 9.5 ± 2.0 hrs/day in SED time, with a mean (SD) SED bout length of 7.1 ± 2.4 mins/bout, over one month post-discharge. The total number of SED bouts >30, >60, and >90 mins were, on average, 4.9 ± 2.3, 1.2 ± 0.8, and 0.3 ± 0.3 bouts/day, accounting for 31.8 ± 12.8%, 12.1 ± 8.2%, and 4.9 ± 4.8% of total SED time, respectively. Four distinct SED bout trajectory groups were identified (Fig 1). The very high (12.2%), high (38.3%), and moderate (38.9%) trajectory groups accrued, on average, 52.0%, 38.1%, and 25.7% of total SED time from bouts ≥30 min, respectively, with little change in day-level SED bouts post-discharge. The low trajectory group (10.6%) accrued, on average, 9.8% of total SED time from bouts ≥30 min, with a decline in SED bouts post-discharge.

CONCLUSION: ACS survivors accrued ~30% of total SED in prolonged, uninterrupted bouts ≥30 min, on average, after hospitalization, with the majority showing little day-level change in such bouts over the first month post-discharge.

Figure 1. Trajectories of total sedentary time accrued in bouts ≥30 minutes in ACS survivors post-discharge.
MEDICINE & SCIENCE IN SPORTS & EXERCISE®

2118 June 1 11:00 AM - 11:15 AM Impact of 10-weeks Of High Intensity Interval Training On the Myokine METRNL And Inflammatory Markers In Older Adults With Rheumatoid Arthritis Or Prediabetes
David Bartlett. Duke University, Durham, NC. (Sponsor: William E. Kraus, FACSM)

No relevant relationships reported

PURPOSE: Rheumatoid arthritis (RA) and diabetes are inflammatory diseases associated with physical inactivity. Physical inactivity and inflammation are augmented by dysregulated skeletal muscle remodeling. During exercise, skeletal muscle produces a number of factors, termed ‘myokines’, which enhance exercise adaptations. One such myokine, meteor-in-like protein (METRNL), regulates both muscle and systemic adaptations. The purpose of this study was to examine the effects of high-intensity interval training (HIIT) in older adults with RA or prediabetes on muscle and plasma METRNL.

METHODS: Twenty-two older adults (67 ± 7 years) with either RA (n=12) or prediabetes (n=10) completed 10 weeks of HIIT consisting 3 x 30 min sessions/week of ≥60 second intervals at 80-90% interspersed by 50-60% VO2max. Clinical characteristics, blood and skeletal muscle METRNL and inflammatory markers were assessed before and after HIIT.

RESULTS: Following 10 weeks of HIIT, plasma METRNL increased in those with RA (p=0.02) but not in those with prediabetes (p=0.568). Muscle METRNL mRNA increased following exercise in those with prediabetes (p=0.002) but not RA (p=0.986) while muscle METRNL concentrations increased in both groups (p=0.05). Greater plasma METRNL with exercise was associated with a reduced percentage of inflammatory CD14+/CD16+ monocytes in those with RA (p=0.05). Greater METRNL mRNA with exercise was associated with greater muscle IL-8 (r = -0.571; p=0.007). Greater muscle METRNL with exercise was associated with greater concentrations of muscle IL-10 and IL-6 (both r = -0.663; p=0.003); greater muscle IL-6 with exercise was associated with better grip strength and 30-second chair stands (r = -0.443; p=0.05).

CONCLUSIONS: Although METRNL was not associated with changes in disease indices, exercise-induced increased plasma and muscle protein and mRNA were associated with improved inflammatory profiles. Our data suggest METRNL is associated with a beneficial inflammatory response to exercise training in patients with inflammatory disease; although protein translation responses may differ depending on the disease. Thus, HIIT may improve the coordination of cytokines and myokines critical for skeletal muscle and systemic exercise-induced adaptations. Funding: EU Marie Curie (PIOF-GA-2013-629981).

TEST AND RESULTS: XR AP Pelvis: showed a left comminuted acetabular fracture with an associated posterior hip dislocation

DIFFERENTIAL DIAGNOSIS: Acetabular pelvic fracture and posterior hip dislocation

TREATMENT AND OUTCOMES: She was transported to the local Emergency Room where she was evaluated and imaging was performed. She required a higher level of care and was transferred to a high level trauma center where she was admitted. The next morning (Monday) she underwent a surgical reduction of the posterior hip dislocation. She remained in traction until Tuesday when she had an additional CT scan and was taken back to the operating room for an open reduction, internal fixation of the acetabular fracture. She was up on crutches the next morning after surgery and spent one additional night in the hospital until being released on Thursday evening before flying home the next afternoon (Friday). After being admitted on Sunday night, she spent 4 days/nights total in the hospital and one night in a hotel. 5 days after the incident, she returned home to Utah.

The patient was non-weight bearing for 8 weeks. She was in formal physical therapy for 10 weeks and was able to ambulate without assistance 2.5 months after accident. She has slowly begun to return to weightlifting by 11 months post-injury.

2123 June 1 9:50 AM - 10:10 AM Groin Injury- Football
Amanda Chaneys, Amanda Goodale, Richard Okrakagy, Henry Stiene, FACSM. 1TriHealth Sports Medicine, Cincinnati, OH. 2Beacon Orthopedics and Sports Medicine, Cincinnati, OH. (Sponsor: Henry Stiene, MD, FACSM)

No relevant relationships reported

HISTORY: A 22 year old division III college football player was running during practice and tried to make a cut on 8/22/17 and felt a pull in his left groin. The patient was evaluated by the athletic trainer who felt a pull in the left groin and was diagnosed with a left adductor strain. The athlete met with the athletic trainer frequently over the next few weeks to treat his pain with modalities such as laser therapy, electrical stimulation and cupping as well as doing strengthening exercises and activity modification. During game on 9/9/17, athlete played most of the game but had great amount of pain. He woke up the morning of 9/11 and noticed that he was severely bruised at the left groin region and was unable to walk without discomfort. The athlete said that he felt pain radiating into his abdomen and down into his left leg. At that point, he was referred to our Sports Medicine clinic.

PHYSICAL EXAMINATION: General: under no acute distress; alert and oriented Heart: regular rate and intact distal pulses; Lungs: CTA bilaterally; Abdomen: soft, mildly tender at right and left lower quadrants, non-distended, normal bowel sounds in all four quadrants; Groin: diffuse ecchymosis at left groin region & at pubic symphysis and left pubic tubercle; tendon to palpation at left side of pubic region as well as at left lower quadrant of abdomen; weak left hip adductors & hip flexors noted on exam and pain with hip adduction and hip flexion DIFFERENTIAL DIAGNOSIS: 1. Left hip Adductor strain 2. Left hip Adductor tear 3. Left pubic tubercle bone contusion 4. Left iliopsoas strain TEST AND RESULTS: Left Hip X-ray AP and Lateral: no acute fracture or abnormal findings MRI of Pelvis w/o contrast: left adductor longus tear with 2.5 cm of retraction FINAL WORKING DIAGNOSIS: Left adductor tendon avulsion with approximately 2.5 cm of tendon retraction.

TREATMENT AND OUTCOMES: The athlete had approximately two weeks of rest after time of diagnosis. The consulting orthopedic surgeon recommended conservative treatment with activity modification and rehab exercises as he was desiring to finish his senior season. He continue to report pain with activity and at the conclusion of the season, will likely be reimaged to determine if conservative treatment is still acceptable or if injury has worsened further to the point of requiring surgery.

2122 June 1 9:30 AM - 9:50 AM Pelvic Injury - Weightlifting
Erin S. Barnes. Temple University, Philadelphia, PA. (Sponsor: Mark Lalavalle, FACSM)

No relevant relationships reported

HISTORY: A 34-year-old female was competing in the 90 kilogram weight-class at a national weightlifting competition. During her 3rd snatch attempt at 80 kilograms, she fell forward on both hands and knees and then to the platform. She has slowly begun to return to weightlifting by 11 months post-injury.

PHYSICAL EXAMINATION: Urgent examination revealed an athlete lying on her back with her left hip slightly flexed with severe pain at rest and with passive movement of the hip joint. She was unable to move her left hip voluntarily. Her bilateral lower extremity sensory exam was intact and reflexes were symmetric. She was able to flex and extend both knees and ankles. There were no deformities on palpation of her lumbar spine and sacroiliac joints. DIFFERENTIAL DIAGNOSIS: Posterior hip dislocation, Iliac Crest fracture, Hip Pointer, Acetabular Fracture, Femoral Neck Fracture

2124 June 1 10:10 AM - 10:30 AM Testicular Pain- Football
Mary Jaculli, DO. Evergreen Sports Medicine Fellowship, Augusta, ME. (Sponsor: Peter Sedgwick, MD, FACSM)

No relevant relationships reported

HISTORY: 21 year-old collegiate football player presents to the clinic with recurrent, intermittent, severe left testicular pain occurring at rest for the past two weeks. The first episode was so severe it prompted him to go to the emergency department. There, urinary studies were performed which were negative for infection and he underwent a scrotal ultrasound. The ultrasound showed decreased left testicular vascularity, but negative for torsion. The pain had mostly resolved at the time of imaging. He returned to the ED the following day with another severe episode and underwent a second scrotal ultrasound, which showed swelling of epididymis. He was treated empirically for epididymitis with ciprofloxacin and asked to follow up.

At follow up, he reports his testicular pain is gradually improving but is still sore. Denies swelling or redness of testicle. No urinary symptoms. Denies risk factors for sexually transmitted infections. Denies history of genitourinary surgery. He admits to smoking 1-2 packs/day and occasional marijuana use. He denies a history of illicit drug use. He denies sexual activity in the past month. He denies a history of travel.

PHYSICAL EXAMINATION: Well appearing, no acute distress. Abdomen soft. No inguinal, femoral, ventral hernia. Normal scrotum bilaterally without erythema or rash. Normal vas deferens bilaterally, normal spermatic cord bilaterally. Left epididymis...
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not enlarged, but mildly tender to palpation. Right normal. Left testes with Bell Clapper deformity, non-tender, no mass. Right testes normal. Circumcised penis with normal meatus.

DIFFERENTIAL DIAGNOSIS: Testicular torsion-detorsion syndrome; Epididymitis; Torsion of testicular appendage; Orchitis Inguinal hernia; Varicocele; Hydrocele; Epididymal hypertension

TEST AND RESULTS: Urinalysis: negative; Urine culture: negative; Scrotal US: Normal testicles with symmetric blood flow; Scrotal US: 9/23/17: Left epididymitis. Normal testicles with symmetric blood flow; Scrotal US: 9/23/17: modestly decreased but present vascularity of left testicle of uncertain significance but incompatible with torsion at this time. FINAL WORKING DIAGNOSIS: Testicular torsion-detorsion syndrome

TREATMENT AND OUTCOMES:
Referred to urology. Withheld from contact play until evaluated by urology. Urology recommended orchiopexy, which was performed within 1 week of specialty evaluation. Per urology, can return to aerobic and contact activity 2 weeks after procedure.

June 1 10:30 AM - 10:50 AM
Hip Pain - Hiking
Cory Mitchell, Caitlin Waters, Herb Stevenson. UM: Memorial Medical Center, Worcester, MA. (Sponsor: Pierre Rouzier, FACSM)

(No relevant relationships reported)

HISTORY: A 78-year-old male is seen for evaluation of left lateral thigh pain. Symptoms present over the past few years but have worsened over the past six months. Recalls no specific onset. Pain is 3/10 and aching in quality. It is located over the lateral hip and thigh. Symptoms are worse with lifting and hiking, particularly on an incline. Pain is better with rest and does not radiate. He has associated burning, also with activity, in the same distribution. Denies back pain. He has no allergies, is a former smoker and takes medications for high blood pressure and cholesterol. Denies prior injuries or surgeries of the back, hip or legs.

PHYSICAL EXAMINATION: GEN: A&O3x, in NAD. Central obesity. HEENT: N/CAT. EOMI. CV: RRR, 2 peripheral pulses PULM: CTAB SKIN: No rashes or signs of infection. NEURO: Symmetric strength and sensation in all 4 extremities. MSK: No deformity of the left hip. He has tenderness over the anterior greater trochanter but is otherwise nontender. External/internal rotation full, passive flexion to 110. Resisted abduction causes pain without reproduction of burning sensation. Negative FABER and FADIR. Antalgic gait. Lumbar spine non-tender. Full flexion/extension. Negative straight leg raise.

DIFFERENTIAL DIAGNOSIS: Gluteus medius/minimus tendinopathy Left hip osteoarthritis IT Band syndrome Piriformis syndrome


FINAL WORKING DIAGNOSIS: Gluteus minimus tendinopathy with partial tear Meralgia paresthetica

TREATMENT AND OUTCOMES: 12-week course of physical therapy: 40% decrease in pain, burning feeling unchanged. Palpation-guided greater trochanteric bursa cortisone injection: minimal relief. Ultrasound-guided needle tenotomy of gluteus minimus tendon without effect on lateral hip pain. Returned to regular daily activities and household chores. Yet to resume hiking due to lack of muscular endurance.

June 1 10:50 AM - 11:10 AM
Left Hip Pain and Swelling Following a Bicycle Accident
George A. Ceremuga, Edward R. Laskowski, FACSM, Kristina M. Collbenson, 2Mayo School of Graduate Medical Education, Rochester, MN. Mayo Clinic, Rochester, MN. (Sponsor: Edward Laskowski, FACSM)

(No relevant relationships reported)

HISTORY: A 45-year-old male bicyclist presented for evaluation of left hip pain and swelling following a bicycle accident that occurred approximately one week prior to presentation. His chief complaint was left groin and posterolateral gluteal region pain that increased with activity and improved with rest and anti-inflammatory medications. Radiographs were performed revealing no definitive acute fractures of the left hip. MRI revealed nondisplaced fractures of right sacral ala and left superior and inferior pubic rami as well as a large femoral fluid collection overlying left gluteal musculature.

PHYSICAL EXAMINATION: Healthy-appearing individual in no apparent distress. Normal gait cadence and stride. Significant ecchymosis with underlying, ballotable, fluid collection of left lateral hip and gluteal region. Tenderness to palpation in this region. Joint range of motion is full. Strength is full and sensation is grossly intact throughout. Discomfort with hip internal rotation and SInchfield’s and FABER tests on left. Straight leg raise is negative bilaterally.


TESTS AND RESULTS
Left hip radiographs: No definite acute fractures involving left hip. Left hip MRI: Nondisplaced fractures of the right sacral ala and left superior and inferior pubic rami. Large femoral fluid collection overlying the left gluteal musculature with surrounding subcutaneous edema, consistent with a Morel-Lavallée lesion.

FINAL WORKING DIAGNOSIS: Moro-Lavallée Lesion

TREATMENT AND OUTCOMES
1. Touch weightbearing crutch ambulation for left lower extremity and use of contraction shorts.
2. Ultrasound-guided needle aspiration of gluteal fluid collection: 180 cc of serosanguineous fluid obtained; compression dressing applied afterwards.
3. Two weeks later, surgical evaluation revealed 15 x 10 cm reaccumulation of fluid in the same location. Advised to undergo incision and drainage and partial capsulectomy. Surgery was without complications and a JP drain was placed.
4. Left thigh JP drain exchange performed for clogged drain.
5. Drain removed but 4 days later repeat aspiration of 32 cc was performed.
6. One week later, repeat aspiration of 32 cc was performed, followed by complete resolution.

June 1 11:10 AM - 11:30 AM
"Hip Pop" - Acute Anterior Thigh Pain in an Adolescent Soccer Player
Jonathan Koretoff. University of Minnesota, Minneapolis, MN. (Sponsor: Suzanne Hecht, FACSM)

(No relevant relationships reported)

HISTORY: 15-year-old male club soccer athlete reported acute onset of left proximal thigh pain after sprinting straight ahead while playing in a game in a soccer tournament. He was the starting goalie for the team. While running, he felt a pop in his proximal thigh with inability to bear weight. Reported the sensation occurred while sprinting. He collapsed on the field and was evaluated by a sideline sports medicine physician as well as a certified athletic trainer. He was then transported to the on-site medical clinic. No numbness and tingling. No prior pain or injury.

PHYSICAL EXAM:
GEN: Mild distress while sitting in wheelchair. No distress while lying flat. Awake, alert, and oriented x 3
MSK: LEFT HIP: No bruising or gross deformity. Tenderness over proximal hip flexors. Tenderness on postero medial aspect of hip adductor musculature. Unable to raise leg from the exam table unassisted. Marked pain with active range of motion in flexion with knee extended. Moderate pain with passive hip flexion. Unable to bear weight. 2-5 strength in hip flexion. FABER/FADIR elicited pain over proximal quadriceps. No bony pelvic tenderness LUMBAR SPINE: No bruising or gross deformity. Non tender spinous processes and paraspinal musculature. No radicular pain with straight leg raise. Achillies and patellar reflexes bilaterally symmetrical


TEST AND RESULTS: Xray left hip (AP and lateral). Lessor trochanteric apophyseal avulsion fracture, minimally displaced

FINAL WORKING DIAGNOSIS: Lesser trochanteric apophyseal avulsion fracture

TREATMENT AND OUTCOMES: He was placed non-weight bearing on crutches. At follow-up 1 week post injury he lacked active range of motion of his left hip. After his initial clinic visit, further follow up occurred at 2 weeks, 1 month, and 2 months. At 2 weeks he could bear weight with pain but lacked active range of motion. At 1 month he could bear weight without pain but lacked active range of motion. At 2 months he could bear weight and hop without pain but had 3/5 hip strength and had active range of motion with no pain. Referred to physical therapy. He is now enrolled in return to run program. Imaging at 6 weeks and 2 months showed stable fracture.

Abstracts were prepared by the authors and printed as submitted.

DIFFERENTIAL DIAGNOSIS:
- Parsonage Turner Syndrome
- Brachial Plexopathy
- Radicopathy, mononeuropathy
- Inflammatory Myopathy

Faciocapulohumeral muscular dystrophy

TEST AND RESULTS:
EMG: Isolated right pectoral nerve mononeuropathy. MRI: Denervation changes within the right pectoralis major muscle. No abnormalities of the right brachial plexus. Ultrasound: Atrophy of the right pectoralis major. Visualized elements of the lateral and medial pectoral nerves are normal.

FINAL WORKING DIAGNOSIS:
Right pectoral major atrophy in the context of isolated right pectoral nerve mononeuropathy.

TREATMENT AND OUTCOMES:
Patient was referred back to physical therapy with recommendations to hold off on bench pressing exercise until he demonstrates neurologic recovery. At the one month follow up improved bulk and muscle quivering of his right pectoralis major was seen. He was allowed to pursue low resistance pectoral strengthening with recommendations to continue to avoid any heavy load pectoralis exercise for one to three months after which he can initiate a gradual return to normal activity.

History:
20 yo M right hand dominant decathlete at a division III college presents with left shoulder weakness. Started 2 months prior, the morning after a routine weight lifting workout. Began with an ache in the shoulder followed by a tight feeling with some radiation to the trapezius up the neck, and finally with some weakness lifting and externally rotating the arm that slowly increased over a week then plateaued. He had no paresthesias. The pain slowly subsided and resolved over approximately 3 weeks, but the weakness persisted. PMHx, PSx, FHx are non-contributory, not taking any medications.

PHysical examination:

BP 108/70 mmHg | Pulse 60 | Ht (5’9”) | Wt 170 lb | BMI 25.16 kg/m2

Left shoulder exam reveals atrophy of infraspinatus and supraspinatus, non-tender to palpation in neck, shoulder or upper arm. Normal active and passive ROM in all motions of the shoulder and neck. Reisted ROM was painless and yielded 4+/5 strength in external rotation & abduction. Neer’s, Hawkins’, AC compression, O’Brien’s, labral shear, Yergason’s, Speeds, stability testing, Spurling’s are all negative. Neurovascular: dermatomes intact to light touch in B/L upper extremities, 2+ reflexes biceps, triceps, brachioradialis, 2+ radial pulses

DIFFERENTIAL Diagnosis:

Suprascapular nerve impingement, brachial plexitis (Parsonage Turner syndrome), rotator cuff tear(infraspinatus and/or supraspinatus), cervical radiculopathy (C6), thoracic outlet syndrome.

Tests and Results:
#Limited bedside MSK US of left shoulder: no obvious entrapment at the spinoglenoid notch.

Patient was referred to Neurology for EMG who then ordered an MRI to rule out cervical radiculopathy.

#EMG of left upper extremity.

Suprascapular nerve - Right was normal. Left had normal latency, but CMAP was distorted. Median nerve normal. Needle exam - abundant acute denervation in infraspinatus, less so in supraspinatus. Both with decreased recruitment. Deltoid muscle demonstrated decreased recruitment with minimal polyphagia.

#MRI CERVICAL SPINE: Normal MRI scan of the cervical spine.

Final/Working Diagnosis: Parsonage turner syndrome with primary involvement of the suprascapular nerve.

Treatment: PT

Outcomes: Strength slowly improving. No pain.
Management of a Patient with Lateral Elbow Pain Secondary to Acute Adverse Neural Irritation

Sean Harris¹, James Gregory², Alexis Ortiz, FACSMB, Memorial Hermann, Houston, TX; UT Health, Houston, TX; Texas Woman’s University, Houston, TX. (Sponsor: Alexis Ortiz, FACSMB)

HISTORY: A 2138 June 1 9:30 AM - 9:50 AM

Bilateral Cubital Tunnel Syndrome in a Female Ice Hockey Player

Kiran Bojedla, Damian Mosher. Millcreek Community Hospital, Erie, PA. (Sponsor: Patrick Leary DO, FACSMB)

DIFFERENTIAL DIAGNOSIS:
1. Lateral epicondylalgia
2. Cervical radiculopathy
3. Peripheral neuropathy

TEST AND RESULTS:
Elbow anterior to posterior and lateral radiograph
- Congenitally deepened olecranon fossa, resulting in excessive elbow hyperextension
Lateral corticosteroid injection
- Immediate onset of radiating symptoms into medial forearm; no improvement in lateral elbow symptoms

Grip strength measured with hand-held dynamometer
- Pain-free grip on right measured at 158 (50% on L)

FINAL/WORKING DIAGNOSIS:
Lateral epicondylalgia with underlying acute peripheral nerve irritation, and possible distal sensory overlap of radial/median nerves.

TREATMENT AND OUTCOMES:
6 PT sessions over 6 weeks consisting of:
1. Thoracic manipulation
2. Radio-humeral distraction
3. Distal radial nerve sliders
5. Closed-chain tendons loading progression

Outcomes at 6 weeks:
1. Improved Quick DASH from 34 to 3
2. Normal adverse neural testing
3. Pain-free grip improved to 45# on right
4. Return to normal functional activities

Bilateral Wrist Pain and Hand Numbness -- Football

Jonathan Harvey. University of Minnesota Sports Medicine Fellowship, Minneapolis, MN. (Sponsor: Dr. Suzanne Hecht, FACSMB, FACSMB)

HISTORY: 2138 June 1 9:30 AM - 9:50 AM

Wrist Injury - Taekwondo

Catherine Scruggs, Claire Gross, Holly J. Benjamin, FACSM, Daniel P. Mass. MacNeal Hospital, Bervlin, IL. University of Chicago, Chicago, IL. (Sponsor: Holly J. Benjamin, MD, FACSM)

History: An 18-year-old right-hand dominant male, nationally-ranked Taekwondo competitor presented with a 4-year history of left wrist pain. Four years prior to presentation, he was kicked on the ulnar wrist while sparring. At that time, he had tenderness over the ulnar styloid and distal physis, no tenderness at the ulnar-carpal intersection syndrome, Lateral antebrachial cutaneous nerve neuritis, Radial tunnel syndrome, Brachial plexus injury, Cervical injury. DIFFERENTIAL DIAGNOSIS: Lateral epicondylalgia tests were all + on right (Cozen’s, Mill’s, Maudsley’s), but did not reproduce radiating symptoms. She had painful supination, with mild reproduction of radiating symptoms. Performing Tinel percussion over supinator during elbow extension/pronation reproduced radiating pain from elbow to medial forearm.

DIFFERENTIAL DIAGNOSIS:
1. Thoracic manipulation
2. Radio-humeral distraction
3. Distal radial nerve sliders
4. Closed-chain tendons loading progression
5. Closed-chain tendons loading progression
6. Normal adverse neural testing
7. Pain-free grip improved to 45# on right
8. Return to normal functional activities

Bilateral Arm Injury --- Women’s Ice Hockey

Kiran Bojedla DO, Millcreek Community Hospital Sports Medicine, Erie, PA.

(e-mail: Kiran.bojedla@gmail.com (Sponsor: Patrick Leary DO, FACSMB)

HISTORY: A 23-year-old female junior ice hockey collegiate athlete presented with bilateral distal arm pain and grip strength weakness, developed while lifting weights during off-season conditioning. Patient had been doing front squats with increasingly heavy loads put onto flexed elbows and wrists. Complained of pain waking her up at night and worsening recently, and with hand numbness/tingling during the day.

PHYSICAL EXAMINATION: Examination in the Training Room revealed bilateral grip strength weakness, left worse than right, numbness on the medial side of the wrists and 4th/5th fingers, and positive Tinel’s Sign / Phalen’s Test. At the shoulder, strength was 5/5 throughout and ROM was full bilaterally. Symptoms of grip strength weakness and paresthesias worsened over several visits.

DIFFERENTIAL DIAGNOSIS:
1. Carpel Tunnel Syndrome
2. Cubital Tunnel Syndrome
3. Central spinal cord lesion
4. Multiple Sclerosis

TREATMENT AND OUTCOMES:
Electromyelogram: Disruption of ulnar nerve conduction velocity through cubital tunnel bilaterally.

Cervical MRI: Possible Tarlov cyst at C5-C6 on left, no stenosis appreciated at any level, no herniations

Chest X-ray: No acute abnormalities

WORKING DIAGNOSIS:
Bilateral Cubital Tunnel Syndrome

TREATMENT AND OUTCOMES:
1. Keep arms extended at elbow as much as possible
2. Completely shut down from hockey activities (no skating / stickhandling)
3. Plan for L ulnar nerve release with Orthopedic Surgeon 11/2017
4. RTP to be determined depending on response to therapy
The patient continued to practice through pain for the following week. He was able to perform all activities of daily living without discomfort. The patient denied swelling, pain in other joints, weakness, and paresthesias.

**PHYSICAL EXAMINATION:**
Examination revealed tenderness to palpation at the base of the second and third metacarpals and pain with stressing the second and third carpometacarpal joints. There was severe pain to use of a tuning fork over the proximal second and third metacarpal. Fingertip and wrist ranges of motion were full and pain-free, and there was no swelling.

**DIFFERENTIAL DIAGNOSIS:**
1. Wrist extensor tenosynovitis
2. Ganglion cyst
3. Rheumatoid arthritis
4. Metacarpal stress fracture
5. Crystal arthropathy

**TEST AND RESULTS:**
PA, oblique, and splayed lateral radiographs of the right hand: -Negative for fracture; there were no erosions or degenerative change.
Noncontrast MRI of the right hand: -Stress fracture of the right second metacarpal in the proximal shaft with extension to the proximal articular surface; also observed was a stress fracture in the adjacent trapezoid. -Less prominent stress fracture/stress reaction of the right third metacarpal with no cortical break.

**FINAL WORKING DIAGNOSIS:**
Right second metacarpal proximal shaft stress fracture and right third metacarpal shaft stress fracture/reaction.

**TREATMENT AND OUTCOMES:**
1. Hold from tennis activities for 6 weeks.
2. Racket grip type changed from Western to Eastern grip type.
3. Gradual return to tennis starting 6 weeks after cessation of sport with focus on maintaining optical tennis mechanics and low-intensity groundstrokes.
4. Serves were initiated at 7 weeks after tolerating groundstrokes without discomfort.
5. Full return to sport by 3 months after being able to meet demands of his sport with pain-free high-intensity tennis shots.

**E-26 Free Communication/Poster - Water Sports**
Friday, June 1, 2018, 7:30 AM - 12:30 PM
Room: CC-Hall B

**2165 Board #1 June 1 9:30 AM - 11:00 AM**
**Associations Between Land-Based Performance Assessments and Maximal Effort Combat Swim Force Production**
Meaghan Beckner¹, Elizabeth Nagle, FACSM², Anne Beeth¹, Takashi Nagai¹, Meghan Schmidt¹, Chris Connaboy¹, John Abt, FACSM², Scott Lephart, FACSM², Bradley Nindl, FACSM¹. ¹University of Pittsburgh, Pittsburgh, PA. ²University of Kentucky, Lexington, KT.

**CONCLUSION:**
Combat swimming (CS) requires military personnel dressed in full combat gear to swim while holding or towing additional weight (i.e. ammunition, rucksack, etc.). Reportedly, additional gear can amount to over 40 kg and increases the demand on muscle force production to overcome water resistance. Limited research has explored relationships between limb length, strength, and anaerobic power assessments and CS flutterkick performance during a 30-second maximal effort tethered swim test (TST).

**PURPOSE:**
To examine relationships between limb length, strength, and anaerobic power assessments and maximum effort CS force production. **METHODS:** Six female (26 ± 9.2 years, 169.7 ± 5.9 cm, 67.5 ± 9.4 kg) and six male (30 ± 8.0 years, 179.4 ± 7.6 cm, 80.8 ± 15.4 kg) skilled swimmers participated in isometric muscular hip strength (HS) testing using a handheld dynamometer, and a 30-second Wingate cycle ergometer anaerobic test (WAnT). Limb length (LL) was measured from the Anterior Superior Iliac Spine to the medial malleolus. For TST, subjects wore full military gear weighing approximately 12 kg, including combat boots and fins, and performed a maximal effort flutterkick in a prone position holding a flotation device for 30 seconds. After testing for normality, correlations between HS, LL, WAnT, and TST were determined using Pearson’s correlation (p<0.05). RESULTS: Absolute Wingate mean power was significantly correlated to TST mean force (TST mean force (0.883, p<0.001). Correlations were identified between LL and TST peak force (TST peak force (0.653, p=0.021; left: 0.659, p=0.020). There was no significant correlation between isometric peak HS and TST. CONCLUSION: LL and absolute WAnT mean power are associated with CS anaerobic kicking performance more so than isometric HS. Findings should not dismiss the relevance of strength, but promote specificity of the assessment. Identifying significant relationships between power and strength assessments and swimming force during CS flutterkick is important to help to improve training for optimal CS anaerobic performance.

Supported by ONR: N00014-14-1-0022/N00014-15-0069

**2142 June 1 10:50 AM - 11:10 AM**
**Metacarpal Stress fractures Presenting As Dorsal Hand Pain In A High School Tennis Player: A Case Report**
John K. Evans, Keith A. Bengston, Cara C. Prideaux, Edward R. Laskowski, FACSM. Mayo Clinic, Rochester, MN.

**HISTORY:**
A 17 year-old right-hand dominant male tennis player presented to the hand clinic for a two week history of right dorsal hand pain. The patient noticed hand pain while at practice the day following a one-day tennis tournament involving three separate matches. Severe pain in the dorsum of the wrist was noted with forehands, serves, and volleys, but was less notable during backhands. The pain was sharp and severe for about three seconds after each hit and then quickly resolved to a pain-free baseline.
ABSTRACT

Predictors of performance can aid coaches and trainers in prescribing exercise programs for rowing athletes. To date, most of the prediction models have been developed for runners and cyclists. PURPOSE: The aim of this study was to develop a regression model to predict performance of a simulated 2 kilometer rowing ergometer time trial. METHODS: A group of mixed gender rowing athletes (n=12) completed in a counterbalanced order a 2 kilometer rowing time trial and a continuous progressively incremented graded exercise test on a rowing ergometer. Subjects were 23.9±1.4 years old, weighed 79.1±12.85 kg, were 187.3±12.60 cm tall, had a VO_{2max} of 55.48±10.32 ml/kg/min and had 3.17±2.79 years of rowing experience. Physiological measures were recorded during both testing protocols. RESULTS: Maximum Power/Stroke Ratio (r = -0.96, p<0.001), Upper Extremity Lean Mass (ULM) and Lower Extremity Lean Mass (LLM) were strong and significant predictors of 2 kilometer rowing performance. CONCLUSION: The four significant predictors of rowing performance suggest training should focus on improving both aerobic capacity and strength.

Statement of Disclosure: This study was not funded and has no conflicts of interest.
The importance of a swimming specific test of maximal aerobic power (VO₂max) to assess aerobic fitness, track training adaptations, and predict performance is well established. The ability to incrementally and systematically regulate intensity with changes to flow has made swimming flume tests (VO₂max) desirable laboratory tools, although few exist due to the complexity and cost of equipment. Pool tests (VO₂max) simulate free swimming and are more cost effective. However, little research has compared these modes. Purpose: To examine the relationship between physiological responses to VO₂max A and VO₂max B tests are presented in Table 1. For validity, a two-tailed correlation was calculated for the two tests: VO₂max A (r = 0.908; p = 0.001) and VE (r = 0.853; p = 0.001), and a moderate correlation for BLA (r = 0.634; p = 0.029). There were no significant correlations between the two tests for RER, HRmax, RPE, and T crit. Conclusion: Results indicate that a VO₂max test elicited higher maximal physiological responses compared to a VO₂max test, indicating that VO₂max may provide a better mode for assessing maximal aerobic capacity in swimmers. Future research should explore the swimming flume’s flow and propulsion characteristics on kinematics and its impact on the ability to predict performance.

### Methods

Ten NCAA Division 1 swimmers (n = 4 women, age 20.3 ± 0.5 years, weight 64.8 ± 12.3 kg; n = 6 men, age 20.0 ± 0.6 years, weight 82.6 ± 6.9 kg; mean ± SD) participated in 3 testing sessions: immediate post-season (V₁), mid-offseason (V₂), and early season (V₃) separated by 8 weeks between V₁ and V₂, and 14 weeks between V₂ and V₃. Each testing session was comprised of an in-pool power test consisting of incrementally-loaded 25-m swims at maximal effort. During the test, participants were attached to a pulley system ending with a 20-gallon bucket. Initial load was set at 40 lbs for men and 20 lbs for women, and increased by 20 lbs and 15 lbs respectively after each trial completion. Swimmers were allowed to rest for 3 min after each trial. Speed, work, and power were calculated using the distance traveled per second factoring in the additional weight in bucket. Heart rate (HR), lactate (BLA), and rating of perceived exertion (RPE) were measured continuously, and ratings of perceived exertion (RPE) were measured. Blood lactate (BLA) was measured post-test. Normality was assessed, and a paired samples t-test was used as appropriate.

### Results

A two-tailed correlation was calculated for the two tests: VO₂max A (r = 0.908; p = 0.001) and VE (r = 0.853; p = 0.001), and a moderate correlation for BLA (r = 0.634; p = 0.029). There were no significant correlations between the two tests for RER, HRmax, RPE, and T crit. Conclusion: Results indicate that a VO₂max test elicited higher maximal physiological responses compared to a VO₂max test, indicating that VO₂max may provide a better mode for assessing maximal aerobic capacity in swimmers. Future research should explore the swimming flume’s flow and propulsion characteristics on kinematics and its impact on the ability to predict performance.

### Changes in Collegiate Swim Anaerobic Performance Between Pre-season and Post-season

Haoyang Wang, 1 Guillaume Spießmann, 1 Brian Irving 1, Jack Marucci, 1 Shelly Mullinen, 1 Brian Harrell 2, Rick Sharp, 1 FACSM, 1 Neil Johannsen, 4 Louisiana State University, Baton Rouge, LA 1 Baton Rouge General Sport Medicine, Baton Rouge, LA 1 Iowa State University, Ames, IA.

No relevant relationships reported.

Purpose: To examine the cyclic nature of collegiate swim training on anaerobic performance.

Methods: Ten NCAA Division 1 swimmers (n = 4 women, age 20(±3.5) y, weight 64.8±12.3 kg; n = 6 men, age 20.0±0.6 y, weight 82.6±6.9 kg; mean±SD) participated in 3 testing sessions: immediate post-season (V₁), mid-offseason (V₂), and early season (V₃) separated by 8 weeks between V₁ and V₂, and 14 weeks between V₂ and V₃. Each testing session was comprised of an in-pool power test consisting of incrementally-loaded 25-m swims at maximal effort. During the test, participants were attached to a pulley system ending with a 20-gallon bucket. Initial load was set at 40 lbs for men and 20 lbs for women, and increased by 20 lbs and 15 lbs respectively after each trial completion. Swimmers were allowed to rest for 3 min after each trial. Speed, work, and power were calculated using the distance traveled per second factoring in the additional weight in bucket. Heart rate (HR), lactate (BLA), and rating of perceived exertion (RPE) were measured. Blood lactate (BLA) was measured post-test. Normality was assessed, and a paired samples t-test was used as appropriate.

Results: A two-tailed correlation was calculated for the two tests: VO₂max A (r = 0.908; p = 0.001) and VE (r = 0.853; p = 0.001), and a moderate correlation for BLA (r = 0.634; p = 0.029). There were no significant correlations between the two tests for RER, HRmax, RPE, and T crit. Conclusion: Results indicate that a VO₂max test elicited higher maximal physiological responses compared to a VO₂max test, indicating that VO₂max may provide a better mode for assessing maximal aerobic capacity in swimmers. Future research should explore the swimming flume’s flow and propulsion characteristics on kinematics and its impact on the ability to predict performance.
**E-27**  
**Free Communication/Poster - Youth**  
**Friday, June 1, 2018, 7:30 AM - 12:30 PM**  
**Room: CC-Hall B**

**2174 Board #10  June 1 9:30 AM - 11:00 AM**

**Acute Cardiometabolic Responses to Medicine Ball Exercise in Children**

Avery D. Faigenbaum, FACSM, Jie Kang, FACSM, Anne Farrell, Nicholas A. Ratamess, Nicole Ellis, Ira Vought, Jill Bush, FACSM. *The College of New Jersey, Ewing, NJ.*

(No relevant relationships reported)

Medicine ball (MB) exercises are effective for strength and conditioning in adults, but the cardiometabolic responses of this training modality for children is unknown.

**PURPOSE:** To examine the acute cardiometabolic responses to MB exercise in children.

**METHODS:** Ten male adolescent, elite handball players (age: 16±0.5 years) were tested prior to-, 3 minutes- and 24 hours- following the three conditions (DS, SS, or DS protocols.

**RESULTS:** Peak values for HR and VO2 during the treadmill test were 198.9 ± 8.3 bpm and 54.9 ± 10.1 mL·kg⁻¹·min⁻¹, respectively. During the MB protocol, mean HR significantly (p<0.05) increased from 121.5 ± 12.3 bpm during EX1 to 178.3 ± 9.4 bpm during EX5 and mean VO2 significantly (p<0.05) increased from 15.5 ± 2.9 mL·kg⁻¹·min⁻¹ during EX1 to 34.9 ± 5.1 mL·kg⁻¹·min⁻¹ during EX5. Mean HR and VO2 values during the MB protocol ranged from 61.9% to 69.9% and 25.3% to 63.3% of HRpeak and VO2peak, respectively.

**CONCLUSION:** These descriptive data indicate that MB exercise can pose a moderate-to-vigorous cardiometabolic stimulus in children and may serve as a worthwhile compliment to youth strength and conditioning programs.

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**2175 Board #11  June 1 9:30 AM - 11:00 AM**

**Dynamic Stretching Can Impair Performance Of Adolescent Male handball Players For At Least 24 Hours.**

Monoeem Haddad¹, Mohammad Shoaii Prince¹, Nidhal Zarrouk², Karim Chamari², David G Behm². *Qatar University, Doha, Qatar.*

**(No relevant relationships reported)**

**PURPOSE:** There are many adult studies reporting static stretch (SS)-induced deficits and dynamic stretch (DS) performance improvements shortly after the intervention. However, there is only a single study examining stretch-induced performance changes with children at 24 hours' post-stretch. The objective of this study was to examine physiological responses of adolescent trained athletes at 24 hours after experiencing SS or DS protocols.

**METHODS:** Ten male adolescent, elite handball players (age: 16±0.5 years) were tested prior to-, 3 minutes- and 24 hours- following the three conditions (DS, SS, or DS protocols).

**RESULTS:** Three-way repeated measures ANOVAs revealed that i) both the SS and control conditions exhibited knee extensor 60°/sec (-8.7 to -16.3%) and 300°/sec (-10.3 to 12.9%) isokinetic force and power-related deficits at post-test, ii) DS impaired knee flexor 60°/sec isokinetic force (-9.9% to -10.1%) and power-related (-9.6% to 19.1%) measures at post-test and at 24 hours' post-test, iii) DS (12.07% and 10.47%) and SS (13.7% and 14.6%) enhanced knee flexor 300°/sec isokinetic force and power-related measures compared.

**CONCLUSIONS:** Testing-induced knee extensor isokinetic impairments were counterbalanced by DS, however the hip flexion DS could have produced minor muscle damage decreasing knee flexor forces and power at 600°/s.

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**2176 Board #12  June 1 9:30 AM - 11:00 AM**

**What Kind Of Scenes And Situations Make Children Find Pleasure In Exercise**

Takahiro Nakano¹, Koshio Kasuga¹, Tomoko Sakai¹, Kazuo Oguri¹. *Nagoya Gakuin University, Aichi, Japan.*

**1**Gift University, Gifu, Japan. *Gifu Shotoku Gakuen University, Gifu, Japan.* (Sponsor: Kiyoji Tanaka, FACSM)

(No relevant relationships reported)

Recently, the need for acquiring the habit of exercise since childhood is increasing. As its background, the awareness of likes and dislikes pertaining to, and strengths and weaknesses of exercise is sometimes clarified in childhood. In order to resolve the decrease in children’s physical fitness, it is necessary to convey children the pleasures of exercise at an early stage. Therefore, educators should promote exercise opportunities that exclude children’s awareness of weaknesses and prioritize expressing the pleasures of exercise. Hence, we ought to understand exactly what kind of scene and situation makes children find pleasure in exercise.

**PURPOSE:** The purpose of this study was to examine the difference in the kind of scenes and situations that make children find pleasure in exercise between children who like and dislike exercise.

**METHODS:** The subjects of this study were 1,846 elementary school children who belonged to the 5th or 6th grade. Data from seventeen items related to liking or disliking exercise, scenes and situations that make children find pleasure in exercise, and value of exercise were analyzed. The difference between children who liked and disliked exercise was analyzed using chi-square test. The most sensitive item to distinguish between children who liked and disliked exercise was examined using decision tree analysis. **RESULTS:** The ratio of children who liked exercise was 81.9% in boys and 69.1% in girls. Children who liked exercise understood the value of exercise for health and a good life significantly more than children who disliked exercise. A significant relationship was confirmed between all items related to scenes and situations that make children find pleasure in exercise and like or dislike exercise. The item “it is fun to exercise with many friends” was used to classify children who liked and disliked exercise most sensitively using decision tree analysis. In addition, 90.3% of the children who did not find pleasure in winning the game answered that they disliked exercise. **CONCLUSIONS:** It was confirmed that most of the children who dislike exercise did not understand the value of exercise since childhood. Conveying the pleasures of exercise since childhood was important. However, it was suggested that focusing excessively on winning or losing has the risk of promoting dislike of exercise.

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**2177 Board #13  June 1 9:30 AM - 11:00 AM**

**Development and Validation of the Chinese Assessment of Adolescent Physical Literacy**

Yan Peng¹, Ming Yang², Liangjue Yang², Chuanrong Wei³, Tindong Zhang². *StChuan Aerospace Vocational College, Chengdu, China.*

**Northeast Normal University, Changchun, China.**

(No relevant relationships reported)

**PURPOSE:** China’s physical fitness has been declining for nearly 30 years. How to improve the quality of youth fitness into a focus. The Canadian assessment of Physical Literacy (CAPL) provided a path to evaluate Chinese adolescent physical. The purpose of developing and validating an evaluation system of Chinese adolescent physical literacy.

**METHODS:** Through the database of Web of Science, PubMed, and CNKI, the primary institutional resources of Physical literacy at home and abroad were collected, and the index system of adolescent physical literacy was constructed by Delphi method and mathematical statistics way.

**RESULTS:** Using the Likert 5 point scale designed the Chinese Evaluation of physical literacy (CEPL). Using exploratory factor analysis (EFA) method explored the reliability of the CEPL that Cronbach’s alpha coefficients were 0.85. Three factors were extracted that the cumulative contribution rate was 60.6%, three elements were verified by the adolescent’s physical literacy self-measurement scale of the three dimensions, each coefficient was above 0.82, and the re-test reliability range of three factors was between 0.80-0.82. The version of ESCAPL was composed of four parts, daily behavior, physical ability, knowledge and understanding and motivation, and confidence. The results of the assessment were divided into four grades as follows, Initial level <41.5, Development level 41.5 – 62.5, Higher level 62.6 – 78.5, and the highest level 78.5.

**CONCLUSIONS:** The evaluation index system of adolescent physical literacy evaluation is judged by expert points two rounds, and the indexes are effective. After the empirical test, the adolescent physical literacy self-test scale and the physical ability measurement table have the high reliability and the validity can be used for the young athletic level measurement and the appraisal. The research was supported by NPOPS Grant 15CTY011, and Fundamental Research Funds for the Central Universities Grant 1709240.
Encouraging regular physical activity (PA) is a major public health objective in the United States for several reasons, including the promotion of physical fitness. As such, the first edition of federal Physical Activity Guidelines for Americans (PAG) was released in 2008. For youth, these PAG include recommendations for aerobic and muscle-strengthening (MS) activity. PURPOSE: To examine the association between adherence to PAG and physical fitness in a nationally-representative sample of children and adolescents. METHODS: The NHANES National Youth Fitness Survey (NNYFS) collected fitness test and PA questionnaire data on children and adolescents (ages 3-15 years, n = 1,576). Fitness testing was completed for the plank (3-15 years), modified pull-up (5-15 years), handgrip strength (6-15 years), and aerobic fitness (12-15 years) by trained test administrators. Fitness test results were converted into age-specific percentile scores. All subjects reported the number of previous days of the week that included 60 minutes of PA, while 12-15 year olds also reported the number of previous days that included MS activities. Independent t-tests were used to compare the mean physical fitness percentile of youth reporting 7 days of 60 minutes of PA to those reporting ≤ 6 days and adolescents reporting 2 or more days of muscle-strengthening activity to those reporting ≤ 1 day. RESULTS: Youth reporting 7 days/week of PA had a higher mean relative grip strength (53.8 vs. 46.8 percentile), modified pull-up (53.7 vs. 47.1 percentile), and VO$_2$max (48.9 vs. 40.8 percentile) compared to those with ≤ 6 days/week (all p < 0.05). Those participating in MS activity 2 days/week had a higher relative grip strength (54.7 vs. 45.3 percentile), modified pull-up (54.2 vs. 46.8 percentile), plank (54.5 vs. 44.4 percentile), and VO$_2$max (45.7 vs. 39.8 percentile) compared to the ≤ 1 day/week group (all p = 0.05). CONCLUSION: In this nationally-representative sample, meeting PAG’s was associated with measures of aerobic capacity, muscular strength, and muscular endurance. Future prospective research is needed to investigate the impact of changing PA level to meet (or not meet) the PAG on physical fitness.

### Board #15

**Three-Year Tracking of Moderate-to-Vigorous Physical Activity During Structured and Unstructured Play In Youth**

Michael J. Wieraenga, Kimberly A. Clevenger, Rebecca W. Moore, Karin A. Pfeiffer, FACSM. *Michigan State University, East Lansing, MI. Eastern Michigan University, Ypsilanti, MI.* (Sponsor: Karin Pfeiffer, FACSM, FACSM)

Tracking is the maintenance of a relative position within a group over time. Previous studies indicate that habitual, moderate-to-vigorous physical activity (MVPA) tracks at low to moderate levels in youth, but there is limited research on specific contexts of MVPA, such as during structured and unstructured play. PURPOSE: To characterize tracking of MVPA in youth across four time periods during a three-year period for both structured and unstructured play. METHODS: Youth (N=108), 58.3% female, 6-15 years old, visited the laboratory four times over three years. During each visit, participants engaged in 30 minutes each of structured and unstructured play. Youth wore a uniaxial accelerometer on an elastic belt over their right hip (data collected in 1-second epochs). MVPA minutes were determined using Evenson cut-points (=574 counts/15-sec). Tracking of MVPA minutes was evaluated using tracking coefficients (Pearson’s r) between each pair of time points (classified as low (r=0.30), moderate (r=0.30-0.60), or moderately high (r>0.60) and intra-class correlations (ICC) via ANOVA. ICCs provided an overall correlation across the four time points [classified as poor (ICC<0.50), moderate (ICC=0.50-0.75), good (ICC=0.75-0.90), or excellent (ICC=0.90)]. Participants were classified into quartiles of MVPA for each visit, and percent agreement and weighted kappa [classified as poor (<0.20), fair (0.21-0.40), moderate (0.41-0.60), good (0.61-0.80), or very good (0.81-1.0)] were calculated. RESULTS: Tracking coefficients were non-significant to moderate for structured play (r=0.20-0.30) and moderate to moderately high for unstructured play (r=0.38-0.66, p<0.05). The ICC was classified as poor (0.42) for structured play and excellent (0.80) for unstructured play (p<0.05). Percent agreement ranged from 24.0-36.6% for structured play and 30.0-44.3% for unstructured. Weighted kappa for structured play ranged from non-significant to poor (p<0.09-0.19), but was fair to moderate (0.24-0.49, p<0.05) for unstructured. CONCLUSION: We found evidence of low to moderate tracking for participation in MVPA during structured and unstructured play. Results suggest that MVPA during structured and unstructured play tracks similarly to habitual physical activity in youth.

### Board #17

**The Influence Of Non-cognitive Functional Characteristics At Age 6 On Physical Fitness Characteristics At Age 10**

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Human non-cognitive functioning is developed mostly in early childhood. It may be that physical characteristics during childhood affected by daily exercise behaviors are also affected by non-cognitive functional characteristics in the early childhood. PURPOSE: The purpose of this study was to examine the influence of non-cognitive functional characteristics at the age of 6 years in the physical fitness characteristics at the age of 10 years.

METHODS: Subjects included 223 children (110 boys and 113 girls) who performed the physical fitness test (eight exercises) at 10 years of age. In order to understand non-cognitive functional characteristics at 6 years of age, a questionnaire of 21 questions consisting of 8 items (self-recognition, motivation, perseverance, self-control, social appropriateness, resilience and coping ability, creativity, and personality) was used. Evaluation of non-cognitive function was carried out by three kindergarten teachers who had the experience of being their home-room teacher. From the evaluation obtained, grouping was performed with the upper group (UG), the middle group (MG), and the lower group (LG) based on the evaluation value of each non-cognitive function. Statistical analysis of the data was conducted using a one-way ANOVA and multiple comparisons (Tukey’s HSD test) to compare physical fitness among the groups.

RESULTS: Results of the analysis revealed significant differences in physical fitness in all items except “nervous” among the 21 questions. UG of each item was significantly higher than LG. In particular, there was a very high effect size (ES) in “persistent efforts” (ES: 1.99), “ingenuity” (ES: 1.92), and “ability to pull out” (ES: 1.85).
CONCLUSIONS: It was suggested that children with increased non-cognitive functions such as condition judgment ability and tenacity in early childhood have a good effect on physical fitness at school age.

METHODS: A total of 1559 youths from SGP (age: 13.49 ± 1.21 years, height: 159.76 ± 8.94 cm, weight: 51.91 ± 13.38 kg, Body Fat (BF) %: 21.51 ± 10.25 %) and 1530 youths from HK (age: 13.51 ± 0.98 years, height: 160.69 ± 8.40 cm, weight: 52.20 ± 12.43 kg, BF%: 21.16 ± 9.99 %) participated in this study. Body Mass Index (BMI) and BF% were measured by bio-electric impedance analysis. Cardiovascular fitness, lower limb flexibility, arm strength, abdominal endurance were tested using the 15m youth Progressive Aerobic Cardiovascular Endurance Run test (PACER), one-legged sit-and-reach test for both legs (SRT), handgrip strength test for both hands (HS), and 1-minute sit-up test (SUT) respectively.

RESULTS: Using the Independent T-Test, significant differences were found between SGP and HK youths for height (SGP: 159.76 ± 8.94 cm, HK: 160.69 ± 8.40 cm, p < 0.0005), SRT (SGP: 54.14 ± 10.15 cm, HK: 49.59 ± 12.04 cm, p < 0.0005), HS (SGP: 25.18 ± 7.77 kg, HK: 26.03 ± 6.96 kg, p = 0.002), SUT (SGP: 38.94 ± 11.92, HK: 30.56 ± 10.14, p < 0.0005) and PACER (SGP: 40.93 ± 23.90 laps, HK: 35.49 ± 18.44 laps, p < 0.0005). There were no significant differences in weight, BMI, and BF% between youths in both countries, with low obesity rates in both countries (SGP: 12.7%, HK: 10.32%).

CONCLUSIONS: Results indicated similar body composition results in both countries. SGP youths had lesser arm strength as compared to HK youths. However, SGP youths had higher abdominal endurance, better flexibility and were more aerobically fit as compared to HK youths. Both SGP and HK youths need to maintain their physical activities to improve their cardiovascular fitness as this will help to reduce cardiovascular diseases in youths in the future.

RESULTS: Seventy-four elementary school students (34 boys, 40 girls) aged from 6 to 12 years old participated in this study (mean height: 136.11 cm, mean weight: 33.23 kg). In addition to MJC, all students were assessed in terms of 20-m sprint time (ST), rebound jump index (RJI), vertical jump (VJ), and grip strength (GS). For RJI, students were measured with an optical measurement system as they performed five consecutive rebound jumps with both legs: RJI was calculated as jump height divided by ground contact time. Pearson’s product-moment correlation coefficients (r) were determined to check for associations between MJC and the other fitness indicators. The training effects of jump rope exercise were investigated by comparing students’ performance before and after completing four weeks of training. Students were allowed to decide which rope jumping movement skills they wanted to learn. The sample of children from Spanish primary school.

RESULTS: Before training, students achieved a mean MJC of 93±98 jumps, with a range of 2-459 jumps. A negative correlation was observed between MJC in before training and ST (r = 0.46, p < 0.01). Additionally, positive correlations were observed between MJC and SJ (r = 0.57, p < 0.01), VJ (r = 0.33, p < 0.01) and GS (left-hand: r = 0.31, p < 0.01; right-hand: r = 0.34, p < 0.01). Four weeks of training resulted in significant improvements in SJ (r = 0.43, p < 0.01), RJI (r = 0.7%, p < 0.01), and VJ (r = 5%, p < 0.01). However, jump rope exercise frequency did not result in any apparent differences in training effects.

CONCLUSIONS: These results suggest that MJC was associated with a variety of physical abilities in elementary school students. However, it could not be clearly demonstrated that jump rope training improve performance indicators related to SSC ability in elementary school students.

Obesity is identified as a worldwide issue and thus assessing health related components of physical fitness in youths may help in identifying risk factors associated with obesity. PURPOSE: To compare fitness variables between the youths of Singapore (SGP) and Bangkok (BKK).

METHODS: A sample of 1559 (Age: 13.49 ± 1.21 years, Height: 159.76 ± 8.94 cm, Weight: 51.91 ± 13.38 kg) youths from SGP and 1098 (Age: 13.95 ± 0.85 yrs, Height: 158.88 ± 7.98 cm, Weight: 53.01 ± 14.13 kg) youths from BKK were recruited for this study. Body composition was measured using a bio-impedance analysis (BIA) machine. A one-legged sit-and-reach test for both legs (SRT), handgrip strength test for both hands (HS), 1-minute sit-up test (SUT), and 15m youth Progressive Aerobic Cardiovascular Endurance Run (PACE) test was conducted to measure flexibility, arm strength, abdominal endurance, and cardiorespiratory endurance respectively. RESULTS: There was a significant difference in body composition between the youths in SGP and BKK, as indicated by their body mass index (SGP: 20.19 ± 4.21 kg.m$^{-2}$, BKK: 20.85 ± 4.64 kg.m$^{-2}$, p < 0.0005) and body fat percentage (SGP: 21.51 ± 10.25 %, BKK: 23.43 ± 11.23 %, p < 0.0005). Significant differences were found between the youths of both countries for SRT for both legs (SGP: 108.27 ± 20.31 cm, BKK: 103.59 ± 18.25 cm, p < 0.0005), HST for both hands (SGP: 50.32 ± 15.53 kg, BKK: 52.20 ± 12.72 kg, p = 0.001), SUT (SGP: 38.94 ± 11.92, BKK: 27.19 ± 9.97, p < 0.0005), and PACER (SGP: 40.93 ± 23.90 laps, BKK: 30.73 ± 16.26 laps, p < 0.0005).

CONCLUSIONS: The youths of SGP had lower body composition, were more flexible, had higher abdominal endurance, and were more aerobically fit compared to the youths of BKK. This indicated a lower risk of obesity and cardiovascular risk in SGP youths as compared to BKK. More research is needed to identify the reasons for these differences which may help youths to continue participating in high levels of physical activity and exercise to reduce cardiovascular risks.

CONCLUSIONS: These results suggest that MJC was associated with a variety of physical abilities in elementary school students. However, it could not be clearly demonstrated that jump rope training improve performance indicators related to SSC ability in elementary school students.
of this study highlight that FMS can be a feasible screen test for evaluating functional movement skills and asymmetries in pediatric populations, in order to reduce the risks of orthopaedic abnormality arising from suboptimal movement patterns in adult lifespan.

2186 Board #22 June 1 9:30 AM - 11:00 AM Impact of Football Intervention on Fitness Outcomes among 9-11 Years Old Chinese Children Jie Zhuang1, XinZhao Cao1, Peijie Chen1, Yong Gao2. Shanghai University of Sport, Shanghai, China. 2Boise State University, Boise, ID. (Sponsor: Weimo Zhu, FACSM) (No relevant relationships reported)

PURPOSE: To examine the impact of a 10-week flag football intervention on aerobic fitness, muscular strength and speed among 9-11 years old Chinese children.

METHODS: A total of 122 9-11 years old Chinese children were randomly divided into intervention group (IG; n=62) and control group (CG; n=60). The IG received ten-week flag football (FF) lessons (60-90 mins per lesson, twice a week), including throwing and catching balls, positioning, attacking, defending, game rules and games while CG took conventional PE lessons (35 mins per lesson, 3 times a week). Participants took 20-m shuttle run (20-m SRT), jump rope (for muscular power) and 50-meter dash (for speed) tests before and after intervention. 

RESULTS: A significant group-by-time interaction was observed for jump rope test (p=0.03): no difference between IG and CG at baseline, but jump rope performance was significant improved among IG while no change among CG after intervention. There was also a significant group-by-time interaction for 50-meter dash (p=0.013): no difference at baseline between IG and CG, but 50-meter dash performance improved among IG while no change in CG after intervention. Although VO2max and 20-m SRT scores of both IG and CG participants increased from baseline to after intervention, there was no group difference in the improvement, p>0.05.

CONCLUSIONS: 10-week FF training effectively improves muscular power and speed among 9-11 years old Chinese children.

2187 Board #23 June 1 9:30 AM - 11:00 AM Effect of Injury Prevention Program on Performance Measures in Middle School Boys Soccer Players Stuart McCreary, Shane Caswell, Nelson Cortes. George Mason University, Manassas, VA. (No relevant relationships reported)

Lower extremity injuries are common in boys’ youth soccer. Lower extremity injury prevention programs (IPPs) have been shown to be effective in reducing injury risk and increasing performance among high school and adult soccer players. To date, little research has examined the effectiveness of IPPs to change physical performance characteristics among middle school-age (10-14 years) athletes.

PURPOSE: To determine the effectiveness of a novel 16 exercise IPP in male middle school soccer players on vertical jump (VJ), single-leg long jump (SLLJ), and single-leg anterior reach (SLAR).

METHODS: Students (N=49, 12.6 ± 0.7 years, 1.59 ± 0.1 m, 53 ± 13 kg) playing on 3 separate boys’ middle school soccer participated in this study. During the season and at the beginning of each practice session all athletes completed a 16-exercise IPP that lasted 6 weeks. Each IPP session was supervised by the team’s coach and the athletic trainer. The IPP involved dynamic movements with the aim of improving physical performance for the athletes including power, core stability, balance, and agility. Performance testing was conducted pre- and post-season and included VJ, SLLJ, and SLAR. The VJ and SLLJ were completed on a turf field with the athletes in cleats to produce a more realistic environment during testing. The SLAR was completed indoors with the athletes standing barefoot on a flat, hard surface. The SLAR and SLLJ tests won’t impede an participant’s leg length. Paired t-tests were conducted to compare pre- and post-intervention groups (p<0.05).

RESULTS: A statistically significant improvement in VJ (pre = 41.3 ± 9.8 cm, post = 46.9 ± 13.9 cm; p<0.05) and a reduction in SLAR for both right and left limbs (Right pre = 66.8 ± 7.5, post = 63.6 ± 6.2 cm; Left pre = 68.0 ± 6.9 cm, post = 61.2 ± 8.3 cm; p<0.05) was attained. No significant differences were found for SLLJ (p>0.05).

CONCLUSION: The findings suggest that our IPP was effective in improving VJ in middle school soccer players, but was detrimental for SLAR. Coaches and other professionals should ensure that performance improvements are not at the cost of injury risk. Future research should be conducted to determine which aspects of the injury prevention program affects the various tests performed so that more comprehensive and effective IPPs can be implemented.

Supported by the Potomac Health Foundation.

2188 Board #24 June 1 9:30 AM - 11:00 AM Season Long Changes in Training Load Metrics for a World Champion Youth Ice-Hockey Team Brandon Bastianelli, Davor Stojanov, Dakota Burke, Andrea Workman, Kenneth Martel, Stephen Megregor. Eastern Michigan University, Ypsilanti, MI. (No relevant relationships reported)

With increasing use of player worn sensors (PWS) in team sports, previously unknowable information is now within grasp. The team sport of ice hockey presents numerous challenges with regard to the assessment of training load. More specifically, the differences in training load experienced by skaters of different positions is of interest to optimize player development and avoid injury.

PURPOSE: Use PWS to measure on-ice physiological exertions and quantify training load differences between forwards (F) and defensemen (D) members of a national junior ice hockey team over the course of a season.

METHODS: 19 members of the US National Team Development Program (17.5 ± 2.1 y, 1.82 ± 0.8 m, 83.1 ± 7.6 kg) consented to procedures approved by the EMU-HSRC. Zephyr biobehavior-3 (Zephyr, MD) measured triaxial accelerations and heart rate for all on-ice practices and games. Exponentially weighted session Dynamic Accelerations (DYNAs) were used to determine Intensity Factor (IF) that was expressed relative to a player’s Dynamic Functional Threshold (DFT; 30 min maximal acceleration). Dynamic Training Load (DTL) was calculated using the individualized IF and session duration to reflect training load of a single session. DTL was used as the input for an impulse-response performance model to calculate Chronic Training Load (CTL), Acute Training Load (ATL) and Performance Readiness (PR) over a given period of time. MANOVA statistical tests compared metrics by session type and position for main effects and a Bonferroni post hoc in the event of statistical differences (α=0.05).

RESULTS: Overall, differences by position were observed with F being higher than D for both DFT (31.1 ± 0.01 v. 30.3 ± 0.01) and IF (0.82 ± 0.02 v. 0.81 ± 0.03) (p<0.05). No differences were observed, overall, for DTL, CTL, ATL or PR by position. Interactions were also observed for DA and IF by position and session. For F, DA was greater for games than practice, while practices were greater than games for D.

CONCLUSION: F appeared to perform greater accelerations and relative intensities in games and practices than D, but this did not result in significantly different training loads between positions. It also appears as though F exhibited greater accelerations and intensities in games than practices, while D exhibited the converse. Supported by the USA Hockey Foundation.

2189 Board #25 June 1 9:30 AM - 11:00 AM Season Long Changes in Training Load Metrics for a World Champion Junior Ice-Hockey Team Dakota J. Burke, Davor Stojanov, Andrea Workman, Kenneth Martel, Stephen McGregor. Eastern Michigan University, Ypsilanti, MI. (No relevant relationships reported)

PURPOSE: Use player worn sensors (PWS) to measure on-ice physiological exertions and quantify training load changes for players on a Junior National ice hockey team over the course of a single season which culminated in a World Championship.

METHODS: 19 members of a National Team Development Program (17.5 ± 2.1 y, 1.82 ± 0.8 m, 83.1 ± 7.6 kg) consented to procedures approved by the EMU-HSRC. Zephyr BI3 (Zephyr, MD) PWS measured triaxial accelerations (g’s) for all on ice practices (P) and games (G). Dynamic Accelerations (DYNAs) were generated from exponentially weighted accelerations and Dynamic Functional Threshold (DFT) from peak 30 min DYNAs within a 2 week moving window. Intensity Factor (IF) was based on session DYNAs relative to DFT. Dynamic Training Load (DTL) for a single session...
was calculated using the IF and the session duration. DTL was used as the input for an impulse response performance model to calculate Chronic Training Load (CTL), Acute Training Load (ATL) and Performance Readiness (PR) over a given amount of time. MANOVA was used to compare metrics by session type, (G) vs (P), and by month (M1 - M7) for main effects and Bonferroni post hoc in the event of statistical differences (α=0.05)

RESULTS: RESULTS: All training load metrics were different between G and P, by month and arm and method for session by month by arm. APO was also examined separately, DTL was not different across M1-M4, but declined during M5-M7 (108.5±2.5, 116.2±2.9, and 58.4±2.5, respectively; p<0.05) with M7 being lower than M1-M6. IF was highest during M1 (86±1) and significantly declined over the season and was lowest at M7 (74±1). In contrast, for G, DTL increased for M1 (193.0±1.9) and M2 (200.0±2.2) but were not different for the remainder of the year, while IF peaked at M3 (83±1) and was lowest (p<0.05) at M7 (79±1). For performance modeling metrics, CTL peaked at M3 (p<0.05), but despite the reduced DTL for P in M7, CTL and ATL were not different during M7 compared to M6 (p>0.05)

CONCLUSIONS: In the last month before the World Championships, training loads and intensities of practices were reduced significantly, while game loads remained constant but intensities were reduced. The training loads imparted by games were sufficient to maintain CTL, but ATL was not reduced and PR was not increased leading into the primary objective of the season

2190 Board #26 June 1 9:30 AM - 11:00 AM Implementing a Progressive Resistance Training Program in Youth Junior Olympic Women's Gymnastics.

Michael M. Lockard, Tynan F. Gable. Willamette University, Salem, OR.

(No relevant relationships reported)

Competitive gymnasts in the Women's Junior Olympic (JO) program are highly conditioned, typically training 8-20 hours per week. Training often consists of high-repetition body-weight activities with little variability in the exercises performed. This method of training lacks progressive resistance training (PRT), a cornerstone adaptation to specification for training goals. PURPOSE: To investigate the benefits of 10 wks of PRT, 1 day/wk, on muscular strength and power in women's JO child and adolescent gymnasts. A program was implemented for all competitive levels during regular practice, while minimizing time away from normal training.

METHODS: 47 females aged 7-17 yrs (mean 10.2±2.7 yrs), competing on JO levels 3-10 participated.

15 exercises were each completed for 1 set of 10 reps. Tests for upper- and lower-body power included vertical leap, medicine ball-put, and an arm-ergometer modified Wingate anaerobic test (Arm-WanT). Analysis: Gymnastics must have attended at least 70% of the training sessions during the 10-week study. Level 3 gymnasts (n=19) underwent the control condition, completing normal body-weight non-progressive conditioning. They were compared to the Level 4 gymnasts who were of similar age and gymnastics training experience. Level 4-10 gymnasts were separately analyzed in a quasi-experimental repeated measures design. RESULTS: Compared to the Level 3 controls, Level 4 gymnasts had greater improvement in vertical power (p=0.003), and Arm-WanT peak power and mean power (p=0.044 and 0.023), but no difference in medicine ball-put distance or Arm-WanT fatigue index. Gymnastics Levels 4 to 10 similarly improved vertical power (222±75W to 247±688W, p=0.001), Arm-WanT peak power (80.9±30.1W to 93.2±60.5W, p=0.001), and mean power (62.8±23.2 to 70.1±27.3, p=0.001), with no change in medicine ball-put distance or Arm-WanT fatigue index. CONCLUSION: 10-wks of PRT will improve upper- and lower-body power in child and adolescent female JO gymnasts.

2191 Board #27 June 1 11:00 AM - 12:30 PM Ipsilateral and Contralateral Posterior Cerebral Artery Blood Velocities During Handgrip Exercise

Kazuya Suzuki, Takuro Washio, Masato Hatanaka, Hiroki Sakurai, Shigehiko Ogoh, FACSM. Toyo University, kawagoe, Japan.

(No relevant relationships reported)

Previous studies reported that an increase in the contralateral middle cerebral arterial blood flow velocity was larger than mean blood velocity in the ipsilateral side during handgrip (HG) exercise. These findings suggest a significant increase in blood flow for the artery supplying the cortical projection of the exercising limb. On the other hand, the response of posterior cerebral blood flow (CBF) to exercise is significantly different from anterior CBF. However, it remains unknown whether there is different CBF response to HG exercise between ipsilateral and contralateral posterior cerebral arteries.

METHODS: The purpose of this study was to examine the effect of HG exercise on CBF in ipsilateral and contralateral posterior cerebral arteries.

RESULTS: Six healthy male subjects performed HG exercise of the right hand for 3 min at 30% maximum voluntary contraction in a semi-supine position. Arterial pressure and posterior cerebral artery blood velocity (PCAV) were measured by finger photoplethysmography and transcranial Doppler (TCD). When P was examined separately, DTL was not different across M1-M4, but declined during M5-M7 (108.5±2.5, 116.2±2.9, and 58.4±2.5, respectively; p<0.05) with M7 being lower than M1-M6. IF was highest during M1 (86±1) and significantly declined over the season and was lowest at M7 (74±1). In contrast, for G, DTL increased for M1 (193.0±1.9) and M2 (200.0±2.2) but were not different for the remainder of the year, while IF peaked at M3 (83±1) and was lowest (p<0.05) at M7 (79±1). For performance modeling metrics, CTL peaked at M3 (p<0.05), but despite the reduced DTL for P in M7, CTL and ATL were not different during M7 compared to M6 (p>0.05)

CONCLUSIONS: In the last month before the World Championships, training loads and intensities of practices were reduced significantly, while game loads remained constant but intensities were reduced. The training loads imparted by games were sufficient to maintain CTL, but ATL was not reduced and PR was not increased leading into the primary objective of the season

2192 Board #28 June 1 11:00 AM - 12:30 PM Age-related Differences in Cerebral Oxygen Diffusive Capacity during Normobaric Hypoxia Exposure

Xiangrong Shi, FACSM, Xiaoli Liu, Hannah Schenck, Shande Chen, James Hall, Sarah Ross, Gregory Kline, Robert T. Mallet. UNT Health Science Center, Fort Worth, TX.

(No relevant relationships reported)

Cerebral perfusion and oxygen diffusion capacity were enhanced in young adults due to hypoxia-induced hypoxemia. This study examined cerebral oxygenation and perfusion in elderly adults during exposure to normobaric hypoxia.

METHODS: Eight elderly (70 ± 2 yr, 4 women) and eight young adults (25 ± 1 yr) were exposed to 5 min 10% O2. During the test, heart rate (HR, electrocardiogram), arterial blood pressure (ABP, NIHBP100D), O2 saturation (SaO2, Radiometer), middle cerebral artery blood flow velocity (Vmax, Ez-Dop) and cerebral tissue oxygenation (ScO2, Somatom 5100C INVSOS) were continuously monitored.

RESULTS: Baseline SaO2, HR, and mean ABP were not significantly different in elderly vs. young subjects (SaO2, 96.0±1.3 vs 97.0±0.3%; HR, 71±4 vs 63±2 bpm; ABP, 91±3 vs 89±2 mmHg). However, baseline Vmax (43.5±2.2 vs 53.7±1.8 cm/s, P<0.005) and ScO2 (86.6±0.7 vs 75±4.0%, P<0.001) were lower in elderly than young adults. During hypoxia exposure, HR was significantly increased with decreases in SaO2; the rate of tachycardia per unit hypoxemia was smaller (P<0.001) in elderly (-0.48±0.05 bpm%) than young (-0.84±0.02 bpm%) group. ABP was not altered during hypoxia-induced hypoxemia in either group. SaO2 during 5-min hypoxia exposure fell appreciably, to 77.5±2.3% and 75.9±1.4% in elderly and young groups, respectively; the rate of decrease in SaO2 per unit time was not significantly different between the groups. However, in terms of unit hypoxemia, the rate of decrease in ScO2 was smaller (P<0.002) in elderly (0.69±0.01%) than young (0.85±0.03%) adults, while the rates of increase in Vmax were similar between elderly and young groups (-0.28±0.05 vs -0.37±0.07 cm/s, P<0.325). Fractional cerebral oxygen extraction during hypoxemia declined in elderly subjects (P<0.038), but progressively increased in young adults (P<0.05).

CONCLUSIONS: Aging diminishes cerebral oxygenation and perfusion at rest. During exposure to normobaric hypoxia, elderly adults depend solely on an activated cerebral vasodilation to maintain O2 delivery, but cerebral oxygen diffusive capacity is not enhanced as in young group.

2193 Board #29 June 1 11:00 AM - 12:30 PM Cerebral Blood Flow Pulse Is Influenced By Ascending Aortic Flow During Acute Hypotension

Tomoya Suda1, Aki Hirasaawa, Takahiro Uechi1, Kazukuni Hirabuki1, Noritaka Hata1, Yuki Sano, Takeaki Matsuoka, Shigeki Shibata, Shigehiko Ogoh, FACSM2. 1Kyorin University, Tokyo, Japan. 2Toyo University, Saitama, Japan.

(No relevant relationships reported)

Purpose: Recently, it has been suggested that cardiac function is one of important physiological factors to determine cerebral blood flow (CBF). However, dynamic relationship between cardiac output and CBF is still unknown. The purpose of the present study was to assess the dynamic relationship between arterial blood pressure (BP) or ascending aortic blood flow and CBF.

METHODS: Six male healthy subjects participated (age, height, and weight; 33.6±1 yrs, 173.3±3 cm, and 72.8±1 kg) in the present study. Continuous beat-by-beat arterial BP was recorded from a finger using the Penaz method. Ascending aortic blood flow velocity (Ao-BFV) and middle cerebral artery blood flow velocity (MCA-BFV) were continuously measured using supra-sternal and transtemporal probes, respectively. After 10 min of resting condition, bilateral thigh cuffs were inflated to 200 mmHg and maintained for 2 min. Then both cuffs were rapidly deflated, and data were subsequently collected for 1 min. The same measurements were performed in the
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Sleep disorders increase the risk of cardiovascular disease. For example, previous cohort studies suggested that sleep deprivation contributed to the onset of cerebrovascular disease. However, its physiological mechanism remains unknown. We hypothesized that sleep disorders attenuated dynamic cerebral autoregulation (CA), which is one physiological mechanism of cerebral blood flow regulation.

PURPOSE: To test our hypothesis, the present study investigated if there was an effect of acute sleep deprivation on dynamic CA. METHODS: Six healthy young men participated in the present study. Each subject was instructed to shorter his individual sleep duration (individual averaged sleep duration minus 2 hours) to created sleep deprivation condition. Following manipulating sleep duration, each subject visited the laboratory to perform experiments in the morning (between 8 and 10 am). Mean arterial pressure (MAP) and middle cerebral artery blood velocity (MCAv) were measured during the experiment. Dynamic CA was assessed by transfer function analysis of spontaneous oscillations between MAP and MCAv in the low-frequency range (LF, 0.07-0.20 Hz) in each subject under these two different sleep conditions: control (averaged sleep duration, 6.5 ± 0.9 h) and sleep deprivation conditions (3.9 ± 0.4 h).

RESULTS: Acute sleep deprivation did not change either MCAv or MAP. Also, unexpectedly, there was no difference in the LF phase shift (P=0.46) and gain (P=0.53) of transfer function analysis between conditions, indicating that dynamic CA was not affected by acute sleep deprivation.

CONCLUSIONS: In the present study, the manipulated acute sleep deprivation did not change dynamic CA. This finding suggests that an insufficient sleep-induced cerebrovascular disease may be associated with other physiological factors, but two hours less sleep or acute change in sleep deprivation may not be enough to alter cerebral circulation.

The previous study reported that cold stimulation-induced acute high sympathetic nerve activity (SNA) impaired dynamic cerebral autoregulation (CA) in anterior cerebral circulation using transfer function analysis. However, the effect of acute change in SNA on dynamic CA in posterior cerebral circulation remains unknown.

The posterior cerebral circulation has insufficient sympathetic innervation compared to anterior cerebral circulation; therefore, we hypothesized that the effect of sympathetic activation on dynamic CA in posterior cerebral circulation may be different from that in anterior cerebral circulation. PURPOSE: The purpose of the present study was to examine the effect of cold stimulation-induced high sympathetic activation on dynamic CA in posterior cerebral circulation. METHODS: Six healthy young subjects participated in this study. Mean arterial pressure (MAP), left middle cerebral artery blood velocity (MCAv) and right posterior cerebral artery blood velocity (PCAv) were measured throughout the experiment. At 90 sec after left hand immersion in cold water (2°C), dynamic CA was evaluated using thigh cuffs occlusion and release technique. To quantify dynamic CA, the rate of regulation (RoR) was calculated from the change in cerebral vascular conductance index during occluded-cuffs release. RESULTS: The cold stimulation increased MAP (mean ± SD; +14.6 ± 10.8 %, P < 0.02), while there was no change in MCAv (0.52) and PCAv (0.73) compared with control condition. The RoR in both middle cerebral artery (MCA) and posterior cerebral artery (PCA) was not changed by cold stimulation (MCA and PCA, 0.26 and 0.30). In addition, there was no difference in the change in RoR between MCA and PCA (P=0.224). CONCLUSIONS: The cold stimulation-induced high SNA did not modify dynamic CA in both anterior and posterior cerebral circulation. These findings suggest that the role of SNA on dynamic CA in posterior cerebral circulation may be similar to anterior cerebral circulation.
Aerobic exercise training (AET) may improve cerebral blood flow (CBF) regulation and reduce the risk of dementia. CBF is sensitive to changes in the arterial partial pressure of carbon dioxide (CO₂), which is assessed as cerebral vasomotor reactivity (CVMR). Currently, the effect of AET on CVMR in patients with mild cognitive impairment (MCI) is unclear. PURPOSE: To determine 1) effects of AET on CVMR in MCI patients, and 2) the reproducibility of CVMR over 12 months. METHODS: Seventy MCI patients were randomized to 12 months of moderate-intensity AET or stretching program. CBF velocity (CBFV) by transcranial Doppler, mean arterial pressure (MAP) by plethysmography, and end-tidal CO₂ (EtCO₂) by capnography were measured during hyperventilation (hypocapnia) and during a modified rebreathing protocol (hypercapnia). Cerebrovascular conductance index (CVCi) was calculated by CBFV/MAP, and CVMRs were calculated by ΔCBFV/ΔEtCO₂ and ΔCVCi/ΔEtCO₂. In addition, blood pressure response to hypo- and hypercapnia was determined by ΔMAP/ΔEtCO₂. Cardiorespiratory fitness was assessed by maximal oxygen uptake (VO₂max) using a modified Astrand-Bultin treadmill protocol. Intraocular correlation (ICC) was used to test the reproducibility of CVMRs over 12 months. RESULTS: Data were available from 16 patients in AET program and 17 patients in stretching program. After intervention, VO₂max significantly increased in AET group as compared with stretching group. Mean CBFV, MAP, and EtCO₂ at rest remained at similar levels in both groups. Hypocapnic CVMRs increased significantly over time in both groups but no effect of AET or stretching intervention on CVMRs did not change with treatment or time. The ICCs of ΔCBFV/ΔEtCO₂ and ΔCVCi/ΔEtCO₂ were 0.55 (P=0.001) and 0.74 (P=0.001) during hyperventilation and 0.316 (P=0.008) and 0.545 (P=0.001) during hypocapnia, respectively. CONCLUSIONS: In MCI patients, a 12-month AET program did not alter hypo- or hypercapnic CVMRs as compared with stretching group. Although hypocapnia CVMRs were reproducible over 12 months, hypocapnic CVMRs showed lower reproducibility. Supported by the NIH (R01AG033106).

PURPOSE: Cerebral autoregulation is a homeostatic mechanism that serves to maintain cerebral blood flow constant over a wide range of perfusion pressure. Syncope is thought to be caused by cerebral hypoperfusion due to the transient blood pressure drop, and thus impairment of cerebral autoregulation may facilitate syncope. A previous study has reported that a past history of syncope is a strong predictor of future syncope recurrence. However, it is unclear whether impaired cerebral autoregulation would be related with recurrent syncope. The purpose of this study was to test our hypothesis that cerebral autoregulation would be impaired in syncope patients with a past history of syncope as compared with those for the first time.

METHODS: We evaluated cerebral autoregulation in 24 syncope patients for the first time (age: 64.19 years old, male/female: 15/9) and 20 syncope patients with a past history of syncope (age: 52.26 years old, male/female: 11/9). In patients with recurrent syncope, the number of past syncope was 2.9±1.6 times (range 2-7 times). Middle cerebral artery mean blood flow velocity (MCA Vmean) and mean arterial pressure (MAP) were measured by transcranial Doppler ultrasound and tonometry on right radial artery for 3 min in the supine position. In offline analysis after the measurement, the transfer function gain between MAP and MCA Vmean were calculated at very low frequency (0.023-0.07 Hz, VLF) and low frequency (0.07-0.2 Hz, LF) ranges to estimate dynamic cerebral autoregulation. RESULTS: LF gain did not differ between syncope patients with a past history of syncope and those for the first time (P=0.23). In contrast, VLF gain was significantly higher in patients with a past history of syncope than in those for the first time (1.81±1.17 cm/s/mmHg vs. 1.09±0.65 cm/s/mmHg, P=0.02). CONCLUSIONS: These data suggest that impaired cerebral autoregulation at least in part explains physiological mechanisms underlying recurrent syncope.
Aerobic Exercise Improved Cardiac and Mitochondrial Function in Chronic Heart Failure in Rats

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University of Minnesota, Minnesota, MN. (Sponsor: Li Li Ji, FACSM)

Purpose: The purpose of this study was to investigate whether aerobic exercise can improve cardiac and mitochondrial functions of heart failure induced by pressure overload in rats. We explored the mechanism of adaptational changes at the post-transcriptional level with the experimental model. Methods: The rat model of heart failure was accomplished by abdominal aorta constriction (AC). Eight weeks after the operation, the animals were divided into 4 groups: sham control (SC), sham plus training (ST), AC without training, and AC plus training (AT). Training was performed on treadmill at 25m/min, 0° grade for 60 min per day and last for 8 weeks. Heart structural and functional parameters were measured with echocardiography. Mitochondrial respiratory functions were measured with high-resolution respirometry. The miRNAs expression profiles were investigated by Affymetrix® Microarray. RT-PCR was used to validate the expression levels of miRNAs. Results: Compared with AC, the cardiac structure index LVIDd were significantly decreased, while the cardiac functional indexes ejection factor (EF) and fractional shortening (FS) were significantly increased in AT. Mitochondrial state 3 respiration and respiratory control ratio (RCR) decreased significantly in AC vs. SC, whereas the reductions were restored by AT to SC level. Mitochondrial complex 1 activity in AC was significantly lower than that in SC, but such reduction was not observed in AT. MiR-10a-5p and miR-542-5p levels in AT hearts were significantly higher than those in AC, and lower than that in SC, but such reduction was not observed in AT. MiR-10a-5p and miR-542-5p expression levels were significantly higher in AT compared with SC. Conclusions: Aerobic exercise can ameliorate the pathogenesis of heart failure and improve heart function in experimental animals. This effect is largely achieved by improvement of mitochondrial function, especially complex 1 function in electron transfer chain. MiR-10a-5p and MiR-542-5p may be involved in this process through regulating key components of mitochondrial. More studies are needed with larger number of patients, including accurate measurement of body composition and characterizing exercise capacity evaluation after surgical repair.

Waist Circumference and BMI Are Associated With Cardiovascular Disease Risk Markers In Police Officers

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INTRODUCTION: Christie et al. (Circulation, 2005; 111:1904-1914) has shown that body fatness is a better predictor of cardiovascular disease (CVD) risk than aerobic fitness in a cohort of healthy men. We sought to replicate their findings in a cohort of police officers. PURPOSE: The purpose of this study is to determine whether fatness or aerobic fitness is more highly associated with selected CVD risk markers in a cohort of police officers. METHODS: Six female and 49 male police officers underwent screening for 9 selected metabolic and hemodynamic risk markers for CVD along with a maximal treadmill test to determine aerobic fitness. Waist circumference (WAIST), fat mass (FATMASS), percent body fat (%FAT), and body mass index (BMI) were chosen as indicators of fatness. Multiple linear regression models were used to validate the correlation coefficients with the independent associations of fatness to CVD risk while controlling for fitness and age. RESULTS: The regression models for FATMASS and %FAT were not statistically significant. The model for WAIST showed an association with 5 of the 9 risk markers after partialing out the effects of aerobic fitness and age (r=13 to .27, p<.01). The model for BMI demonstrated similar associations with 4 of the 9 risk markers (r=10 to .15, p<.05). In contrast, aerobic fitness was not independently associated with any of the risk markers in either of the significant regression models. Conclusions: In police officers, body fatness is associated with CVD risk while aerobic fitness is not.

Pulmonary Artery Sling And Exercise Capacity : A Longitudinal Study In A Young Girl

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Introduction: Pulmonary artery sling is a rare congenital vascular malformation that consists of an anomalous origin of the left pulmonary artery from the posterior aspect of the right pulmonary artery. The anomalous left pulmonary artery crosses the mediastinum posterior to the trachea or carina and anterior to the esophagus, compressing both organs. Respiratory complaints predominates over esophageal symptoms. In asymptomatic patients, surgical repair is controversial. Data regarding exercise capacity and other cardiopulmonary parameters is scarce.

Aim: To evaluate exercise parameters in an early pubertal girl with uncorrected pulmonary artery sling at baseline and 3 years later (late puberty).

Methods: Maximal cardiopulmonary exercise testing (CPET) was completed on a cycle ergometer at age 11 y/o and 14 y/o by a girl with uncorrected pulmonary artery sling. Data was processed and analyzed retrospectively.

Results: Peak oxygen uptake (VO2peak) was higher in the first test (41.9 ml·kg⁻¹·min⁻¹, 119% predicted) than in the second test (30.6 ml·kg⁻¹·min⁻¹, 87% of predicted). Maximal and submaximal pulmonary exercise parameters improved in the second test (breathing reserve: 9.7 liters, 15% predicted in the first test vs. 31.5 liters, 39% predicted in the second test and for lowest VE/VCO2 and VE/VO2 slopes: 28.7 and 34.9 vs 25.7 and 27.7 respectively), with no similar expected improvement in cardiovascular parameters (oxygen pulse (VO2/HR) 9.2 ml·beat⁻¹, 125% predicted in the first test vs. 9.3 ml·beat⁻¹, 92% predicted respectively and for VO2/HR slope: 14.1 ml·beat⁻¹ vs 14.9 ml·beat⁻¹).

Conclusions: In this case of uncorrected pulmonary sling a deterioration in exercise capacity and cardiovascular exercise parameters was observed over puberty inspite of improvement in pulmonary parameters. Possible mechanisms are maturation dependent abnormal pulmonary slang flow, deconditioning and increased % body fat. To the best of our knowledge this is the first report of exercise evaluation in this unique population. More studies are needed with larger number of patients, including accurate measurement of body composition and characterizing exercise capacity evaluation following surgical repair.

Arterial stiffness is a significant risk factor for cardiovascular events and early detection is key for intervention and monitoring. This pathophysiological process is accelerated in type 2 diabetes (T2D), yet the onset of this condition has a limited body of research.

PURPOSE: To evaluate (1) arterial stiffness properties via pulse wave analysis (PWA) across a 4-group spectrum, and (2) determine whether waist-to-height-ratio (WHr), waist circumference (WC) or body mass index (BMI) serves as the best predictor of early changes in PWA- pathophysiology.

METHODS: PWA was measured in 52 participants across four groups separated by HbA1c values: 13 normo-glycemic (N, 4.0-5.1), 14 high normal (HN, 5.2-5.6), 20 prediabetes, (PD, 5.7-6.4) and 13 with T2D (T2D, ≥ 6.5). Brachial, central and peripheral pressures, central and peripheral augmentation index (AIx) data were collected via Sphygmocor using validated methods after overnight caffeine abstinence. Pulse wave velocity (PWV) and arterial stiffness (AS) were calculated using validated methods after overnight caffeine abstinence and a minimum 4-hr fast. Group differences were evaluated via MANCOVAs. HbA1c, WHr, WC and BMI data were assessed through regression to determine the best predictor.

RESULTS: Significant differences were found between N to T2D and HN to T2D for brachial systolic blood pressure (SBP) [F(3,46)=2.743, p<.05], brachial diastolic blood pressure (DBP) [F(3,46)=3.329, p<.028] and brachial mean pressures (MP) [F(3,46)=4.321, p<.009]. Central DBP and MP differed between N to T2D, and HD to PD and T2D groups [DBP,F(3,44)=3.874, p<.015; MP,F(3,44)=3.303, p<.029]. Central pulse pressure (PP) and MP were significantly different between groups. Peripheral pressures significantly differed between N and both PD and T2D. HD and both PD and T2D groups for peripheral SBP [F(3,44)=3.007, p<.040], peripheral DBP [F(3,44)=4.316, p<.009] and peripheral MP [F(3,44)=3.487, p<.023], but not PP or
PAI, WHR and WC were identified as the best predictors of CAIs after adjusting for age and height ($R^2=0.80, F(3,45)=16.023, p<0.0005$; adj. $R^2=0.640$), while PAI had no significant predictive power.

CONCLUSIONS: PAI may be effective for identifying differences in multiple brachial, central and peripheral pressure measures across a novel, predefined HAIC spectrum; however, more research needs to be executed to validate these findings. WHR and WC, but not BMI, effectively predicts CAIs.

The cardiovascular response to physical activity is abnormally exaggerated in patients with type 2 diabetes mellitus (T2D). Recent studies in patients with T2D have suggested that this exaggerated responsiveness is mediated, in part, by the skeletal muscle metaboreflex. However, the mechanisms causing augmentations in muscle metaboreflex function in this disease remain to be elucidated. Chronic hyperinsulinemia associated with peripheral insulin resistance is one of the pathophysiological characteristics of T2D. Evidence suggests that transient receptor potential (TRP) channels, which contribute to metaboreflex activation, are more responsive to stimuli in the presence of insulin. Given that metaboreflex afferent fibers reside in skeletal muscle, it is suggested that hyperinsulinemia may underlie the skeletal muscle metaboreflex activity characteristic in T2D.

PURPOSE: To examine the impact of insulin on neuronal responses to chemical stimulation in thin muscle afferents and dorsal root ganglia (DRG) of normal healthy rodents. It was hypothesized that insulin potentiates the activity of metaboreflexically sensitive afferent fibers.

METHODS: Chemically activated neurons were assessed by single-fiber recordings from rat muscle-nervé preparations in vitro and by whole cell patch-clamp recordings from cultured mice DRG neurons. The magnitude of responses to capsaicin stimulation and the capsaicin activated current were recorded, respectively.

RESULTS: Compared to control conditions, thin muscle afferent response magnitude was significantly increased by insulin exposure (0.03±0.03 vs. 0.25±0.02 imp, n=3, P<0.05). In DRG cell culture, total charge transfer by capsaicin activated current was largely augmented by insulin administration (403±159 % changes from control conditions, n=3, P<0.011).

CONCLUSIONS: These data demonstrate that thin muscle afferent as well as DRG neuronal responses to capsaicin are augmented by insulin exposure in normal healthy animals. The data support the concept that chronic hyperinsulinemia may potentiate skeletal muscle metaboreflex function in T2D contributing to the abnormal cardiovascular response to exercise characteristic of this disease. Supported by the Lawson & Rogers Lacy Research Fund in Cardiovascular Disease and JPS KakenHiJP17K10769

PURPOSE: To describe vascular function and aerobic capacity in breast cancer survivors (BCS) who are within one year of completing primary anti-cancer therapy and post a 16-week exercise intervention.

METHODS: Applanation tonometry was used to evaluate vascular function (pulse wave velocity, PWV) and cardiopulmonary exercise testing to evaluate aerobic capacity ($VO_{2peak}$) pre and post 16 weeks of progressive aerobic and strength training exercise at a community-based exercise program. Descriptive statistics were used to characterize the sample, paired t-tests to assess pre-post change, and Pearson correlations to evaluate associations between PWV and $VO_{2peak}$.

RESULTS: Eight BCS, mean age=60 (±8y), BMI=29.5 (±7.4) have been evaluated at baseline. Mean baseline PWV=7.2 (±1.65 m/s) and mean $VO_{2peak}$ was moderate (r=0.42, p=0.083). Mean $VO_{2peak}$ improved (+4.04±1.43, p=0.049) in 3 subjects who have completed the exercise intervention to date. Post-intervention PWV was not evaluable at follow-up.

CONCLUSIONS: It has been previously established that aerobic capacity is impaired in BCS compared to age-matched, non-cancer populations. Our findings support this notion (17.3 vs. -36mL/kg/min healthy, Jones et al., 2012). Vascular function in our sample is similar to previously reported values in BCS (Grover et al., 2015) but reference literature is limited. Our approach exploring correlations between vascular function and aerobic capacity following primary cancer therapy is novel and important as it relates to the potential for designing future preventative interventions. Exercise appears beneficial to aerobic capacity. More follow-up data is needed, and is underway, to assess impact of exercise on vascular function. Supported by funding from Breast Cancer Research Foundation of New York.

PURPOSE: Remote ischemic preconditioning (RIPC), induced by intermittent periods of sublethal ischemia and reperfusion, is a powerful stimulus for adaptations that increase cardioprotection from ischemic-reperfusion (IR) injury. Although RIPC-induced cardioprotection has consistently been demonstrated using animal models, two major clinical trials in humans undergoing cardiac surgery has yielded conflicting results. These different results may be explained by coexisting conditions (e.g., diabetes, obesity, and hypertension) and other factors (e.g., dose of ischemia used to ‘precondition’ vessels, preexisting ischemia, medications, age, fitness level, etc.). Using skin as an alternative human model to study RIPC, we tested cutaneous microvascular responsiveness to local heating (Tk=42°C) before and after repeated RIPC. We hypothesized that seven consecutive days of RIPC will improve the vasodilation response to local heating.

METHODS: Nine young participants (26 ± 1 years, 4 male and 5 female) performed RIPC for seven days. Each daily RIPC session consisted of 4 repetitions of upper arm ischemia for 5 minutes. The upper arm blood flow occlusion was induced by an arm cuff to 220 mmHg for 5 minutes followed by deflation for 5 minutes. Before and after the 7-day RIPC training period, laser intensity (HF = 10.3±3.7%) running. However, for those mice exposed to the high intensity running schedule, the tumour hypoxia fraction was significantly reduced to 4.3±2.2% (p<0.03). The Hoechst 33342 analyses on tumour perfusion showed currently pending.

CONCLUSIONS: Our data show that mice running at high intensity for 30 minutes elicited an acute reduction in the hypoxic fraction in the tumour when compared to sedentary mice or mice running at both moderate and low intensities. Our future studies will focus on how long the reduction in hypoxia is maintained after running and how that exercise regime can be used to improve tumour treatment-response, especially to radiation.

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E-30 Free Communication/Poster - Vascular Function

Seven Days Of Remote Ischemic Preconditioning Augmented Local-heating Induced Vasodilation In Human Skin

Jahyun Kim, Warren Franke, FACSM, James Lang, Iowa State University, Ames, IA. (Sponsor: Warren Franke, FACSM)

(No relevant relationships reported)
spokele contrast imaging (LSCI) was used to measure the speed and number of blood cells moving through the forearm cutaneous microvasculature and reflected as a flux value; therefore, blood flow changes during local heating. Flux and blood pressure measurements were collected during baseline (Tsk=33°C) and local heating of forearm skin (Tsk=42°C). Data are represented as cutaneous vascular conductance (CVC), which was calculated as flux / mean arterial pressure.

RESULTS: After seven days of RIPC, the cutaneous vasodilation response to local heat was increased (P<0.01 vs. Tsk=33°C, +1.51 vs. +0.20 CVC, P<0.05). Baseline values were not different following RIPC (P<0.01 vs. Post: 0.29 ± 0.40 CVC).

CONCLUSIONS: Seven days of RIPC augmented the local heating response in young forearm skin blood flow. These data suggest that endothelial factors contributing to the local heating response in skin may be affected with repeated RIPC.

2210 Board #46 June 1 11:00 AM - 12:30 PM
The Role of Melatonin in Exercise Enhanced Endothelium-dependent Vasorelaxation In Mesenteric Arteries of SHR
WU Ying, Shi Lijun. Beijing Sport University, Beijing, China. (No relevant relationships reported)

PURPOSE: To determine if melatonin plays an important role in the hypotensive effects of exercise training. Further, to study the role of melatonin binding to melatoninergic receptors in the vasorelaxation of small MAs in SHR.

METHODS: Twelve male normotensive Wistar-Kyoto rats (WKY, n=18) and SHR's (n = 48) were used. SHR's were randomly divided into four groups: SHR sedentary group (SHR-SED, n = 18), SHR sedentary with melatonin receptor antagonist luzindole (Luz) injection group (SHR-SED + Luz, n = 6), SHR exercise group (SHR-EX, n = 18), and SHR exercise with luzindole injection group (SHR-EX + Luz, n = 6). Luzindole injection groups were injected intraperitoneally (i.p.) with luzindole (1 mg/kg/day in sterile saline) each day. Rats in the exercise groups were subjected to aerobic exercise. Blood pressure and heart rate were measured after exercise. Serum melatonin levels were examined by ELISA. The mechanical properties of small mesenteric arteries were studied by myography. Western blot and immunofluorescence colocalization were performed to examine the protein expression and distribution of MT1, MT2 receptors and eNOS, as well as their colocalization in the endothelial cell layer in SHR, which was significantly attenuated by intraperitoneal administration of luzindole, a nonselective melatonin receptor (MT1/MT2) antagonist. Serum melatonin levels in the SHR group were significantly lower than those in the WKY group at 8:00-9:00 and 21:00-22:00, respectively (8.5±3.2 vs. 12.7±2.8 pg/mL, P<0.05). Luzindole decreased the blood pressure and heart rate in SHR, which was significantly attenuated by intraperitoneal administration of luzindole in SHR. Both exercise training and luzindole ameliorated this endothelium-dependent impairment of relaxation in hypertension. Immunohistochemistry and Western blotting showed that protein expression of the MT2 receptor and eNOS, as well as their colocalization in the endothelial cell layer in SHR, which was significantly attenuated; exercise training suppressed this reduction.

CONCLUSIONS: These results provide evidence that regular exercise has a beneficial effect on improving endothelium-dependent vasorelaxation in MAs, in which melatonin plays a critical role by acting on MT2 receptor to increase NO production and/or NO bioavailability.

2211 Board #47 June 1 11:00 AM - 12:30 PM
The Effects Of Acute Bouts Of Whole Body Vibrate On Central Hemodynamics In The Frail Elderly: A Pilot Study
Katie Burnet. University of North Carolina at Chapel Hill, Chapel Hill, NC. (No relevant relationships reported)

PURPOSE: Whole body vibration training (WBV) is a promising alternative to conventional exercise therapy in the frail elderly. However, little is known about its effect on the cardiovascular system. The aim of this study was to determine whether an acute bout of WBV: (i) improves measures of central hemodynamics [central systolic blood pressure (cSBP), Augmentation Index (AIx), and Double Product (DP)]; and (ii) can be completed without inducing orthostatic intolerance - a sustained drop in systolic blood pressure <20 mmHg or diastolic pressure >10 mmHg.

METHODS: Nine elderly rest home residents (81.1 years (SD 7.1), 88% F) participated in a randomized cross-over design incorporating WBV and non-vibrational control experimental conditions (CON) on two separate testing day. On each occasion, participants laid supine for their basement measurement, completed their CON or WBV training, then returned to supine for 90-minute post-exercise evaluation. RESULTS: There was no between-day difference at baseline. During training, no interaction or between-condition effects were observed for any variable, but there were moderate-large time effects for cSBP (P<0.001), and DP (P<0.001). Following training, no interaction or between-condition effects were observed for cSBP or DP, but an interaction effect was reported for AIx (P<0.019). Post-hoc analysis revealed a non-significant time effect for CON (P=0.016), Eta 0.015) and a significant large effect in AIx for WBV (P=0.020, Eta=0.202). None of the participants exhibited orthostatic tolerance.

CONCLUSIONS: WBV is a safe training method for the frail. Future research is warranted to determine the chronic effects on cardiovascular health.

2212 Board #48 June 1 11:00 AM - 12:30 PM
Effects Of Habitual Isometric Handgrip Exercise On Central Blood Pressure In Older Adults
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Central (aortic) blood pressure (BP) is a more important predictor of cardiovascular diseases than peripheral (brachial) BP. Isometric handgrip exercise can effectively decrease peripheral BP. However, effects of isometric handgrip exercise on central BP remain unknown. PURPOSE: The present study aimed to determine whether habitual isometric handgrip exercise decreases central BP in older adults with stage 1 and 2 hypertension. METHODS: Twenty-four male and females (mean age 63±2 y; ±SEM) with stage 1 and 2 hypertension (brachial systolic or diastolic BP of 140-179 or 90-109 mmHg, respectively) who were not actively involved in regular resistance endurance training were randomized to a group that did isometric handgrip exercise (IHG) or a control (CON) group. The isometric handgrip exercise comprised four unilateral 2-min isometric contractions at 30% of maximal voluntary contraction using a programmed handgrip dynamometer with 1-min rest periods for five days per week for four weeks. Central systolic BP (cSBP), brachial systolic BP (bSBP), brachial diastolic BP (bDBP), and the augmentation index at a heart rate of 75 beats per minute (AIx 75) were non-invasively measured after resting in the supine position for at least five minutes in both groups before (baseline) and after four weeks of training using an automated application tonometric system. RESULTS: Baseline cSBP, bSBP, bDBP, and AIx75 did not significantly differ between the groups. Consistent with previous studies, bSBP and bDBP after training significantly decreased from baseline from 155±17 to 142±3 mmHg and from 94±3 to 88±2 mmHg, respectively (P<0.05 for both). The cSBP and AIx75 did not change in the CON group, but significantly decreased from baseline in the IHG group from 165±4 to 148±4 mmHg and from 88±4% to 82±4%, respectively (P<0.05 for both). The cSBP was significantly lower after training in the IHG than in the CON group (148±4 vs. 159±3 mmHg, P<0.05). CONCLUSIONS: These results suggest that isometric handgrip exercise could reduce central BP in older adults with stage 1 and 2 hypertension. Therefore, isometric handgrip exercise might be an effective non-pharmacological therapy for prevention and treatment of cardiovascular disease.

2213 Board #49 June 1 11:00 AM - 12:30 PM
Arterial Stiffness and Mitochondrial Oxidative Capacity in Obese African Americans
Joshua E. McGee, Terence E. Ryan, Gabriel S. Dubis, Savanna G. Barefoot, Patricia M. Brophy, Damon L. Swift. East Carolina University, Greenville, NC. (No relevant relationships reported)

Arterial Stiffness and Mitochondrial Oxidative Capacity in Obese African Americans

Joshua E. McGee, Terence E. Ryan, Gabriel S. Dubis, Savanna G. Barefoot, Patricia M. Brophy, Damon L. Swift. East Carolina University, Greenville, NC.

PURPOSE: African Americans are at greater risk for arterial stiffness and mitochondrial dysfunction compared to Caucasian Americans. Prior studies report a relationship between arterial stiffness and mitochondrial function in individuals with hypertension or gestational diabetes, but it has not been evaluated in healthier populations or African Americans. This study assessed arterial stiffness and mitochondrial oxidative capacity in two skeletal muscle mitochondrial capacity in obese African Americans. METHODS: Fifteen (47.7 ± 6.9 yrs; 34.6 ± 4.2 kg/m²; 86.7% female) obese African Americans from an on-going exercise training study were analyzed. Mitochondrial capacity was determined via near-infrared spectroscopy (NIRS) and quantified as recovery kinetics of muscle O2 consumption (rate constant) after a short bout of exercise (fastus lateralis), followed by short bouts (5-10 s) of ischema. Arterial stiffness was assessed as carotid-femoral pulse wave velocity (cfPWV) and aortic augmentation index (AIx). RESULTS: No significant correlation was observed between rate constant and cfPWV (r=0.17, P=0.55) or AIx (r=0.01, P=0.97), but approached significance withingroup pressure (r=0.59, P=0.057) and age (r=0.59, P=0.057). No significant findings between arterial stiffness and mitochondrial capacity parameters. CONCLUSIONS: Arterial stiffness was not associated with mitochondrial oxidative capacity. Future studies should consider a larger sample size or greater variance in African American participant demographics (e.g. sedentary status, BMI gender).
The aging process is associated with a gradual decrease in exercise performance, leg muscle blood flow and oxygenation, and endothelial vascular reactivity. PURPOSE: To examine potential differences in femoral artery flow-mediated dilation (FMD) and calf muscle oxygenation (HbO₂,) during low-intensity plantarflexion exercise in older adults. METHODS: 43 young-old (YO; n=24, 67±1 years) and older-old (OO; n=19, 70±1 years) individuals were included in this study. We measured body fat % and leg mass (LLM) by DXA and endothelial reactivity to ischemia (VIC) using a dynamometer. VO₂max was estimated using a submaximal treadmill test. fa-FMD was assessed by Doppler ultrasound, measuring the relative change in diameter from baseline to peak hyperemic response following 5 min of muscle ischemia. After a 10-min semi-recumbent rest, participants performed three sets (3-min each) of rhythmic plantar-flexion exercise at increasing intensity (20, 30 and 40 pounds) separated by 1-min of rest. Percent changes (%Δ) in muscle HbO₂ from baseline to the 3rd min of each set was monitored by near-infrared spectroscopy (NIRS) on the medial gastrocnemius muscle. RESULTS: There were no-between-group differences in VO₂max, VIC, LLM, body fat %, and fa-BF (P>0.05). During exercise, the OO group exhibited a higher %Δ in HbO₂ compared to the YO group in sets 1 (60.0±21.2 vs. 44.7±17.2% Δ; p<0.05) and sets 6 (66.7±18.8 vs. 52.6±18.2% Δ; p<0.05). CONCLUSIONS: There was a lower calf muscle oxygenation during low-intensity plantar-flexion exercise performed at the same absolute intensity in OO compared to YO adults. Execising at a greater relative intensity may explain the lower calf muscle oxygenation in OO adults.
resulting in the reduction in arterial stiffness. However, the underlying molecular mechanism related to different effects of different exercise training on arterial stiffness remains unclear. **PURPOSE:** This study aimed to clarify the different responses of arterial stiffness and NO production to different exercise training in rats and humans.

**METHODS:** Animal study; Forty 10-week-old male Sprague-Dawley rats were randomly divided into 4groups; sedentary control (CON), AT (treadmill running for 60min at 30%n/min, 5days/wk for 8weeks), RT (ladder climbing, 8-10sets/day, 3days/ wk for 8weeks). Results: Arterial systolic and diastolic BP significantly decreased in AT and RT compared to CON (P<0.05). NO production was significantly elevated in AT and RT compared to CON (P<0.05), but did not change in the RT. Arterial eNOS phosphorylation was negatively correlated with aortic PW (r=-0.38, P<0.05). Human study; carotid-forearm PWV was decreased and plasma NOx levels was elevated by AT and HIIT (P<0.05). HIIT-induced reduction of carotid-forearm PWV and elevation of plasma NOx levels were equal to that caused by AT. **CONCLUSIONS:** HIIT-induced increase in aortic NO bioavailability may improve central arterial stiffness, as same degree of AT. Supported by Grants-in-Aid for Scientific Research (#17H02182 and #16K13095, M. Imitita)

**RESULTS:**

- **Weight and Fat Distribution:** Compared to NW participants, OB participants had a significantly higher weight (NW) and percentage body fat (BF) (0.48±0.08 vs. 0.55±0.10, P<0.05). Waist-hip ratio (WHR) was elevated by AT and HIIT (P<0.05). HIIT-induced reduction of carotid-forearm PWV and elevation of plasma NOx levels were equal to that caused by AT. **CONCLUSIONS:** HIIT-induced increase in aortic NO bioavailability may improve central arterial stiffness, as same degree of AT. Supported by Grants-in-Aid for Scientific Research (#17H02182 and #16K13095, M. Imitita)

**2220 Board #56 June 1 11:00 AM - 12:30 PM**

**Comparison of Vascular Structure and Function in Obese Children and Youth: A Pilot Study**

Nicola R. Hurley1, Sarah M. Kelly2, Sinead Murphy3, Clare McDermott1, Niall M. Moyna1, 1Dublin City University, Dublin, Ireland, 2Temple Street Children’s University Hospital, Dublin, Ireland.

(no relevant relationships reported)

Comparison of Vascular Structure and Function in Obese Children and Youth: A Pilot Study

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(no relevant relationships reported)

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Comparison of Vascular Structure and Function in Obese Children and Youth: A Pilot Study

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intervention (from 1355 ± 154 to 1274 ± 168 m/s, P = 0.004). Conclusion: The current study firstly demonstrates that regular aquatic exercise, even at a low frequency, could mitigate cardiovascular risk in more than middle-aged and older people. In the future, we should compare effectiveness of aquatic exercise with that of exercise on land, and study on other populations (e.g., hypertensive patients).

PURPOSE: Vascular endothelial dysfunction induced by hyperglycemia and elevated insulin resistance is a potent risk factor for cardiovascular disease (CVD) and likely contributes to multiple chronic disease complications associated with aging like dementia. The aim of this study was to systematically review and quantify the effects of exercise on endothelial function (EF) in type 2 diabetes (T2D). METHODS: Five electronic databases were searched (until June 2017) for studies that met the following criteria: (i) randomized controlled trials; (ii) T2D aged ≥18 years; (iii) measured EF by brachial artery flow-mediated dilation (FMD); (iv) structured and supervised exercise intervention for ≥8 weeks. RESULTS: Thirteen cohorts of eight studies (306 patients, average age 59 years) met the inclusion criteria. Exercise training significantly increased FMD (mean ES = 0.41, 95% CI = 0.21 to 0.62, P < 0.001). Low to moderate intensity subgroups and aerobic exercise (AE) subgroups significantly increased FMD more than moderate to high intensity subgroups and combined AE and resistance exercise (RE) subgroups respectively (P < 0.01, P < 0.05). Exercise training significantly decreased glycated hemoglobin (HbA1c) (mean ES = −0.40, 95% CI = −0.61 to −0.19, P < 0.001). Low to moderate intensity subgroups significantly decreased HbA1c more than moderate to high intensity subgroups (P < 0.05). CONCLUSIONS: Our results suggest that in patients with T2D, lower intensity exercise has physiological meaningful effects on EF, in support of the emerging concept that the lower efforts of exercise are not necessarily less cardio-protective than higher intensity training.

Board #59
June 11 AM - 12:30 PM
Mental Stress as a Contributing Factor to Endothelial-Derived Hyperpolarizing Factor Impairment
African Americans (AA) have a higher prevalence of hypertension and other cardiovascular (CV) complications compared to other populations. While the reasons for this elevated CV disease risk are multifactorial, vascular dysfunction is a key contributing factor. It has been previously shown that mental stress, induced by mental arithmetic, results in a significant increase in forearm blood flow (FBF). This response has been predominantly attributed to a mental stress-induced release and subsequent vasodilatory effect of Nitric Oxide (NO). In this regard, a previous study has reported that AA have an attenuated increase in FBF as compared to Caucasians (CA) in response to mental stress, which may be related to impaired vascular function and thus contribute to establish a new approach for ED treatment.

Board #62
June 11 AM - 12:30 PM
High Aerobic Fitness And Muscular Strength Offset Aging-induced Deterioration Of Male Sexual Function
Hiroshi Kumagai1, Toru Yoshikawa2, Kanae Myeonozeno3, Nobuhiko Akazawa4, Seiji Maeda3, Juntendo University, Inzai, Japan. 2University of Tsukuba, Tsukuba, Japan. 3University of Houston, Houston, TX. 4Incheon National University, Incheon, Korea, Republic of.

PURPOSE: Erectile dysfunction (ED) is an impaired male sexual function and associated with depressive symptoms, quality of life and cardiovascular disease in men. The main causes of ED are aging and impaired vascular functions. Vascular functions are positively influenced by physical fitness, such as aerobic capacity, muscle strength and flexibility. However, the relationship between physical fitness and erectile function remains poorly understood. Therefore, the aim of this study was to investigate the association between physical fitness parameters and erectile function.

METHODS: In 177 adult males (age; 57 ± 15 [range: 23–82] years, BMI; 22.6 ± 2.6 [range: 17.3–33.6] kg/m², mean ± SD [range]), we measured peak oxygen consumption (VO2peak) as an index of aerobic fitness, handgrip strength (HGS) as an index of muscular strength, and sit and reach as an index of flexibility. Also, we measured serum testosterone levels. Erectile function was assessed by using International Index of Erectile Function-5 questionnaire (IIEF5: descending score indicates worsening of erectile function). RESULTS: IIEF5 score was significantly correlated to age (r = −0.56, P < 0.01), height (r = 0.35, P < 0.05), glucose (r = −0.26, P < 0.01), HbA1c (r = −0.43, P < 0.01), testosterone (r = −0.18, P < 0.05), VO2peak (r = −0.52, P < 0.01) and HGS (r = −0.37, P < 0.01), but not sit and reach (r = −0.08, n.s.). Multivariate linear regression analysis revealed that IIEF5 score was significantly and independently associated only with VO2peak and HGS, although age and other factors were included in the regression model as confounders. Furthermore, when the subjects were divided into four groups according to median value of HGS value and VO2peak value, IIEF5 score exhibited the highest value in the group with high-HGS and high-VO2peak, and the lowest value in the group with low-HGS and low-VO2peak. CONCLUSION: These results suggest that the maintenance of high aerobic fitness and muscular strength may offset aging-induced deterioration of male sexual function. Our present findings may provide a novel insight into the role of physical fitness in reducing the risk of ED and contribute to establish a new approach for ED treatment.
Reproducibility of a Ramping Protocol to Measure Cerebral Vascular Reactivity Using Functional Magnetic Resonance Imaging
Nicholas G. Evanoff, Kara L. Marlatt, Justin R. Geijer, Bryon A. Mueller, Kelvin O. Lim, Donald R. Dengel, FACSM.
University of Minnesota, Minneapolis, MN. Pennington Biomedical Research Center, Baton Rouge, LA. Winona State University, Winona, MN. (Sponsor: Donald Dengel, FACSM) (No relevant relationships reported)

**PURPOSE:** Though individual differences in arterial carbon dioxide and oxygen levels inherently exist, the degree of their influence on cerebral vascular reactivity (CVR) is less clear at the micro-vessel level. The introduction of a partial re-breathing method that independently controls end-tidal carbon dioxide (PETO2) and end-tidal oxygen (PETO2) has enabled examination of hypercapnic effects on blood oxygen level-dependent (BOLD) magnetic resonance imaging (MRI) signal changes. The purpose of this study was to examine the within- and between-visit reproducibility of BOLD signal changes to an iso-oxic ramping protocol in PETO2.

**METHODS:** To stimulate changes in CVR, PETO2 was altered while PETO2 was held constant using a computer controlled prospective gas-blending device. Two fMRI scans, each including a linear change in PETO2, were performed on the same visit with a 3-Tesla (3T) scanner. Each ramp consisted of a linear decrease in PETO2 from 30 mmHg (control) to an average of 25 mmHg. Ramp waves were created with 30 min at ~60% VO2max = 31.6 ± 4.5 ml/kg/min and then increasing PETO2 linearly to 35 mmHg over a 30 min period. The protocol was repeated on a separate visit with a minimum of 1 day between scanning sessions. Intraclass correlation coefficients (ICC) and coefficients of variation (CV) were calculated to quantify reproducibility.

**RESULTS:** Eleven subjects (6 females; mean age 26.5±5.7 years) completed the full testing protocol. Very good reproducibility was observed for the within-visit ramp wave (Visi1: ICC = 0.82; CV = 6.5%; Visi2: ICC = 0.84; CV = 6.36%). Similarly, ramp waves were reproducible between scanning sessions (Scan 1: ICC = 0.86; CV = 6.5%; Scan 2: ICC = 0.66; CV = 6.13%).

**CONCLUSION:** This study demonstrates BOLD signal changes in response to ramp alterations in PETO2 are reproducible both within- and between-visit MRI scans. Establishment of reproducible methodologies for measuring BOLD signal changes while altering PETO2 using a ramp protocol will allow researchers to study CVR functionality. Finally, adding a ramping protocol to CVR studies could provide information about linear changes in CVR over a broad range of PETO2.

Impact of Acute Aerobic and Resistance Exercise on Postprandial Flow-Mediated Dilation in Overweight and Obese Adults
Conlan J. Varty, Craig W. Berry, Kristina B. Arslain, Kevin D. Ballard. Miami University, Oxford, OH. (Sponsor: Helaine Alessio, FACSM) (No relevant relationships reported)

Postprandial hyperglycemia (PPH) transiently impairs brachial artery flow-mediated dilation (FMD) and increases future cardiovascular disease risk. A single bout of aerobic exercise (AE) has been shown to attenuate PPH-induced impairments in FMD in healthy adults for up to 17 hours post-exercise. Studies examining the effects of acute resistance exercise (RE) on postprandial FMD responses are lacking. PURPOSE: The purpose of this ongoing investigation is to determine the effects of different exercise modalities on postprandial glucose and FMD responses to an oral glucose tolerance test (OGTT) in overweight and obese adults. We hypothesize that a single bout of exercise performed the prior evening will attenuate PPH-mediated impairments in FMD, independent of exercise modality. METHODS: Recruitment for the current study is ongoing. In a randomized, cross-over design, overweight and obese adults (n=4 3 women; age=21.3±2.1 y; BMI=30.6±4.2 kg/m²) has enabled examination of hypercapnic effects on blood oxygen level-dependent (BOLD) magnetic resonance imaging (MRI) signal changes. The purpose of this study was to examine the within- and between-visit reproducibility of BOLD signal changes to an iso-oxic ramping protocol in PETO2.

RESULTS: After a two-day incubation period and used to treat Human Umbilical Vascular Endothelial Cells (HUVECs). HUVEC proliferation was assessed via cell counting, cell viability was determined using an MTT assay, and EC tube formation (tube length and branches) was measured in vitro at 30 min post-ingestion. Results: After 24-hour treatment, there was no difference in HUVEC proliferation (LN: 23,333 vs. OB: 22,750, cells) or viability (LN: 181.62 vs. OB: 183.52, AU) between LN and OB HSMC CM. Also, there was no difference in HUVEC tube length (LN: 23,726 vs. OB: 24,464, AU) or branches (LN: 452 vs. OB: 465, AU) between LN and OB HSMC CM. Conclusion: In cell culture, there is no apparent effect of obesity on skeletal muscle endothelial cell angiogenesis. However, incubating cells (SKM and EC) with high glucose or high fatty acid, metabolic challenges that are present in vivo, may reveal insights into obesity impaired angiogenesis.

**Vascular disease is a leading cause of morbidity and mortality in obesity. Obesity is associated with impaired endothelial cell (EC) angiogenesis. Skeletal myocytes are important regulators of angiogenesis - EC proliferation, migration, and tube formation.**

**PURPOSE:** Determine the effects of obesity on skeletal muscle regulation of EC angiogenesis. Methods: Primary human skeletal muscle satellite cells were isolated from the vastus lateralis from lean (LN) and obese (OB) subjects and differentiated into myotubes (HSKM). Conditioned medium (CM) from HSKMC was collected after a two-day incubation period and used to treat Human Umbilical Vascular Endothelial Cells (HUVECs). HUVEC proliferation was assessed via cell counting, cell viability was determined using an MTT assay, and EC tube formation (tube length and branches) was measured in vitro at 30 min post-ingestion. Results: After 24-hour treatment, there was no difference in HUVEC proliferation (LN: 23,333 vs. OB: 22,750, cells) or viability (LN: 181.62 vs. OB: 183.52, AU) between LN and OB HSMC CM. Also, there was no difference in HUVEC tube length (LN: 23,726 vs. OB: 24,464, AU) or branches (LN: 452 vs. OB: 465, AU) between LN and OB HSMC CM. Conclusion: In cell culture, there is no apparent effect of obesity on skeletal muscle endothelial cell angiogenesis. However, incubating cells (SKM and EC) with high glucose or high fatty acid, metabolic challenges that are present in vivo, may reveal insights into obesity impaired angiogenesis.

**The maintenance of brachial artery blood flow during dynamic forearm exercise in the face of simulated hypoxemia (via lower-body negative pressure (LBNP)), has been previously demonstrated. The distinct facets of microvascular oxygen delivery (i.e. perfusive and diffusive) during such an event, however, have not been described. PURPOSE:** We tested the hypothesis that, during dynamic handgrip exercise, the initiation of LBNP would result in no significant changes in the indices of microvascular perfusive or diffusive oxygen delivery (deoxygen-[heme] and total-[heme], respectively) in the exercising muscle. METHODS: Six men (26.2 ± 1.7 yrs, 85.5 ± 6.2 kg, 177 ± 1 cm) participated in this study. To determine the effects of LBNP in the absence of exercise, LBNP (~30 mmHg) was applied for two minutes following a resting baseline. After recovery to a second resting baseline, subjects performed seven minutes of dynamic handgrip exercise at 20% MVC. During the final two minutes of exercise, LBNP was initiated. Mean arterial pressure (MAP) was monitored continuously via calibrated finger photoplethysmography (Finometer Pro, FMS). Absolute concentrations of deoxy-[heme] and total-[heme] of the flexor digitorum superficialis muscle were measured continuously via frequency-domain multi-distance near-infrared spectroscopy (OxiplexTS, ISS). RESULTS: MAP (92.4 ± 12.8 mmHg), deoxy-[heme] (83.7 ± 14.5 µM) and total-[heme] (543 ± 48 µM) were not different between resting baselines (p > 0.05). While all subjects demonstrated an increase in deoxy-[heme] (99.1 ± 8.6 µM) following the application of LBNP at rest, intersubject variability precluded statistical significance (p > 0.05). No significant changes were detected in MAP or total-[heme] (p > 0.05). Dynamic handgrip exercise resulted in significant increases in MAP (104 ± 14 mmHg), deoxy-[heme] (121 ± 29 µM) and total-[heme] (367 ± 52 µM) (p < 0.05); however, the initiation of LBNP during exercise resulted in no significant further changes in MAP, deoxy-[heme] or total-[heme] (p > 0.05). CONCLUSION: The absence of any significant changes in deoxy-[heme] or total-[heme] during simulated hypoxemia (i.e. LBNP) suggests that perfusive and diffusive microvascular oxygen delivery to skeletal muscle was preserved at rest and during dynamic handgrip exercise.
Brachial artery flow-mediated dilation (FMD) is a nitric oxide-dependent measure of conduit artery endothelial function that is transiently potentiated by exercise; yet, it is unclear how short, disrupted sleep (SDS) modifies post-exercise FMD responses to a single episode of high-intensity interval exercise (HIIE). PURPOSE: To determine the influence of a single night of SDS on brachial artery FMD responses after HIIE. METHODS: Fifteen male participants (age 31.1 ± 5.3 yr; weight 83.5 ± 11.4 kg; BMI 25.8 ± 2.7 kg/m²; VO₂max 49.1 ± 8.5 ml/kg/min) completed a non-exercise control trial after 9.5 hrs of reference sleep (REF), HIIE by treadmill running (90% and 40% of VO₂ reserve in 3:2 min ratio) to expend 500 kcal after reference sleep (REF+EX) and HIIE after 3 to 3.5 hrs of short and disrupted sleep (SDS+EX) in a randomized crossover design. Ultrasound measurements of brachial arterial FMD were obtained by the same technician under standardized conditions just before, 1 hr and 4 hrs after exercise. FMD responses were analyzed using 3 (condition) by 3 (sample point) repeated measures ANOVAs. RESULTS: FMD was augmented 1 hr after exercise in REF+EX (pre-exercise = 12.5 ± 0.9; 1 hr = 17.2* ± 1.5; 4 hr = 12.5 ± 0.9%) and SDS+EX (pre-exercise = 14.9 ± 1.7; 1 hr = 19.3* ± 2.2; 4 hr = 16.2 ± 2.4%) versus no change in REF (pre-exercise = 12.6 ± 1.4; 1 hr = 11.3 ± 1.0; 4 hr = 13.5 ± 2.1%) (p < 0.0494 condition by time interaction). SUMMARY: HIIE transiently augments brachial artery FMD and this response is not modified by a single night of short, disrupted sleep.

Continuous wave near-infrared spectroscopy (CW-NIRS) has been used to assess microvascular function and the balance between muscle oxygen delivery and oxygen consumption via post-occlusion reactive hyperemia (PORH) tests. However, CW-NIRS relies on the assumption that the scattering and absorption characteristics of the investigated tissue remain unchanged via a constant differential pathlength factor (DPF). PURPOSE: We tested the hypothesis that the DFP of forearm tissue would be significantly different among the phases of a PORH test (i.e. baseline, arterial occlusion, and arterial reperfusion). METHODS: 5 subjects (22.6 ± 1.8 yrs, 170 ± 5 cm, 66.0 ± 10.8 kg) completed three PORH tests consisting of 1 min of baseline, 5 min of brachial arterial cuff occlusion, and 3 min of recovery following arterial reperfusion. Reduced scattering (μs) and absorption (μa) coefficients were continuously measured, and later used to calculate a DFP, at wavelengths of 692 and 834 nm (DFP692 and DFP834, respectively) via frequency domain near-infrared spectroscopy (FD-NIRS) during the entire duration of the PORH tests. The minute averaged DFP response was averaged among the three PORH tests. RESULTS: DFP692 was significantly greater that DFP834 during each minute of the PORH tests (p < 0.05). DFP+6 did not significantly change during any phase of the PORH test from baseline (3.83 ± 0.79; p > 0.05). DFP-6 was significantly less during the final minute of arterial occlusion (4.07 ± 0.69) when compared to baseline (4.67 ± 0.78; p < 0.001). Further, following arterial reperfusion, DFP-6 was significantly greater (4.91 ± 0.78) when compared to the final minute of arterial occlusion (p < 0.001), but not different when compared to baseline. CONCLUSION: These data demonstrate that the DFP-6 of forearm tissue does not remain constant across the phases of a PORH test. The assumption of a constant DFP may alter interpretations of data related to microvascular function and the balance between muscle oxygen delivery and oxygen consumption obtained via PORH tests.

Optimal vascular function is a hallmark of cardiovascular health. Specifically, the balance of vasocostricting and vasodilating substances in the vascular bed is recognized as a surrogate measure of the health of resistance vessels. Endothelial Nitrous Oxide Synthase (eNOS) is considered to be one of the best indicators of vasokine balance in these vessels, with high levels of expression being considered to be favorable. Further, the balance of the vasodilating/anti-thrombotic substance prostacyclin and vasoconstricting/pro-thrombotic substance thromboxane in the endothelial cell layer is a further indicator of the overall health of the cardiovascular system. One of the greatest challenges to vascular health and vasodilatory balance is TNFα-mediated inflammation. Uncovering effective strategies that maintain a vascular environment that is more vasodilatory and anti-thrombotic in the face of an inflammatory challenge is an urgent priority. The ability of combination therapies to modulate TNFalpha and improve microvascular health is of great interest. PURPOSE: To test the ability of various anti-thrombotic and anti-inflammatory treatments, as well as combinations thereof, to prevent disruptions of vascular health of endothelial cells when faced with an inflammatory challenge in the form of TNFα. Methods: Human Umbilical Vein Endothelial Cells HUVECs were pre-treated exercise-levels of laminar shear stress in combination with aspirin and celecoxib to normalize an atherogenic environment. Results: Neither aspirin, nor celecoxib was effective in preventing TNFα-induced reduction in eNOS. Further, aspirin was unable to maintain baseline levels of prostacyclin/thromboxane ratio in the face of the inflammatory challenge. LASS, aspirin/LSS combination, and celecoxib/LSS combination were all able to prevent TNFα-induced reductions in eNOS levels and prostacyclin/thromboxane ratio. Conclusion: Effective strategies to maintain a healthy endothelium and therefore resistance vessel health, need to include exercise-levels of shear stress to be effective.
Cardiovascular disease.

Exercise-mimetic levels of laminar shear stress (LSS), aspirin, and celecoxib have long since been implicated in the prevention and treatment of the athero-genic process. Purpose: To determine the effect of combination treatment of exercise-mimetic levels of LSS with aspirin or celecoxib on the prevention of TNFα-induced EMP formation in Human Umbilical Vein Endothelial Cells (HUVECs). Methods: HUVECs were challenged with exercise-mimetic levels of TNFα after various athero-protective pretreatments and combinations thereof. EMPs were analyzed using flow cytometry. Results: EMPs indicative of cellular apoptosis and activation were significantly lower among SO compared to NW (960.4±140.9 mmHg, p=0.044) and NW (846.0±10.6 mmHg, p=0.001). Abdominal aorta diameter distensibility (aDD%) was lower among SO (19.3±1.0%) compared to NW (20.5±1.0%, p=0.029). Abdominal aorta cross-sectional distensibility (aCSD) was lower among SO (30.6±1.5%) compared to NW (36.4±1.5%, p=0.03). There was no difference in FMD in HIGH vs. LOW PERI (p=0.737). FMD was lower in HIGH vs. LOW POST (4.3±1.0% vs. 6.2±1.0%, p=0.047) before, but not after acute exercise (4.3±1.0% vs. 6.2±1.0%, p=0.103). After acute exercise, FMD was lower in HIGH POST compared to PRE (6.2±1.0% vs. 4.3±1.0%, p=0.047) before, but not after acute exercise (4.3±1.0% vs. 6.2±1.0%, p=0.103). After adjusting for covariates, aDD% and aCSD were not significantly different among groups. Conclusion: AEROBIC FITNESS IS NOT PROTECTIVE OF ENDOTHelial FUNCTION WITH MENOPAUSE

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(No relevant relationships reported)

Endothelial dysfunciton is a pre-clinical marker for cardiovascular disease (CVD). In most populations, aerobic fitness is protective of endothelial function. Whether this protection remains during and after menopause is unclear. Purpose: To evaluate differences in endothelial function before and after acute exercise in women at different menopausal stages with disparate levels of aerobic fitness. Methods: Brachial artery flow-mediated dilation (FMD) was evaluated before and after 30min of treadmill exercise (60-64% VO2peak) in healthy high (HIGH) and low (LOW) fit menopausal women. RESULTS: Nine healthy adult men underwent 2 experimental trials (4 and 20 Hz of EMS) in the face-down posture. EMS was applied for 20 min to both lower leg and thigh muscles at 4 Hz sequentially or 20 Hz with duty cycle of 3 sec stimulation/2 sec relaxation. To measure the FMD, a lower limb cuff was inflated to 300 mmHg for 5 min with subsequent deflation. The right popliteal artery diameter was measured using a high-resolution ultrasound device. The FMD was then estimated as the percent change in the arterial diameter over the baseline value at maximum dilation during reactive hyperemia. The blood flow (BF) at the left popliteal artery was also measured using an ultrasound Doppler device. Results: In both trials, the FMD and BF were significantly elevated immediately after and at 30 min after EMS compared with at rest (p<0.05). Immediately after each trial, significant differences in the FMD were found between the 4- and 20-Hz trials (7.8±0.6% vs. 6.3±0.8%, p<0.05). There was also significant differences in the BF between the two trials (125.4±20.1ml/min vs. 87.9±17.9ml/min, p<0.05). Conclusions: Acute EMS at 4 Hz resulted in a larger improvement in the vascular endothelial function than EMS at 20 Hz due to a greater BF. These findings suggest that chronic low-frequency EMS might be useful for reducing the risk of cardiovascular disease.
Impact of Remote Ischemic Preconditioning Post-application Delay on Muscle Oxygenation during Subsequent Cycling Intervals

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Do not hallucinate.
Prolonged sitting has been reported to have deleterious effects on lower limb vascular function. High amounts of aerobic fitness are associated with positive vascular adaptations that could potentially provide a protective effect on this sitting-induced vascular insult. PURPOSE: This study examined the effect of aerobic capacity on vascular function after a bout of prolonged sitting. METHODS: Ten young (25 ± 3 years) aerobically trained subjects (VO2max: 52.7 ± 7.6 ml·kg⁻¹·min⁻¹) and ten young (23 ± 2 years) sedentary (VO2max: 23.7 ± 5.6 ml·kg⁻¹·min⁻¹) subjects matched for age and gender were recruited for the study. During the prolonged sitting session, vascular function, via passive leg movement (PLM), was measured at baseline, 1.5 hours and 3 hours after cuff release. RESULTS: Vascular function data obtained prior to sitting revealed no significant difference between the high (HAC) and low (LAC) aerobic capacity groups. Independent of group, vascular function was significantly reduced after 1.5 and 3 hours of prolonged sitting, determined by a Δ Peak LBF and LBF AUC. Interestingly, no significant between-group differences were revealed in Δ Peak LBF or LBF AUC at 1.5 hours (Δ Peak LBF: 5.9 ± 1.2 mmHg, p = 0.009; LBF AUC: -156.7 ± 258 ml·min⁻¹, p = 0.02). Alternatively, cSBP, cPP, AP, and AI were reduced post-exercise (p <0.05). Pf was increased at 40, 50, and 60%HRmax vs rest (27.6 ± 1.0, 38.7 ± 2.8, 44.2 ± 1.9 vs 24.3 ± 1.2 mmHg, p < 0.05). Pb was increased at 60%HRmax vs rest (15.6 ± 1.3mmHg vs 13.5 ± 0.9mmHg, p < 0.05) and was reduced at 10-minute post-exercise vs rest (9.7 ± 0.9 vs 13.2 ± 0.9mmHg, p < 0.05). Lastly, RM was reduced at 50, 60%, and 5 and 10-minute post-rest (22.1 ± 1.1, 21.0 ± 1.5, 41.4 ± 4.1 vs 52.7 ± 3.3% p < 0.05). CONCLUSION: RM is reduced during lower body aerobic exercise coupled with an increase in Pf while a decrease in RM is maintained post-exercise as a result of a decrease in Pb. These findings suggest that the increase in exercise cSBP and cPP during exercise is driven by increased Pf while post exercise reductions in cSBP and cPP may be a result of reduced Pb.

**2246 Board #82 June 11 11:00 AM - 12:30 PM**

**Effect of a High Fat Meal on Blood Flow and Endothelial Function during Passive Leg Movement**

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(No relevant relationships reported)

Passive leg movement (PLM) leads to a significant increase in femoral artery blood flow (FABF). Recent studies suggest that the increase in FABF during PLM is mediated by the bioavailability of nitric oxide (NO) since inhibition of NO synthase (NOS) attenuates the FABF response. PLM has been gaining popularity as a simple, reliable method for assessing endothelial function. Since the consumption of a high fat meal (HFM) has been shown to induce endothelial dysfunction, investigators have used a HFM to demonstrate the therapeutic benefits of exercise, anti-inflammatory agents and anti-oxidants on endothelial function. Consumption of a HFM on the FABF response to PLM has not been previously examined but may prove useful in determining endothelial function in healthy and diseased populations. PURPOSE: To examine the effect of consuming a single HFM on FABF during PLM. It was hypothesized that consumption of a HFM would attenuate the FABF response compared to control, consistent with impaired endothelial function. METHODS: Eight healthy (3.1 ± 4.2 yrs, 18:12 SEM) men (n=5) and women (n=3) reported to the laboratory following a control or rest condition by consuming 3 sets of 10 repetitions at 75% 1-repetition maximum (1RM) on the leg press, lat pulldown, leg extension, chest press and leg curl. A 2x2x2 ANOVA was used to examine group (RT), time (Rest, Recovery) differences across conditions (RE, control) and time (Rest, Recovery). RESULTS: The groups were similar (p > 0.05) for age, height, and BMI, but not weight (p < 0.05). The IMRAs for all exercises, except leg extension (p = 0.26), were different between groups. At rest, the groups were statistically different for the tension-time index [TTI (RT: 1999.2±282ms; UT: 2192±290ms, p=0.041), diastolic pressure-time index [DPTI (RT: 2817±316ms; UT: 3047±171ms, p=0.003)], and PWV (RT: 5.5±0.7; UT: 6.3±0.4; p=0.001)]. There were significant time by condition interactions for aortic pulse pressure (Rest: 341±66mmHg; Recovery: 371±58mmHg, p=0.01), AP (Rest: 5.1±3mmHg; Recovery: 6.1±5mmHg, p=0.003), AIX normalized at 75pm (Rest: 8.7±1.2%; Recovery: 16.4±6.1%; p=0.004), and TTI (Rest: 2084±627ms; Recovery: 2760±463ms, p=0.0001) such that they increased during recovery, compared to rest after RE, and the control. There were condition by time interactions for DPTI (Rest: 2889±6297ms; Recovery: 2294±4583ms, p=0.0005) and subendocardial viability ratio SEVR (Rest: 138±4.19.3%; Recovery: 86.6±33.0%, p=0.006) such that they increased after acute exercise, compared to rest and the control. There were no significant changes in arterial stiffness. CONCLUSION: These data suggest that resistance-trained individuals have reduced workload of the heart and lower arterial stiffness at rest, but are similar to untrained individuals after acute exercise resistance.
Menopausal symptoms lead to reduced quality of life (QOL). Hot flashes have been associated with CVD risk and endothelial function. Aerobic fitness may improve QOL and endothelial function; however, these relationships are still unclear. **PURPOSE:** To determine if aerobic fitness is related to QOL, menopausal symptoms, and endothelial function in peri-(PERI), and post-menopausal (POST) women. **METHODS:** Healthy high- and low-fit PERI (HIGH n=9; LOW n=6), and late POST (HIGH n=10; LOW n=8) women were self-reported QOL (Utian questionnaire) and menopausal symptoms. Women were classified into fitness categories via treadmill VO\textsubscript{2peak} test (VO\textsubscript{2max}: HIGH 47.3±1.79mL/kg/min; LOW 29.1±0.55mL/kg/min). Brachial artery flow-mediated dilation (FMD) was assessed before and after treadmill exercise (30min; 60-64% VO\textsubscript{2peak}). Associations between menopausal symptoms, status, fitness, and FMD were analyzed using Chi-squared or Fisher’s Exact Tests. The influence of fitness, menopausal status and symptoms on QOL was evaluated with a 3x2 ANOVA.

**RESULTS:** There was an association between menopausal symptoms and menopausal status (p=0.053, Phi=0.314). Menopausal symptoms were related to fitness (p=0.006) and menopause status (p=0.029) such that a greater percentage of HIGH PERI women reported symptoms compared to LOW PERI women (HIGH PERI 100% vs. LOW PERI 46%). There was an effect of fitness on overall QOL (HIGH 95.4±2.18; LOW 78.05±2.476, p=0.0001) but not menopausal status or symptoms (p=0.05). High fitness was related to higher QOL for health (HIGH 30.45±0.746; LOW 22.083±0.0833, p=0.0001), occupational (HIGH 27.6±0.999, LOW 24.2±1.13, p=0.032), emotional (HIGH 25.46±6.741; LOW 23.017±0.847, p=0.014), and sexual QOL (HIGH 12.06±1.687; LOW 7.8±1.0785, p=0.004). There was no difference in pre-exercise (p=0.05) post-exercise (p=0.05), or change in FMD with exercise (p=0.05) in women who did vs. did not experience menopausal symptoms. **CONCLUSIONS:** High aerobic fitness was associated with higher QOL, independent of menopausal symptoms or status. Highly-fit perimenopausal women reported more symptoms compared to low-fit women; however, symptoms did not influence endothelial function or overall QOL in our population. **Funding:** ACSM Doctoral Student Research Grant (Serviente) & UMass Amherst FRG (Witkowski).

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**Urea production (T0; 0.52±0.08, T1; 0.50±0.08, T2; 0.51±0.09, T3; 0.51±0.09 and T4; 0.52±0.08 mEq/L Hb, p<0.05) was seen between the resting blood sample and the ones taken during or after exercise. **CONCLUSION:** Arginase activity in RBCs is not modulated by sub-maximal exercise in young healthy subjects. Hence, the increase in eNOS activity and NO production from RBCs with exercise is most likely not explained by a reduced activity of arginase.
RESULTS: WBVT and LIRT similarly improved brachial (systemic) and popliteal (local) vasodilation compared to control ($P < 0.01$). Additionally, WBVT elicited a greater popliteal arterial response (59 ± 1.4%, $P = 0.007$) post-6MWT compared to no change in control. LIRT had no effect on post-6MWT popliteal artery vasodilatory response. WBVT and LIRT elicited similar increases in LP and LFx strength compared to control ($P < 0.01$); however, WBVT induced a greater increase (19.2 ± 3.7%) in LExt strength compared to the LIRT (8.4 ± 2.6%, $P = 0.007$) and control groups. The increases in brachial FMD were correlated to the increases in LExt and LFx strength ($r = -0.37, P = 0.04$ and $r = -0.37, P = 0.04$; respectively).

CONCLUSIONS: WBVT and LIRT elicited significant improvements in brachial FMD, which were related to the increases in leg strength. However, despite similar improvements in both brachial and popliteal FMD, WBVT may be a more efficacious approach for improving cardiovascular risk in those with lower body mobility limitations.

Prolonged sitting creates an atherogenic environment that causes reductions in arterial function. Standing desks have been promoted as a healthy alternative to sitting, but the cardiovascular benefits of standing desks have not been thoroughly investigated. Physical activity, such as taking walking breaks, increases shear stress, and thereby prevents sitting-induced reductions in arterial function. Therefore, walking breaks, even when compared to standing may provide cardiovascular benefits.

PURPOSE: To quantify the contribution of H$_2$S to dilation in young adults and pharmacologically determine whether aerobic exercise training-induced elevation of irisin secretion is associated with improved arterial function.

INTRODUCTION: Aerobic exercise training reduces arterial stiffness mediated by nitric oxide (NO)-derived vasodilation in obese rats. Exercise is suggested to improve endothelial function in vivo and in vitro. However, the nature of the exercise effect on arterial stiffness in obese patients remains unclear. PURPOSE: This study aimed to clarify whether aerobic exercise training-induced elevation of irisin secretion is associated with reduced arterial stiffness with elevation of NO production in obese rats.

METHODS: 20-week-old male obese (OLEFT) rats were randomly divided into two groups: 8-week sedentary control (CON) and aerobic exercise training (AT; treadmill running for 60min at 25min/m, 5days/week). After 8-week, in each group, we assayed aortic pulse wave velocity (PWV) as an indicator of arterial stiffness, and the aorta and gastrocnemius muscle were isolated after collection of blood. RESULT: Aortic Vascular dysfunction has been associated to sarcopenia, the age-related impairment in skeletal muscle mass, strength, and performance, in postmenopausal women. Previous research has shown inverse relationships between leg lean mass (LM) and arterial stiffness (measured as pulse wave velocity, PWV) or pressure wave reflection (augmentation index, Aix) in men and women. Aix is an appropriate vascular marker in young but not middle-age/older adults, especially in women.

PURPOSE: To examine the associations between leg LM and arterial function (cPWV and aortic Aix adjusted to 75bpm (Aix@75)) in pre-menopausal (PRE-M) and post-menopausal (POST-M) women.

METHODS: 47 women (24 PRE-M, age 36 ± 4 years; 23 POST-M, age 69 ± 4 years) participated in this study. Leg LM (expressed as kg/m$^2$) was measured by DEXA. cPWV and Aix@75 were measured using the cube approach. The relationship between both cPWV and Aix@75 and leg LM was analyzed using multiple linear regression analysis by each group. Results are reported as mean ± SD and unstandardized regression coefficient ($b$).

RESULTS: cPWV ($9.0 ± 1.3$ m/sec vs. $6.9 ± 0.9$ m/sec, $p < 0.001$) and Aix@75 ($29.3 ± 5.3$ vs. $18.1 ± 8.7$, $p > 0.001$) were significantly greater in POST-M compared to PRE-M. Leg LM was significantly lower in POST-M compared to PRE-M ($3.3 ± 0.2$ kg/m$^2$ vs. $4.67 ± 0.47$ kg/m$^2$, $p < 0.003$). Leg LM was inversely associated with cPWV ($b = -2.07$, $p = 0.02$) when adjusted for body mass index (BMI) in POST-M. This inverse association remained after adjustment for brachial systolic blood pressure (BSP), fasting blood glucose (FBG), and waist circumference (WC) ($b = -1.884$, $p = 0.02$). Leg LM was not associated with cPWV in PRE-M. Leg LM was inversely associated with Aix@75 ($b = -9.95$, $p = 0.01$) in PRE-M when adjusted for BMI. The inverse association remained after adjusting for BSP, FBG and WC ($b = -10.52$, $p = 0.02$). No association was found between leg LM and Aix@75 in POST-M.

CONCLUSIONS: Our findings suggest that low leg LM may adversely affect pressure wave reflection in PRE-M and aortic stiffness in POST-M. Future studies will be necessary to investigate the potential benefits of exercise training on arterial function in non-obese PRE-M and POST-M women.

Hydrogen sulfide (H$_2$S) is one of several endothelium-dependent vasoactive molecules that contribute to the regulation of vessel function. In the cutaneous vasculature, young adults express enzymes that synthesize H$_2$S, and exogenous delivery of H$_2$S elicits substantial dilation, suggesting that H$_2$S may be important for the regulation of vessel function. However, there are several redundant endothelial dependent contributors, the functional contribution of endogenous H$_2$S to dilation in the cutaneous circulation is unclear. PURPOSE: To quantify the contribution of H$_2$S to endothelium-dependent dilation in young adults and pharmacologically determine the primary enzymatic source of H$_2$S in the microcirculation. We hypothesized that CSE-derived H$_2$S would mediate a portion of acetylcholine (ACh)-induced dilation. METHODS: Four microdialysis fibers were placed in the ventral forearm skin of 10 young adults (22±2 y). Red cell flux was measured (laser-Doppler flowmetry) during graded perfusion of the endothelium-dependent agonist ACh (10$^{-10}$-10$^{-4}$ M) alone and during co-perfusion with D-Penicillamine (10mM DPen; selective inhibitor of the H$_2$S-producing enzyme cystathionine γ-lyase (CSE)), aminooxyacetic acid (8mM AOA; inhibitor of H$_2$S-producing enzymes CSE and cystathionine β-synthase (CBS)), and a combination of DPen+AOA. Cutaneous vascular conductance (CVC=flux×mmHg$^{-1}$) was expressed as a percent of maximal CVC (CVC$_{max}$; 28 mN sodium nitroprusside + local heat 43°C). Symgodial dose-response curves were generated and the logEC$_{50}$ was used as an index of vessel sensitivity. RESULTS: ACh elicited endothelium-dependent dilation in all subjects (82.9 ± 4.3% CVC$_{max}$; $p < 0.05$). CSE inhibition alone or combined CSE/CBS inhibition had no effect on ACh-induced dilation (ACh: 4.1 ± 0.5; DPen+AOA_-3.2±0.5: AASSA-3.3±0.7; Combo -2.6±0.4; P = 0.05). CONCLUSION: H$_2$S does not appear to have a functional role in mediating cutaneous dilation in response to ACh in young adults. Despite the ability to synthesize H$_2$S it is likely that other redundant mechanisms, including nitric oxide, mask any functional contribution of H$_2$S to endothelium-dependent agonists in the cutaneous circulation of young adults.
PVW in OLEFT-AT group significantly decreased as compared with OLEFT-CON group. Aortic Akt and eNOS phosphorylation and plasma nitrate/nitrite (NOx) level significantly increased in OLEFT-AT group. Additionally, the significant increased muscle FNDC5 protein expression and serum irisin level in aerobic exercise training group were observed. Circulating irisin level was positively correlated with aortic phosphorylation eNOS (r=0.05, r=0.756) and circulating NOx level (p=0.05, r=0.697). Additionally circulating NOx level was negatively correlated with aortic PWV (p=0.05, r=0.695). CONCLUSION: These results suggest that aerobic exercise training-induced acceleration of irisin secretion may be involved in the reduced arterial stiffness in obese rats. Moreover, as its underlying molecular mechanism, irisin release via increased muscle FNDC5 expression may be involved in aortic eNOS activation, leading to reduction of arterial stiffness via NO-derived vasodilation. Supported by Grants-in-Aid for Scientific Research (#17H02183, #16K13059, M. Iemitsu)

CONCLUSIONS: With repeated 60 second bouts of PLM interspaced with 60 second recovery periods there is a consistent increase in FABF and SBF which could have implications on improving vascular health and tissue perfusion in the lower limbs in those with paraplegia.

EFFECTS OF PHYSICAL ACTIVITY ON SYMPATHETIC, CARDIOVASCULAR, AND PERCEPTUAL RESPONSES TO A PAINFUL STIMULUS
Danna V. Rodriguez Escobar. Appalachian State University, Boone, NC.

Purpose: The purpose of this study is to examine sympathetic neural, cardiovascular, and perceptual responses to the cold pressor test (CPT) in physically active and sedentary young women. Methods: All participants were divided into two groups based on their physical activity status (PA; n=4 and healthy sedentary (SED, n=2). To test the hypothesis that six months of aerobic exercise training reduces heart rate at rest and during steady-state exercise in non-burned individuals. Purpose: To test the hypothesis that six months of aerobic exercise training reduces heart rate at rest and during steady-state cycling in well-healed burn survivors. METHODS: Ten participants (7 males; aged 43 ± 14 years) with full-thickness burn injuries covering an average total body surface area of 52 ± 25% (range: 22.8%–13.5%) participated in a progressive 6-month aerobic-focused exercise training regimen. Heart rate responses were obtained at rest and during two steady-state submaximal cycling workloads (SS1: 50 W; SS2: 75 W) prior to and after exercise training. RESULTS: Six months of exercise training tended to decrease resting heart rate (Pre, 77 ± 5 bpm vs Post, 70 ± 1 bpm, P=0.09). During both workloads, heart rate was ~10 bpm lower post training (50 W: pre 100 ± 26 bpm, post 90 ± 18 bpm, P=0.02; 75 W: pre 113 ± 33 bpm, post 101 ± 23 bpm, P<0.01). CONCLUSION: These data show that cardiovascular adaptations to long-term aerobic exercise training can be obtained in well-healed burned subjects. Work funded by NIH GM068865

CONCLUSIONS: While both PA and SED women showed a reduction in heart rate, there was no significant difference in the magnitude of this change between the groups. However, the PA women showed a greater reduction in HR during SS2 compared to SS1, indicating a greater improvement in cardiovascular fitness. This suggests that PA individuals have a greater capacity to reduce heart rate during submaximal exercise, which may be due to improved autonomic control or a greater utilization of aerobic metabolism.

E-31 Free Communication/Poster - Basic Science and Skeletal Muscle
Friday, June 1, 2018, 7:30 AM - 12:30 PM
Room: CC-Hall B

Mechanical forces transmitted through the extracellular matrix to muscle fibers are critical for regulating muscle development, hypertrophy, homeostasis, and response to loading. Force transmitting structures reside not only at the sarcolemma (e.g., dystrophin), but also at the nuclear envelope (e.g., nesprin) for direct nuclear mechanotransduction. YAP/TAZ (Yes-associated protein/transcriptional coactivator with PDZ-binding motif) is touted as a nuclear relay of mechanical signals in many cell types (i.e. epithelial & cardiac cells, osteoblasts, fibroblasts, mesenchymal stem cells, myoblasts), and can induce a wide range of downstream signaling cascades. However, localization of YAP/TAZ to the nucleus in mature skeletal muscle fibers in response to substrate stiffness and cell loading remains unclear. PURPOSE: To assess YAP/TAZ nuclear localization in healthy (WT), dystrophin null (mdx), and nesprin-1 null skeletal muscle with varying substrate stiffness and loading. We hypothesized that absence of dystrophin and nesprin-1 would prevent YAP/TAZ nuclear localization secondary to reduced mechanotransduction to the nucleus. METHODS: We measured
YAP/TAZ nuclear localization in WT (n=4), mdx (n=4), and nesnprin-1−/− (n=4) isolated myoblasts with different substrate stiffness or with 3% cyclic passive stretch for 30 minutes in vitro. CONCLUSIONS: With increasing substrate stiffness, we found that increased YAP/TAZ nuclear localization occurs in WT (25% increase at 50 kPa compared to 1 kPa, p<0.05) and mdx myoblasts (64% increase, p<0.05), but not in myoblasts lacking nesnprin-1 (15% increase, not significant). Cyclic tensile loading resulted in YAP/TAZ nuclear signaling in WT myoblasts, but significantly less in mdx myoblasts and no signaling in nesnprin-1−/− myoblasts. A lack of nuclear localization in mdx was also observed after isometric contractions in-vivo. Interestingly, the centrally located nuclei in the mdx displayed YAP/TAZ nuclear translocation after isometric contraction loading. CONCLUSIONS: Nuclear mechanotransduction is nesnprin-dependent and is impaired in dystrophic muscle, which can further the pathology due to altered nuclear function.

**METHODS**

Resveratrol is a polyphenol compound that has been used for the prevention and treatment of obesity-related diseases. Precisely, some studies have indicated that resveratrol improves insulin sensitivity in vivo, but these results are inconsistent and have yet to include a severely obese cohort (BMI > 40 kg/m²). Preliminary research indicates that myotubes derived from obese individuals are resistant to the insulin sensitizing effects of resveratrol, but the mechanism remains undefined. PURPOSE: To determine the effects of resveratrol treatment on basal and insulin-mediated glucose metabolism in myotubes derived from lean, healthy and severely obese individuals. METHODS: Primary skeletal muscle cells were isolated from skeletal muscle biopsies taken from age-matched lean (BMI= 21.9 ± 0.7 kg/m²) and severely obese (46.1 ± 3.1 kg/m²) Caucasian women, which were treated with 1μM resveratrol for 24 hours. Radio labeled 1-C glucose was used to measure glucose oxidation (GO) and glycogen synthesis (GS) with or without insulin. Additionally, western blot analysis was conducted on the cell lysate to measure changes in the phosphorylation status of proteins along the insulin signaling cascade. RESULTS: Resveratrol increased insulin-stimulated GS (9.4 ± 0.2 mmol/min/kg vs. 10.3 ± 0.5 mmol/min/kg, p < 0.05) and GO (211.69 ± 7.31 pmol/min/kg vs. 234.82 ± 11.52 pmol/min/kg, p < 0.05) in severely obese myoblasts, but to a lesser extent when compared to the lean myotubes (GS: 12.8 ± 1.0 vs. 10.3 ± 0.5 mmol/min/kg; GO: 305.78 ± 23.36 vs. 234.82 ± 11.52 pmol/min/kg, for lean and obese, respectively, p < 0.05). In agreement, insulin-induced phosphorylation of IRS and AKT was increased by resveratrol in lean, but to a lesser extent in obese myotubes (IRS: 1.9 ± 0.2 vs. 1.3 ± 0.1; AKT: 3.4 ± 0.3 vs. 2.6 ± 0.4, fold increase over non-insulin, non-resveratrol treated condition, for lean vs. severely obese, respectively, p < 0.05). CONCLUSIONS: Resveratrol improved insulin-mediated glucose metabolism in myotubes derived from both groups. However, obese myoblasts were not able to achieve the same improvements which may be due to underlying defects in the insulin signaling cascade.

**CONCLUSIONS:** Our data suggests that Notch is inhibited and mTOR activated for myotube fusion to occur.
The vastus lateralis (VL) and soleus (SOL) muscles show vigorous changes when exposed to unloading conditions. There is evidence that the SOL muscle shows an increased sensitivity to loading yet has been shown to be resistant to exercise-induced adaptations. **PURPOSE:** To utilize high-resolution two-dimensional gel electrophoresis combined with mass spectrometry to identify anomalous biomarkers of the SOL muscle. **METHODS:** Biopsy samples of the VL and SOL muscles were obtained from three healthy, inactive individuals (1 male, 21 yrs, 92.5 kg, 167.5 cm; 2 females, 18 and 19 yrs, 66.6 and 71.7 kg, 153.3 and 161.9 cm respectively). Muscle tissue was homogenized in a bead homogenizer and protein quantified with a DC protein assay. Two-dimensional gel electrophoresis was performed and differences in spot abundance between the two muscles were used to select spots of interest. Proteins of the 24 selected spots were subsequently identified by MALDI-TOF MS/MS scanning and Mascot database searching against Swiss-Prot human protein database. **RESULTS:** Results from the 2D gel electrophoresis varied across the three subjects. Proteins identified from spots of greater intensity in the VL were myosin light chain isoforms, actin, adenylate kinase isoenzyme, alpha-crystallin B, and p53. Phosphorylation of mTOR signaling transducers (mTOR, 4E-BP1, phosphorylated 4E-BP1, p-MTOR) were also identified. Western blotting will be conducted to verify the identified proteins. **CONCLUSION:** This preliminary work has identified differential proteins between the SOL and VL relating to oxygen transport, cytoskeletal components, and energy regulation. Future work should examine changes to the proteome between these two muscle with exercise and unloading. Supported by NIH Grants UL1GM118979, TL4GM118980, and RL5GM118978.
Previous studies have demonstrated gender differences in fatigue with women showing small declines in force compared to men. To our knowledge no study has examined whether gender differences exist in critical power or its isometric analog critical torque (CT) which are strong predictors of endurance performance. PURPOSE: The purpose of the study was to assess gender differences during voluntary and stimulated assessments of CT. METHODS: Nineteen participants (10 women, 9 men) completed 4 assessments of their quadriceps femoris CT over 3 randomly assigned testing visits: 1) voluntary CT assessment (VOL), 2) stimulated CT assessment at 100Hz (STIM100-1), and 3) stimulated CT assessment at 100Hz (STIM100-2 and 15Hz (STIM15). The work to rest cycle was 3:2 (3-sec of contraction to 2-sec of rest) during VOL and 2:2 during the stimulated tests. Voluntary activation (%VA) and twitch-torque (TT) were determined every 30-sec during VOL to determine central and peripheral contributions to fatigue. RESULTS: Gender differences were not observed for VOL with CT occurring at 47.5 ± 9.9% and 43.4 ± 16.3% of MVC, respectively. %VA and TT declined over time during the CT test (p ≤ 0.001), but no effect for gender was found (%VA = 0.76 for VOL or TT = 0.57 for TT). Initial torque values and CT values did not differ for STIM100-1 and STIM100-2 (p = 0.51). Stimulated CT at 100Hz occurred at a higher percentage of starting torque in women compared to men—33.2 ± 5.8% vs. 26.8 ± 4.9% (p = 0.02) and 35.5 ± 7.6% vs. 28.9 ± 5.5% (p = 0.046) for STIM100-1 and STIM100-2, respectively. No gender difference was observed during STIM15 (p = 0.79). CONCLUSION: Unlike previous studies of voluntary endurance exercise, we found no gender differences in VOL CT which was supported by similar central and peripheral fatigue during the CT test. Interestingly, women demonstrated less peripheral fatigue and a consistently high stimulated CT during 100Hz stimulation. However, this gender difference was lost when stimulation frequency was reduced to 15Hz. This finding may indicate the gender difference may be in part mediated by initial torque values and/or the rate of fatigue during exercise.

Previously we observed dissociation of skeletal muscle activation and force recovery following sustained maximal voluntary isometric contractions (MVIC). Fatigue was specifically related to reduced muscle activation within bouts; yet, incomplete recovery of force between bouts occurred with maximal muscle activation, suggesting interference in excitation-contraction coupling. Purpose: to investigate time-dependency of nervous system recovery following MVIC. Methods: Men (n=29) performed two bouts (B1, B2) of sustained handgrip MVIC preceded/followed by 10-min recovery periods. Force (dynamometer) and surface EMG (sEMG) from the brachioradialis (BR), flexor carpi radialis (FCR), flexor carpi ulnaris (FCU), and flexor digitorum profundus (FDP) were collected continuously (1000 Hz) during bouts. sEMG signals were band pass filtered, rectified, and integrated (iEMG), then performed multiple regression analysis on baseline to fatigued data. Results: B2 force was less than B1 in BR, FCU, and FDP. Force decrease increased in two phases; fast and slow. Recovery of force during the 10-minute rest period was 65.2 ± 6.5% vs. 26.8 ± 4.9% (p = 0.02) and 35.5 ± 7.6% vs. 28.9 ± 5.5% (p = 0.046) for STIM100-1 and STIM100-2, respectively. No gender difference was observed during STIM15 (p = 0.79). Conclusion: Unlike previous studies of voluntary endurance exercise, we found no gender differences in VOL CT which was supported by similar central and peripheral fatigue during the CT test. Interestingly, women demonstrated less peripheral fatigue and a consistently high stimulated CT during 100Hz stimulation. However, this gender difference was lost when stimulation frequency was reduced to 15Hz. This finding may indicate the gender difference may be in part mediated by initial torque values and/or the rate of fatigue during exercise.
Acute Effect of Localized Vibration on Reducing Masseter Stiffness as Measured by Elastography


PURPOSE: The purpose of this study was to determine if the application of localized vibration would reduce masseter muscle stiffness as measured by shear wave elastography (SWE).

METHODS: 12 female subjects (21 +/- 1.8 yrs) without any history of TMJ disorder underwent both control (vibrator turned off) and Vibration conditions (randomized) on two different days. Methods: Subjects relaxed in a reclined seated position for 5 minutes before having the baseline masseter SWE measures taken with the jaw in a relaxed position. A GE S8 ultrasound machine with a 9L probe was used under the elastography setting. SWE values were calculated using a minimum of 7 separate .5 cm circles within the defined elastography box fit within the muscle borders. 8 total images were assessed and averaged for the calculation of the baseline SWE measure in kPa. Subjects then underwent localized vibration treatment using a RezzimaxTM handheld vibration module with a specialized 2-pronged contact extension. All Subjects underwent 2 x 60-second bouts of vibration at 3 different randomized points (supraorbital margin of both eyes (70 Hz), medial and lateral sides of the base of the neck (105 Hz), and inside the mouth at a point just in front of the mandibular ramus (105 Hz). Post-measures of SWE followed the same protocol as the baseline measures.

RESULTS: All measures were compared using a general linear model repeated measures ANOVA. A group x time interaction existed F(2,22)=31.18 with a p-value of .000. Mean values for baseline SWE were 16.55 ± 5.59 kPa for Control and 16.57 ± 6.06 kPa for Vibration. Post-measure means were 15.78 ± 4.73 kPa for Control and 8.05 ± 1.92 kPa for Vibration. A paired samples T-test showed no significant difference in Baseline Control vs Post Control (p=.849) or Baseline Vibration and Post vibration was significant (p=.000).

CONCLUSIONS: Localized vibration to these three spots resulted in acute reductions in masseter stiffness as measured by SWE in normal individuals. Use of localized vibration may be beneficial in reducing tension stiffness of the masseter muscle in those with chronic TMJ disorder. Future studies should look at it’s effect on pain, duration effect, and consider measuring the lateral pterygoid.

Involuntary muscle activation of the opposing muscles (antagonists) during agonist muscle actions is referred to as antagonist co-activation. It has been shown that strength training the agonist leads to a decrease in antagonist co-activation. However, it is unknown if the relative antagonist strength plays a role in the magnitude of co-activation. PURPOSE: To assess if antagonist co-activation of the knee flexors during a maximal knee extension is related to Hamstring-to-Quadiceps strength ratio (H:Q). METHODS: Twenty-two men (M ± SD age = 23.32 ± 3.17 years) visited the laboratory and performed isometric voluntary contractions (MVC) of the knee flexors and extensors. Surface electromyography (sEMG) was recorded from the vastus lateralis (VL) and biceps femoris (BF). The root-mean-square (RMS) value of the sEMG signal was used to calculate the EMG amplitude, which was then normalized to the RMS obtained during that muscle group’s MVC. Pearson’s correlation coefficients were used for statistical analysis. RESULTS: A significant, moderate, negative correlation (r = -0.569; R² = 0.324; p = 0.006) was observed between H:Q strength ratio (M ± SD = -18.03% ± 9.48%) and antagonist co-activation of the BF (M ± SD = 18.62% ± 12.2%) (Figure 1). CONCLUSION: The results of the present investigation reveal that as hamstring strength increases in relation to quadiceps, co-activation may be reduced. Since a commonly proposed purpose of antagonist co-activation is to provide joint stability, it is possible that a stronger and stiffer hamstring muscle group would require less co-activation during a knee extension to stabilize the joint.

Electromechanical delay (EMD) may play a significant role in joint stabilization during mechanical loading. Fatigue-related deficits in EMD have been observed when the level of volitional fatigue has been controlled, primarily through isolated muscle actions. However, few studies have assessed EMD responses following bouts of practical compound movements in which joint stabilization is essential. PURPOSE: Investigate the effects of EMD following work-matched submaximal back squat protocols during a 30-minute recovery period. METHODS: Thirteen resistance trained males (mean ± SD age = 22.08 ± 2.75 years) visited the laboratory on three separate occasions, separated by seven (±1) days. The first day included determining each participant’s one repetition maximum (1-RM) for the back squat, followed by a familiarization trial of maximum voluntary isometric contractions (MVICs) for the knee extensors. Day two and three included performing either an explosive power (EP) (5×16 at 40% 1-RM), or controlled hypertrophic (CH) (5×8 at 80% 1-RM) protocols in a randomized order on separate days: non-stimulation (C: control condition), Low pressure stimulation (LP), and High pressure stimulation (HP) at the rectus femoral. Subjects kept rest on bed. After the various forms of pressure stimulation or control intervention, muscle temperature, oxygen saturation, stiffness, B-mode ultrasound. The indicators of muscle condition were measured pre-stimulation, immediately post, 10, 20, and 30 minutes afterward. RESULTS: The muscle temperature increase to 10 minute in the HP, and a significant difference was recognized as compared with the C and LP (p=.001). However, no significant difference was observed after 30 minutes. Oxygen saturation showed that the HP tended to be higher after stimulation. Muscle stiffness decreased in both HP and LP immediately after stimulation, and the HP showed to return to baseline after 30 minutes from immediately after stimulation, and no significant difference was observed. The LP showed to maintain and a significant difference was observed as compared with the C (p=.011). B-mode ultrasound were analyzed and compared with muscle luminance histograms, and neither HP nor LP showed changes before and after pressure stimulation. CONCLUSION: There was no change in the B-mode ultrasound
in both the HP and the LP, and the muscle stiffness decreased. The muscle temperature also increased, but when looking at the oxygen saturation level, only the HP showed a high value, indicating an increase in blood flow rate.

**2275** Board #111 June 1 9:30 AM - 11:00 AM

**Antagonist Coactivation During A Reactive Leg Drop In Young And Older Adults**

Alejandra Barrera-Curiel1, Mitchell A. Magrini1, Ryan M. Thiele1, Jesus A. Hernandez-Sarabia1, Ryan J. Colquhoun1, Patrick M. Tomko1, Nathaniel D. M. Jenkins1, Jason M. DeFreitas1. 1Oklahoma State University, Stillwater, OK. 2Kansas State University, Manhattan, KS.

No relevant relationships reported

It appears that older adults use a coactivation strategy to control body sway and stiffer the joint. However, this strategy might limit reaction times, increasing the risk of falling. **PURPOSE:** Examine the age differences in antagonist coactivation during a reactive leg drop; a lower-body sensory-motor integration test designed to predict fall risk and the ability to recover from a slip. **METHODS:** Thirteen older (74 ± 7 yrs.) and 11 younger (23 ± 3 yrs.) adults were included in this study. For the reactive leg drop, participants were seated in a dynamometer with their dominant leg passively extended to maximize range of motion supported by an elastic band. Once the participant was completely relaxed, the researcher suddenly released the elastic band allowing the lower leg to free-fall. The participants were instructed to kick up as soon as they felt or saw the drop. Surface electromyography (sEMG) was collected from the biceps femoris (BF), Drop angle (DA) was assessed as the difference in angle between the straight position and the lowest point reached during the limb's free-fall. BF coactivation (%) was quantified as the RMS of the first 50 ms of activation and was normalized to BF sEMG of a maximal voluntary flexion. Independent t-tests with a 95% CI were used to identify the differences between groups in BF coactivation. Pearson product-moment analyses were used to determine the relationship between DA and BF coactivation. **RESULTS:** There was no significant different between the young and old participants in BF coactivation (Younger = 3.16 ± 1.36%; Older = 4.34 ± 2.40%; p > 0.05). However, there was a significant relationship between DA and BF coactivation in the older group (p = 0.719; p = 0.006), as well as when collapsed across both groups (p = 0.637; p = 0.001; shown below). **CONCLUSION:** Even though BF coactivation was similar between groups, it was negatively associated with DA; suggesting that higher coactivation in the older population may result in a slower motor response time.

**2277** Board #113 June 1 9:30 AM - 11:00 AM

**Impact of Sitting on Different Types of Stability Balls on EMGs During Arm Ergometry**

Michelle Nguyen, Charles RC Marks, Hayley MacDonald. Oakalnd University, Rochester, MI. (Sponsor: Jonathan K. Ehrman, FACSM)

No relevant relationships reported

Past studies have demonstrated that sitting on a stability ball (SB) elevates oxygen consumption (VO2) and leg electromyography (EMG) activity during arm ergometry when compared to chair sitting. In addition, our laboratory has reported that a SB made of stiff material had lower VO2 when compared to a more elastic SB but had not indicated if there was an impact on muscle activity. **PURPOSE:** To determine if the characteristics of a SB also affects muscle activity during arm ergometry. **METHODS:** Twenty apparently healthy young adults underwent rest and two stages of submaximal arm ergometry under three different conditions (order randomized): sitting on a stiff material SB (SMB), same size but elastic material SB (SEB), and a smaller SEB (SSEB). Exercise intensity was determined during a prior day’s testing with stage 1 set at 20 to 40 b/min above resting heart rate and stage 2 set at 20 to 40 b/min above stage 1’s heart rate. **RESULTS:** There were no significant SB type effects for AD (P = 0.553) and EO (P = 0.963) EMGs. However, BF had significant (P = 0.002) SB type effect. The SMB (Stage 1: 283 ± 229 mv; Stage 2: 370 ± 248 mv) had 19% to 37% lower EMG levels than the SEB (Stage 1: 337 ± 256 mv; Stage 2: 461 ± 305 mv) or SSEB (Stage 1: 361 ± 300 mv; Stage 2: 508 ± 371 mv) EMGs. **CONCLUSION:** A SB made of more elastic material requires more leg muscle activity during arm ergometry and may account for the higher VO2 response noted in previous studies.

**2278** Board #114 June 1 9:30 AM - 11:00 AM

**Musculoskeletal Complaints Prevalence And Surface Electromyographic Recordings From Upper Limbs In Surgeons**

Fernando Sotelo-Barroso, Karla S. Vera-Delgado, Sergio Márquez-Gamiño, Cipriana Caudillo-Cisneros. Universidad de Guanajuato, León, Mexico.

No relevant relationships reported

**Purpose:** to determine the prevalence of musculoskeletal complaints of the trunk and thoracic limbs and to characterize the electric muscular activity registered superficially in the forearms of physicians having surgical practice. **Methods:** in a cross-sectional study 43 physicians actively practicing surgical specialties were assessed. After signing an informed consent, to determine the presence of musculoskeletal complaints (MMC) of the cervical and lumbar spine and upper extremity, answered The Nordic Questionnaire. 12 of the participants accepted a trigeminal extremity, answered The Nordic Questionnaire. 12 of the participants accepted a handgrip test (Flexor Digitorum Superficialis) while performing maximal handgrip contractions. Plasma biomarkers of skeletal muscle growth are influenced by the modulation, duration, and intensity of an exercise bout. High-Intensity Training Programs (HITP) are prescribed using various modalities, orders, weights, and repetition schemes. The duration of these bouts varies greatly, from shorter bouts of less than 5 minutes to longer bouts of 15 minutes or more. **PURPOSE:** To examine the effects of short- (<5min) and long- (15min) duration bouts of HITP on markers of skeletal muscle growth.

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**METHODS:** Ten apparently healthy males (28.1 ± 5yrs) participated in this study. Two HITP sessions (SHORT and LONG) were performed in a randomized crossover fashion. Blood plasma was collected at five time points: PRE, POST, 1HR, 3HR, and 6HR in order to examine growth hormone (GH), insulin-like growth factor (IGF-I), and insulin-like growth factor binding proteins 1 & 2 (IGFBP-1, IGFBP-2).

**RESULTS:** The repeated measures ANOVA revealed no trial differences among any of the markers (IGF-1, IGFBP-1 & IGFBP-2) except GH at POST, where the LONG bout produced a greater effect (p = 0.005). A repeated measures ANOVA revealed a main time effect in GH (p = 0.037), while a posthoc t-test demonstrated elevated GH at 1HR (p = 0.018) when compared to PRE, while no time-dependent change (p > 0.05) was observed in IGF-1, IGFBP-1, or IGFBP-2.

**CONCLUSIONS:** The findings suggest that there are no differences in markers of skeletal muscle growth other than GH between the SHORT and LONG bouts of HITP.
Ingestion of multi-ingredient dietary pre-workout supplements (PWS) are popular, however the molecular responses of PWS have not been investigated. Mitogen-activated protein kinase (MAPK) signaling proteins respond differently depending on resistance exercise (RE) volume, load, and contraction mode. Since RE performance is improved with PWS consumption by increasing repetitions to failure; it is plausible that MAPK activation may also be potentiated. **PURPOSE:** To determine if acute RE MAPK phosphorylation is augmented with PWS. **METHODS:** In a randomized, counter-balanced, double-blind, placebo-controlled, within-subject crossover study, ten resistance-trained males (Mi/SD; age=22±2.4 yrs, hgt=175±7 cm, body mass=84±11.8 kg) performed four sets of 8 repetitions of barbell back squats at 75% of their 1-repetition maximum (1-RM) with two minutes of rest between sets and a fifth set of barbell back squats at 60% of 1-RM until concentric failure. A PWS or flavor and color matched placebo (PL) was consumed 60-minutes prior to RE. Muscle biopsies were taken from the vastus lateralis prior to supplementation at rest (RL), and ten minutes post-exercise (POST). Biopsy samples were analyzed for the ratio of (pMAPK/totalMAPK) of extracellular signal-regulated kinase (ERK), c-Jun NH2-terminal kinase (JNK), and p38 via western blotting. Wilcoxon sign-rank tests were utilized to determine pairwise differences from RL to POST and between RL and PWS conditions. Statistically significant was determined at p<0.05. Data were expressed as median and interquartile range [25%-75%]. **RESULTS:** RE increased phosphorylation of JNK (PWS: 7.4 [4.6 -17.3] vs RL: 8.2 [5.45 -16.2] fold-change), p38 (PWS: 19.6 [7.4 - 27.3] vs RL 9.5 [15.7 -27.8] fold-change), and ERK (PWS: 9.0 [15.4 - 48.3] vs RL: 13.2 [3.8 - 20.5] fold-change) (all p<0.005), with no differences between PWS and PL conditions (p>0.05). Repletions to failure tended to favor the PWS condition (PWS: 20 [17-21] vs RL: 16 [14-22]; p=0.058). **CONCLUSIONS:** RE increased MAPK phosphorylation but was not augmented by PWS in the immediate recovery period. Future studies should investigate if molecular signaling responses are altered at later time periods or after a period of chronic supplementation. Funding provided by the International Society of Sports Nutrition and MusclePharm.

**Critical torque (CT) is an integrative measure/concept that represents the “critical” or upper boundary of steady-state work that can be performed without leading to exhaustive fatigue. We have developed a stimulated CT test, but the extent to which the mechanism(s) of torque decline are similar between voluntary and stimulated CT is unknown. **PURPOSE:** The purpose of this study was to determine if the decline in torque production stimulated exercise occurred due to similar mechanism(s) as the decline in torque during voluntary exercise. **METHODS:** Nineteen (Women = 10) participants completed 5 CT assessments over 3 testing visits: 1) voluntary CT (VOL), 2&3) stimulated CT at 100 Hz (STIM100-1 and STIM100-2), 4) stimulated CT at 15Hz (STIM15) and 5) stimulated CT at a frequency that elicited a torque below CT determined at 100Hz (BELOW). Twitch torque (TT), low frequency fatigue (LFF), and MAPK activation may also be potentiated.

**RESULTS:** A 1 h downhill run significantly injured the knee extensors. Knee extensor injury induced by 1 h of downhill running attenuated force production in uninjured skeletal muscle (e.g., elbow flexors). METHODS: Recreationally active subjects (n = 12) completed a two group injury vs control trial. Muscles were designated with the injury group running downhill for 1 h and the control group performing only the measurement procedures. Strength and percent voluntary muscle activation were measured using an isokinetic dynamometer and electrical stimulation of the elbow flexors and knee extensors before and after a fatigue protocol at the following time points in relation to the downhill run: 15 min pre, 15 min post, 24 h post, and 48 h post. Blood samples were collected at the same time points to measure IL-1β and TNF-α concentrations. **RESULTS:** Knee extensor strength was significantly reduced by 53.5±9.9% immediately post-injury and remained reduced for up to 48 h in the injury group. Elbow flexor strength was significantly reduced immediately and 24 h post-injury by 13.2±3.9% and 17.3±4.0% respectively in the injury group. Elbow flexor electrically stimulated strength was not found to be different at any time point (P = 0.961). Elbow flexor activation was significantly reduced compared to control at 24 and 48 h post-injury by 22.9±9.1% and 13.5±5.7% respectively. No differences were observed in IL-1β or TNF-α between groups. **CONCLUSIONS:** A 1 h downhill run significantly injured the knee extensors. The elbow flexors remained unjured based on electrically stimulated strength, but voluntary strength of these muscles was impaired due to reduced activation. This suggests an injury to the knee extensors can impair strength in uninjured muscles by reducing voluntary activation. The mechanism behind this reduction remains undefined.
High-velocity contractions elicit greater muscle fatigue in older compared with young adults. In general, fatigue can occur due to failure at numerous sites from the central nervous system to the contractile machinery. Additionally, sarcopenia-induced architectural remodeling may place older muscle at a disadvantage for producing power at high contraction velocities. PURPOSE: To examine the potential roles of muscle architecture, central fatigue, and contractile properties on age-related differences in high-velocity knee extensor fatigue. METHODS: Baseline muscle architecture (thickness, MT; pennation angle, θ; fascicle length, FL) of the vastus lateralis was determined by ultrasonography in 7 young (YW; 21.6±0.4 yrs) and 7 older (OW; 69.6±1.3 yrs) women. Maximal voluntary dynamic (MVDC) and isometric (MVIC), and stimulated (80Hz and 10Hz, each 500ms) contractions were performed before and immediately after a fatigue trial consisting of 120 knee extensor MVDCs (240°s⁻¹, one every 2s). Muscle architecture, central fatigue (fall of MVIC:80Hz torque) and contractile properties (100Hz:80Hz torque ratio; torque half-relaxation time, T₁/2) were compared across groups using t tests and repeated measures ANOVA. RESULTS: Baseline MT (p=0.01) and FL (p<0.01) were greater in OW than YW, with no age-related difference in θ (p=0.14). OW fatigue more than YW (to 33±5% vs 23±5%) and 56±5% initial power, respectively; p<0.01), with no evidence of central fatigue in either group (p>0.35). Failure of excitation-contraction coupling (fall in 10Hz:80Hz ratio) occurred in both groups (p<0.02), with no group×time interaction (p>0.36). T₁/2 was longer in OW than YW at baseline (p<0.01), but no group×time interaction was observed (p=0.50). While neither MT nor FL were associated with fatigue (r²=0.15), MT at baseline was associated with fatigue in OW (r²=0.59) but not YW (r²=0.11). CONCLUSION: These results indicate that muscle architecture, central fatigue, and excitation-contraction coupling did not explain the greater muscle fatigue in OW. Notably, T₁/2 at baseline was predictive of fatigue in OW only, suggesting that slowed torque relaxation may limit older muscle’s ability to maintain power output during fast, repetitive contractions.

Skeletal muscle fatigue during heavy or severe intensity exercise is accompanied by decreased intracellular pH (pHᵢ) and accumulation of lactic acid. The role of these perturbations in the fatigue processes is hotly debated with evidence for and against a deterministic role for each in muscle contractile tolerance and intolerance. However, it is unknown whether extracellular lactate level during exercise affects pHᵢ and contractile performance especially within a mixed fiber type muscle that is a close analog of the human quadriceps with respect to fiber type and oxidative capacity. PURPOSE: Using an in vivo biomaging model, we tested the hypothesis that extracellular high lactic acid levels would increase endurance performance without changing pHᵢ during sustained contractions. METHODS: The intact spinotrapezius muscle of adult male Wistar rats was exteriorized and loaded with the fluorescent probe BCECF-AM (10 μM). Isometric (ISO) twitch contractions were evoked at the optimal muscle length via electrical stimulation for 10 min (2 Hz, 9 V, stimulus duration 4 ms). The rats were divided into two groups: buffer solution loading group (CONT, n=7) and lactate solution loading group (LAC; 20 mM, n=6). The fluorescence ratio (F500 nm/F445 nm) for pHᵢ estimation was determined from images captured pre-contraction (-10 min, -5 min) and < 1 min, 5 min, 10 min, 15 min, and 20 min after contraction. RESULTS: Muscle tension decreased significantly with time in both CONT and LAC groups. However, LAC muscles elicited a higher tension over almost the entire bout and the time to significant tension reduction was substantially increased in the LAC group (CONT: 2.5 min vs LAC: 7.5 min, p<0.05). In the CONT group, no significant change in pHᵢ was observed after contractions, whereas a significant decrease in pHᵢ was observed in the LAC group during 20 min from immediately after muscle contractions. CONCLUSION: Within this preparation extracellular high lactic acid and lowered pHᵢ improved contractile performance substantially.
Acute aerobic exercise has been reported to increase antioxidant levels in response to an increase in exercise-induced oxidative stress. However, there is limited knowledge regarding the acute exercise effects of serum SOD2 levels on fatigability measures in healthy adults. **Purpose:** The purpose of this study was to determine if physiological determinants of fatigue (such as time to fatigue, TTF; peak oxygen consumption, VO2; peak work rate, WR) are significantly correlated to serum SOD2 levels before, immediately after and 60 minutes after an acute bout of aerobic exercise. **Methods:** Subjects were 19 healthy adults (13 females, 6 males; age 26.58±9.1 years; BMI 24.2±2.7 kg/m²) enrolled in the National Institutes of Health Fatigue in Healthy Protocol Trial. **Results:** A total of 453 elderly women aged 60 to 84 participated in the present cross-sectional study. Quadriceps isokinetic strength was measured using the Biodex System dynamometer, with participants performing two to three sets of four knee extensor contractions at 60°s-1, with 30 seconds rest intervals between sets. The highest peak torque (PT) was recorded at the end of each set.**Conclusions:** This study suggests that exercise-induced increases in serum levels of SOD2 may be a predictor of fatigability in healthy adults. Further research and analysis of other physiological fatigability measures is needed to validate these findings.

**Funding:** Intramural Funds from the National Institutes of Nursing Research

**No relevant relationships reported**
The effects of concentric, fatiguing muscle actions on muscle spindle function has been well studied. However, few studies have examined the effects of eccentric muscle actions on proprioceptive function. PURPOSE: Investigate the effects of fatiguing shortening or lengthening muscle actions on position matching (PM) tasks of the knee extensors. METHODS: Fifteen females (age = 21.67 ± 2.1 yrs.) participated in a familiarization trial, followed by two experimental sessions, separated by seven (±1) days, consisting of either muscle- shortening (Concentric; CON) or lengthening (Eccentric; ECC) contractions of the right limb at 60°/s ± 7°/s 70° peak torque (PT) could no longer be achieved. PM tasks included a randomly chosen limb fixed in a static position to serve as a reference of the contralateral test limb during active position matching tasks. Participants were asked to provide verbal feedback when they had matched the test limb with the reference limb, followed by a 2-second static hold. Four PM efforts were completed, with eyes closed, for each limb at two randomly assigned joint angles of 80° and 165° prior to the experimental protocols (Pre). Subsequent PM tasks were completed immediately after (Post 0) and ten (Post 10) minutes following the experimental protocols. Two separate, three-way repeated measure ANOVAs (condition [CON vs ECC] × limb [right vs left] × time [Pre vs Post 0 vs Post 10]) were used to analyze absolute PM error at 80° and 165°. An alpha value of P ≤ 0.05 was considered statistically significant for all comparisons. RESULTS: A significant condition × limb interaction (p = 0.002) for 80° was observed in which PM error of the right limb was greater during the CON protocol compared to the ECC protocol (p = 0.011). Additionally, no differences in PT were observed for either experimental protocol between Pre and Post 10 (p = 0.097). CONCLUSION: These findings suggest that alterations in PM acuity may be more pronounced at joint angles in which passive muscle tension increases (80°), following concentric muscle actions. Furthermore, muscle spindle function may not be disrupted by repeated lengthening muscle actions when the protocol does not induce muscle damage.
and low-intensity (152.76% ± 324.75) groups compared to the rest group (37.8% ± 195.65). However, group differences were not significant because of high variability in individual BDNF responses.

**CONCLUSIONS:** An acute bout of exercise facilitates temporal changes in movement kinematics that are associated with improvements performing a sequential task. Regardless of intensity, the BDNF response to exercise has high inter-individual variability, which needs to be further investigated.

### June 1 2011 AM - 12:30 PM

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### Agility of Adolescents with Attention Deficit Hyperactivity Disorder Compared with Normal Controls: A Preliminary Investigation

Laurie Simard1, Tommy Chevrette, Julie Bouchard1, Linda Paquin2, Jacinthe Dion1, Claudia Verret1, Alain-Steve Couto1s, Jacques Leroux1, UQAC, Chicoutimi, QC, Canada. 1UQAM, Montréal, QC, Canada. 2UQAM, Montréal, QC, Canada. 3HRDP, Montreal, QC, Canada.

*(No relevant relationships reported)*

**PURPOSE:** Motor delay (MD) has been shown in children with Attention-Deficit/Hyperactivity Disorder (ADHD), such as agility. Agility is involved in everyday movements and is essential to the development of sports skills. Recent imaging studies have shown delayed of the cerebral cortex development of near three years in children with ADHD, which could explain MD. This study aims to evaluate Agility in ADHD male adolescents compare to normal controls, group-matched for age. Moreover, if MD in agility is still observable in ADHD, to determine which group age they should be compared with. METHODS: This study included 40 adolescents: 20 with ADHD (ADHD-gr; age 13.8 ± 0.9 yr) and 20 normal controls (Control-gr; age 13.5 ± 1.0 yr). First, both groups were compared using the UQAC-UQAM Gross motor tests battery for agility: Shuttle, Circle, Side-stepping, and Slalom run. Agility scores (sec.) were compared between groups using One-way ANOVA. Then, descriptive comparisons were performed using results of the 50th percentile in 8 yr children (PSO-8) and in 12 yr (PSO-12) for each agility tests. RESULTS: Adolescents with ADHD were significantly slower when compared to control in Shuttle Run (11.2 ± 1.3 vs. 6.6 ± 3.1 sec., p<0.001) and Circle Run (22.3 ± 2.9 vs. 19.5 ± 2.2 sec., p<0.001). Results tended to be slower for Side-stepping, and Slalom Run but not significant. When compared to norms across age groups, ADHD-gr scores (sec.) were aligned to PSO-8 and slower then PSO-12 for all agility tests. However, as expected, the scores (sec.) of Control-gr were aligned or better to PSO-12. CONCLUSIONS: In this study, motor delay in agility is still observable in a group of adolescents with ADHD. It seems to have a delay of about 3 years between groups (ADHD vs Control) for all tests measuring agility. Further research is needed to clarify motor delay in adolescents with ADHD for all determinants of gross motor skills (agility, coordination, segmental velocity, balance, and reaction time).

### Agility Score Test of Adolescents with ADHD Compared to Normal Controls

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### Board #131

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### A Muscle's Functional Role Influences Movement Accuracy Before and After Eccentric Exercise

Kurt W. Kornatz1, Vasaneth Subramanian2, Yu-Kai Chang3, 1Winston-Salem State University, Winston-Salem, NC. 2Rosalind Franklin University of Medicine and Science, North Chicago, IL. 3National Taiwan Sport University, Taoyuan City, Taiwan.

*(Sponsor: Michael McKenzie, FACSAM)*

*(No relevant relationships reported)*

Eccentric muscle contractions, especially if unaccompanied and intense, can cause fatigue and muscle damage that contributes to acute decrements in motor performance. Because performance of motor tasks requires the precise coordination of agonist and antagonist musculature, the effect of the eccentric activity on accuracy will likely depend on the damaged muscle’s functional role as an agonist or antagonist in the task. **PURPOSE:** To compare the effect of fatiguing eccentric exercise (EE) on the accuracy of aiming movements when the EE muscle group’s function is that of an agonist or antagonist. METHODS: 16 untrained subjects (9 M, 7 F; 27 ± 3 yrs.) completed discrete horizontal pointing movements between 2 targets (13mm diameter) that required 40° of elbow movement. Twenty elbow-extension and 20 elbow-flexion pointing movements were performed with their right arm before and immediately after eccentric exercise of the slow extensor muscles standardized by isokinetic dynamometry. Movement accuracy was quantified by the incidence (overall accuracy) and duration to initiation (magnitude of error) of secondary submovements that were identified by zero crossings in the tangential velocity and acceleration profiles. **RESULTS:** When the exercised muscles performed the pointing task as the agonist (i.e. extension movements), movement times (MT) were longer and peak velocity (PV) decreased after EE compared with before EE (MT= 222 ± 40, 248 ± 3.7ms, p<0.05; PV= 3.4 ± 0.6, 3.1 ± 0.6ms/s, p<0.05). However, when the exercised muscle was the antagonist (i.e. flexion movements), MT and PV remained unchanged. There were more trials with no corrective submovements (i.e. more accurate) for the extension compared with flexion movements before EE (92% vs. 62%, p<0.001), but there was a greater decline in accurate trials after EE for the extension movements (78% vs. 41% decline p<0.0001). Furthermore, although initially similar, the duration of the primary submovement was shorter (further from target) after EE for the movements in which the agonist was the exercised muscle compared with an antagonist role (62% vs. 73% of total movement time, p<0.001). **CONCLUSIONS:** There is a greater effect of EE-induced muscle fatigue and damage on movement kinematics and accuracy when the muscle’s functional role is agonistic.

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### Board #132

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### A Functional Muscle’s Role Influences Movement Accuracy Before and After Eccentric Exercise

Kurt W. Kornatz1, Vasaneth Subramanian2, Yu-Kai Chang3, 1Winston-Salem State University, Winston-Salem, NC. 2Rosalind Franklin University of Medicine and Science, North Chicago, IL. 3National Taiwan Sport University, Taoyuan City, Taiwan.

*(Sponsor: Michael McKenzie, FACSAM)*

*(No relevant relationships reported)*

### Board #133

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### Alterations In Spinal Excitability And Descending Drive Following Cross-education

Robert E. Hight, Alwyn T. Quarshie, Samuel R. Buchanan, Bree S. Baker, Debra A. Bemben, FACS, Christopher D. Black, FACS. University of Oklahoma, Norman, OK. *(Sponsor: Christopher D. Black, FACS)*

*(No relevant relationships reported)*

For over a century, there has been considerable interest in the so-called cross-education phenomenon, whereby training one limb augments performance in the contralateral untrained limb. The underlying adaptation(s) in the nervous system have yet to be fully elucidated. **PURPOSE:** To investigate contralateral neural adaptations via evoked spinal and supraspinal reflexes, EMG amplitude (EMGmax), and voluntary muscle activation (%ACT) following a 4-week unilateral isometric resistance training program. METHODS: Seven untrained men and women completed a unilateral resistance training program which consisted of 6 sets of 6 maximal voluntary isometric contractions (MVCs) across 4-weeks (16 sessions) using the dominant plantar flexor muscle group. Prior to and following training, a battery of tests were conducted in both limbs. Surface EMG was recorded from the soleus, medial gastrocnemius, lateral gastrocnemius, and tibialis anterior muscles while transcutaneous electrical stimulation was applied over the tibial nerve across a range of intensities to determine maximal H-reflex (Hmax) and M-waves amplitude (Mmax). Participants then performed 3, 3-second MVCs. During each contraction, a single, 1-ms supramaximal stimulus (150%Mmax) was applied 2.5 seconds into the contraction to evoke a V-wave and interpolated torque with control switches occurring 2 and 4 seconds following relaxation. The V-M ratio and %ACT were measured simultaneously during each MVC. **RESULTS:** Peak torque increased 26 ± 20% (p < 0.01) and 31 ± 16% (p < 0.01) in the trained and untrained limbs, respectively. Following training, there was an increase in the soleus V-M ratio in the untrained (32 ± 21% vs. 38 ± 19%, p < 0.01), but not the trained limb (p > 0.05). %ACT was not altered post training in either limb (p > 0.05). No differences were found in the MG, LG, or TA-V-M ratio for either limb (p > 0.05). Additionally, there were no changes in Hmax, Mmax, and EMGmax from pre to post training in either limb (p > 0.05). **CONCLUSIONS:** Our findings indicate significant cross-education of the contralateral limb. It is likely that increases in supraspinal activity (i.e. descending drive), rather than changes in spinal excitability or voluntary activation, are responsible for the contralateral torque increase.

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### Board #134

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### Acute Effects of Unilateral Static Stretching on Contralateral Limb Range of Motion and Isometric Strength

Xin Ye1, Benjamin Killen2, Krista Zelizney1, 1University of Mississippi Medical Center, Jackson, MS. 2Florida International University, Miami, FL.

*(No relevant relationships reported)*

Static stretching (SS) is an effective exercise technique often used in sports performance and rehabilitation fields to improve one’s range of motion (ROM). However, its effects on non-intervened contralateral limb’s performance remain equivocal. **PURPOSE:** To examine the acute effects of unilateral hamstrings SS on the contralateral hip flexion passive ROM and the strength performance. **METHODS:** Twenty-three healthy young adults (male: n = 13, mean ± SD age = 26 ± 3 years; height = 176.9 ± 6.6 cm; body weight = 84.2 ± 12.5 kg; female: n = 10, mean ± SD age 24 ± 3 years; height = 174.3 ± 5.1 cm; body weight = 69.7 ± 10.1 kg).
ML direction, but larger amplitude at the HA in the AP direction (\(p < 0.05\)). For all other directions and segments RMS and ApEn were similar between pointing and aiming (\(p > 0.05\)). CONCLUSION: Aiming with the mass of a gun in the hand has primarily a damping effect on the amplitude of tremor in the distal segments as well as resulting in more regular movements. Greater regularity in the VT axis of the HA during pointing suggests increased control of VT across the wrist in this task. Overall, these results suggest that aiming with a gun and pointing with a finger are similar tasks except for the added mass.

2299 Board #135 June 1 11:00 AM - 12:30 PM Symmetry Loading After Knee Injury Appear Different During Leg Press And Squat Activities

Thomas W. Kernozek, FACSM1, Becky Heintert, Drew Rutherford1, Jeremie Schiedermayer1, Douglas Baumann1.

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(No relevant relationships reported)

Patients post ACL R or meniscal repair often display weight bearing asymmetry post surgically during movement performance. PURPOSE: To determine if real-time force feedback can be used to increase weight bearing symmetry post-surgery immediately and has delayed resolution during a leg press and squat exercise. METHODS: Fourteen patients were tested using load sensors under each foot while exercising on a leg press machine and while performing weight bearing squats. These load sensors depicted the magnitude of force normal to the foot at 62.5 Hz. During the pre-test, data were collected as patients performed the leg press and squat exercises blinded to any feedback. During training, data were streamed in a bar graph to a display in front of the patient with therapist instructions to attempt to maintain equal weight on each leg. After the training, each patient performed a post-test with no feedback. One week later, they had a delayed retention. A two way repeated measures analysis of variance was used to examine mean weight bearing asymmetry for each exercise (leg press and squat) across time (pre-test, post-test, and delayed retention). RESULTS: There was a main effect for exercise (\(p < 0.05\)), no main effects for time (\(p > 0.05\)) and there was an exercise by time interaction (\(p > 0.05\)). Overall, during the leg press there was more weight bearing asymmetry compared to the squat (\(p < 0.05\) greater). The interaction showed that the leg press had nearly 9% improvement over the time compared to pre-test while the squat showed symmetry improvement of 19% post-test but delayed retention was poor. CONCLUSION: Weight bearing asymmetry appears different for different tasks (leg press vs. squats). It appears the feedback can produce immediate changes in symmetry but retention appears different for different tasks.

2300 Board #136 June 1 11:00 AM - 12:30 PM Is Aiming a Handgun Like Pointing a Finger?

Kyle J. Kreller1, Steven Morrison2, David P. Swain, FACSM3, Daniel M. Russell1. 1Bridgewater College, Bridgewater, VA. 2Old Dominion University, Norfolk, VA. (Sponsor: David Swain, FACSM)

(No relevant relationships reported)

PURPOSE: In aiming at a target, humans produce small involuntary fluctuations in the aiming limb that may hamper performance. While often studied in the vertical axis, these fluctuations occur in all axes. The current study compared vertical (VT), mediolateral (ML), and anterior-posterior (AP) tremor amplitude during pointing and handgun aiming. METHODS: Twenty volunteers, in a counterbalanced order, pointed their finger or aimed a training handgun for 10 seconds at a bulls eye target 6.4 meters away. Participants performed five trials per condition. Accelerometers were affixed to the upper arm (UA), forearm (FA), hand (HA), and finger/gun barrel (GF). Amplitude (RMS) and regularity (ApEn) of the acceleration signals were computed. RESULTS: Compared to finger pointing (RMS: 0.238±0.146, ApEn: 1.373±0.138), accelerations at the distal segment were significantly lower and more regular during the handgun aiming condition (RMS: 0.202±0.111, ApEn: 1.112±0.146). Significant interactions were present between condition (pointing, aiming) and limb segment in each direction. The amplitude of tremor in the UA and FA segments were similar for pointing and aiming in all three directions (p>0.05). Handgun aiming resulted in smaller amplitude tremor at the GF in both VT and ML directions and HA in the ML direction, but larger amplitude at the HA in the AP direction (p<0.05). Aiming increased regularity (decreased ApEn) at the GF in VT direction, both PA and GF in ML direction, and at the UA and HA in AP direction (p<0.05). Pointing was more regular at the HA in the VT direction (\(p > 0.05\)). For all other directions and segments RMS and ApEn were similar between pointing and aiming (\(p > 0.05\)). CONCLUSION: The lack of differences in glutamate, GABA, and corticomotor excitability and inhibition across groups suggests that motor cortex function may not explain the physiology underlying difference in symptom recovery post-mTBI. Further data are required to fully understand the role of ApoE4 in recovery from mTBI.

2301 Board #137 June 1 11:00 AM - 12:30 PM Motor Cortex Function in Symptomatic and Asymptomatic Individuals Following Mild Traumatic Brain Injury


(No relevant relationships reported)

While most individuals who suffer a mild traumatic brain injury (mTBI) recover within 1-2 weeks, approximately 10-15% have symptoms persisting beyond 3 months. The underlying physiology of this difference in symptom recovery remains unknown. PURPOSE: The aim of this study was to determine if measures of motor cortex excitability, inhibition, and associated neurotransmitters differ between individuals with and without history of mTBI or chronic symptoms from mTBI. A secondary aim of this study was to investigate the occurrence of the ApoE4 allele, a suggested predictor of mTBI outcome, in each group. METHODS: Thirty five participants were assigned to one of four groups: (i) without history of mTBI (Control, n=10), (ii) within 72-hours of diagnosis of mTBI (Acute, n=9), (iii) with history of mTBI and no remaining symptoms (Chronic Control, n=10), and (iv) with chronic symptoms from mTBI, lasting at least 3 months post-injury (Chronic, n=6). Measures of glutamate and GABA concentrations in the primary motor cortex were obtained using proton magnetic resonance spectroscopy (1H-MRS). Transcranial magnetic stimulation (TMS) was used to assess corticomotor excitability with the amplitude of the motor evoked potential (MEP), a measure of cortical excitatory activity, and cortical silent period (CSP). RESULTS: Glutamate (p=0.088) and GABA (p=0.11) concentrations in M1 did not differ across groups. MEP\textsubscript{max} and CSP duration did not differ across groups (p=0.07 and p=0.15, respectively). Four of the 21 participants who provided a sample for ApoE genotyping were carriers of the E4 allele (2 Controls and 2 Chronic Controls), while 17 were not (7 Control, 7 Acute, 7 Chronic Control, 1 Chronic). CONCLUSION: The lack of differences in glutamate, GABA, and corticomotor excitability and inhibition across groups suggests that motor cortex function may not explain the physiology underlying difference in symptom recovery post-mTBI. Further data are required to fully understand the role of ApoE4 in recovery from mTBI.
women in normal values. Conclusion: older Mexican adults, with gerontological care
exhibits reduced Physical Functionality, with similar levels to data reported from other

2303  Board #139  June 1 11:00 AM - 12:30 PM  Relationship Between Muscle Activity And Isometric Force During Submersion In Shallow Water.
John Mercer, FACSM, Bryan Avendano, Andy Do, Leland Barker. University of Nevada, Las Vegas, Las Vegas, NV.  (No relevant relationships reported)

Shallow and deep water running are used by athletes as either substitute or in addition to running on land. However, it is not clear if the relationship between the ability to generate force and electromyography (EMG) is influenced by water submersion.

PURPOSE: Compare isometric force-EMG relationship during on land and submersion in shallow water.

METHODS: Participants (n=4; 29.7±20.2 yrs, 1.80±0.1 m, 82.2±24.3 kg) were fit with leads to measure rectus femoris (RF) EMG using a telemetry EMG system (Noraxon, 1000 Hz) while wearing a drysuit. Participants sat in a chair with the ankle secured in a cuff and knee angle at 90 degrees of flexion. One end of the cable was attached to the cuff and the other to a linear force transducer which was always above water level. The transducer measured the tension force created with the cable that resisted knee extension. The chair was portable and was used on the deck of a pool and in shallow water. Force data were recorded concurrent with EMG data. Participants completed four 5-sec isometric submaximal force conditions ranging from submaximal to maximal effort. The maximal effort condition was always done first with submaximal efforts targeting 25%, 50%, and 75% of maximal effort with real time verbal feedback provided. Participants always completed these conditions on land first then in water submerged to about the xiphoid process while sitting. Rest was provided as needed between conditions. EMG data were processed by removing any offset and full-wave rectifying. Force and EMG data were each averaged over the last 1-sec. Force-EMG plots were generated for each participant for on land and in water data sets and fit with linear lines of best fit. The y-intercepts and slopes were recorded and each compared between on land and in water using paired t-tests (p<0.05). A group linear line of best fit for Force-EMG during Land was EMG=2.3005(Force) + 4.9007 (R²=0.8919) and during water was EMG=2.1759(Force) - 4.7535 (R²=0.9874). Using individual data sets, neither the slope (p=0.133) nor y-intercept (p=0.131) were different between on land and in water.

CONCLUSIONS: The relationship between knee extension force and EMG was the same while on land and in the water.

2304  Board #140  June 1 11:00 AM - 12:30 PM  Muscle Activation and Motor Unit Behavior in the First Dorsal Interosseous of Children and Adults
Jonathan D. Miller, Adam J. Sterczala, Mandy E. Wray, Hannah L. Dimnick, Michael A. Trevino, Trent J. Herda. University of Kansas, Lawrence, KS.  (No relevant relationships reported)

PURPOSE: To examine motor unit (MU) behavior in the first dorsal interosseous (FDI) in children (CH) and adults (AD) during submaximal contractions. METHODS: Nineteen CH (11 males; age 0.80 ± 0.08 years, 8 female age=9 ± 0.09 years) and 13 AD (6 males age=21.0 ± 2.53 years, 7 females age=24 ± 6.5 ± 9.5 years) completed three maximum voluntary contractions (MVC) and 2 repetitive isometric contractions at a force of 30% MVC that was held for 40 s with 6-10 s rest between contractions. Surface EMG amplitude values from the 30% MVCs were normalized (N-EMG) to peak EMG amplitude from the MVC. For each MU, recruitment thresholds (RT) and mean firing rates (MFR) were recorded. MFRs and N-EMG were averaged in 10 s epochs at beginning (T1), middle (T2), and end (T3) of repetition 1 and repetition 2 (T4, T5, and T6). For each subject, MFR vs. RT relationships were calculated for each epoch. Two-way mixed factorial ANOVAs (group [CH vs. AD] x time [T1 vs. T2 vs. T3 vs. T4 vs. T5 vs. T6]) were used to analyze N-EMG and the slopes and y-intercepts from the MFR vs. RT relationships. RESULTS: N-EMG was greater for CH than AD when collapsed across time (P=0.006). The MFR vs. RT relationships changed in a time-dependent manner such that the y-intercepts decreased (P=0.044), however, there was no change in the slopes (P=0.072). No between group differences for slopes (P=0.360) or y-intercepts (P=0.063) suggested that MFR vs. RT relationships were similar between groups. CONCLUSIONS: CH required twice the level of muscle activation in comparison to the AD to complete the task. However, the MFR vs. RT relationships were similar between groups and changed in a time dependent manner.
Recent research indicates that among those who have a history of multiple sport-related concussions (SRC) may have greater postural instability when compared to those that do not have a history of prior SRC. However, little is known regarding the effect on those who experienced multiple SRC on the visual system, specifically oculomotor control. Purpose: To investigate the effect that a prior history of SRC has on oculomotor control within 24-48 hours following SRC. Methods: Twenty-seven (13 female and 14 male; 20 ± 2 yrs) collegiate NCAA Division I athletes with SRC completed two trials of the sport-like antisaccade task (SLT) within 24-48 hours post-injury. Participants were sorted into three equal groups: no history of SRC (NON), a history of one SRC (C1) and a history of two or more SRC (C2). During play of the SLT, all participants were instructed to minimize eye movements away from a central fixed area, while simultaneously swaying in a medial-lateral direction to direct an on-screen avatar to meet the demands of the task. Raw ocular pupil of gaze coordinates were tracked using a monocular eye tracker (240Hz, Argus Science, H7, Medford, MA) that was synced with an 8 camera motion capture system (100Hz, Vicon Motion Ltd., Version 1.8.5, Oxford, USA) during the sport-like antisaccade task and further analyzed using a custom algorithm. A multivariate ANOVA analyzed resultant distance (RD), mean horizontal excursion velocity (HV) and prosaccade errors (PE) by group (NON, C1, and C2). Main and simple main effects for RD are shown for HV and PE were calculated for analysis. Results: No significant omnibus results were noted between the groups for RD (NON=5.780 pixels ±1.527t, (C1=4.935 pixels ±2.582E, (C2=4.665 pixels ±1.305E, (p=0.370, HV (NON=9.912 pixels/second ±44.481E, (C1= 7.250pixels/second ±2.438E, (C2=8.052pixels/second ±2.363E, (p=0.225, and PE (NON=3.730 pixels ±9.243E, (C1=1.629 pixels ±1.635E, (C2=2.161 pixels ±3.243E, (p=0.414). Conclusion: These data suggest that oculomotor control as measured by the SLT may not be sensitive to differentiated between those that have a prior history of SRC and those that do not have a prior history of SRC.

CONCLUSIONS: Strong relationships have been reported between the increases in muscle cross-sectional area (mCSA) and motor unit action potential sizes (MUAP size) for the vastus lateralis (VL). To date, it is unknown if sex-related differences in muscle cross-sectional area and the slopes and y-intercepts for the MUAP size vs. recruitment threshold (RT) relationships. METHODS: Ten males (21.10±0.97 yrs) and ten females (23.70±6.27 yrs) with no participation in any form of structured exercise for the previous 3 years volunteered for this investigation. Ultrasonography was used to examine mCSA, muscle echo intensity (mEI), and subcutaneous fat (sFA) for the VL. Surface electromyographic decomposition techniques were applied to assess MUAP size in relation to RT of the VL during isometric muscle actions at 40% and 70% of maximal voluntary contraction (MVC). Linear regressions were performed for each subject for the 40% and 70% MVC to determine the y-intercepts (millivolts [mV]) and slopes (mV/4%MVC) for the MUAP size vs. RT relationships. Separate two-way mixed factorial ANOVAs (sex [male vs. female] x intensity [40% vs. 70%]) were used to examine possible differences in the y-intercepts and slopes for the MUAP size vs. RT relationships. In addition, independent samples t-tests were used to examine differences in mCSA, mEI, and sFA between sexes. Furthermore, Pearson’s product moment correlation coefficients were calculated comparing mCSA, sFA, mEI of the VL with the slopes and y-intercepts from the 40% and 70% MVCs. RESULTS: The males had greater mCSA (MUAP size) (P=0.002) and slopes than the females (P=0.001), whereas the females had greater sFA (P=0.002) and mEI (P=0.001) for the VL. In addition, all relationships between ultrasound parameters and the slopes for the 40% and 70% MUAP size vs. RT were significant (P<0.001 - 0.020), with the greatest amount of variance explained by mEI (r²=0.657 to 0.687).

CONCLUSIONS: The slopes for the MUAP size vs. RT relationships are dependent on the physical properties of the muscle as measured by ultrasound. In addition, the sex-related differences in mCSA, mEI, and MUAP size in relation to RT suggests greater muscle fiber sizes of the higher-threshold MUs for the males. Supported by a National Strength and Conditioning Association Foundation Grant.
within individuals. Sx2 linear mixed models accounting for repeated measures compared the variables across pattern speeds and trial numbers. Post-hoc Tukey HSDs identified different trial effects. RESULTS: No significant interactions were found in either domain. Significant pattern speed effects were observed in the TEMP domain for VAR (STDEV: FAST 0.07s, SLOW 0.13s, p < .05; CF: FAST 12.9%, SLOW 16.8%, p < .05), and ACC (FAST 0.05s, SLOW 0.10s, p < .05). VAR in the both domains and TEMP ACC changed significantly over the 5 trials (all, p < .05; ACC SPAT, p < .05). ANOVA tests revealed that the different trials for subsequent trials for TEMP and SPAT VAR: #1: 1.05%, #5: 0.08%, p < .05; STDEV: SPAT: #1: 7.7deg, #5: 4.7deg, p < .05; CF: TEMP: #1: 20.8%, #5: 13.2%, p < .05; CF: SPAT: #1: 11.9%, #5: 5.9%, p < .05), and ACC TEMP (#1: 0.11s, #5: 0.07s, p < .05). CONCLUSIONS: VT stimulus appears capable of producing a desired continuous wrist movement at multiple pattern speeds. TEMP VAR was lower and TEMP ACC was higher for the FAST speed, while SPAT measures did not differ between speeds. Lower TEMP and SPAT VAR, and higher TEMP ACC were determined by trial 2, with improved performance maintained in the remaining trials. A lack of change in SPAT ACC may reflect limited SPAT guidance provided to subjects.

2311 Board #147 June 1 11:00 AM - 12:30 PM
The Effects of Resistance Training on Motor Unit Firing Rates and Muscle Activation
Adam J. Sterczela1, Jonathan D. Miller2, Mandy E. Wray2, Hannah L. Dimnick2, Michael A. Devino2, Trent J. Herda3. 1University of Kansas, Lawrence, KS; 2Armstrong State University, Savannah, GA. (No relevant relationships reported)

PURPOSE: To examine the effects of lower body resistance training on motor unit (MU) firing rates and recruitment in the vastus lateralis.

METHODS: Seventeen recreationally active men (20.7 ± 1.9 years; 178.9 ± 7.8 cm; 76.8 ± 9.9 kg) completed three lower body resistance-training sessions per week for eight weeks. Exercise intensities and volumes were programmed according to a linear periodization model. Pre- and post-training, MU behavior of the VL was analyzed during isometric knee extensions performed at 40% maximal voluntary contraction (MVC) torque. Electromyographic (EMG) signals were collected via a 5-pin surface sensor array and decomposed to yield a mean firing rate (MFR) at steady torque and MU action potential amplitude (MUAP). Single MUs were identified using the ratio of the peak of the action potential (AMP) to the RMS of the respective visi’s MVC. Possible differences in the A and B terms of the MFR vs. MUAP relationship and normalized MUAP were analyzed via paired samples t-tests.

RESULTS: Post-training, subjects demonstrated similar B terms (p = 0.278; PRE: -4.06 ± 0.51 pps/mV; POST: -4.1 ± 1.36 pps/mV) indicating a similar decline in MFR with increases in MUAP. However, there was an observed increase in the A term (p = 0.005; PRE: 2.93 ± 2.79 mV; POST: 2.40 ± 4.57 mV) indicating an increase in MFR for a given MUAP post-training. Additionally, subjects demonstrated reduced normalized MUAP post-training (p = 0.029; PRE: 37.9 ± 8.0%; POST: 33.6 ± 8.7%) suggesting reduced muscle activation.

CONCLUSIONS: MUAP is an indirect measure of MU size, thus the larger A terms suggest similarly sized MUs had greater firing rates post-training. EMG amplitude (EMGamp) recorded during the steady torque region of the submaximal contractions was normalized to the peak EMGamp of the respective visit’s MVC. Possible differences in the A and B terms of the MFR vs. MUAP relationship and normalized MUAP were analyzed via paired samples t-tests.

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and females (n=2), 19-21 years, who were a hiking backpack and performed using the dominant arm. Subjects were tested with no backpack, and then (in random order on different days) with the backpack empty, or load. The load equivalent to 10, 30, and 50% of bodyweight in the bottom of the backpack. Trials were repeated with the load high in the backpack using a custom designed box. Three trials were completed for each reach. Mean values were analyzed with repeated measures ANOVA and Tukey’s post-hoc test with significance level p < 0.05.

RESULTS: As reach in normalized for arm length, mean ± SD. When compared to no backpack, load high (30, 50% BW) in the backpack resulted in significant reductions in arm reach (all directions; Low = 140.5 ± 13.8 vs 124.3 ± 6.7, 115.5 ± 7.7; Upward = 161.5 ± 10.7 vs 159.9 ± 9.3, 155.3 ± 12.9; Left = 196.2 ± 8.5 vs 181.6 ± 7.3, 173.4 ± 4.5; Right = 194.8 ± 9.0 vs 181.7 ± 8.0, 175 ± 3.9; Backward = 180.2 ± 6.1 vs 180.5 ± 7.5, 153.5 ± 6.9; Forward = 218.2 ± 10.8 vs 208.9 ± 8.1, 200.9 ± 10.1) and load low (50% BW) in the backpack resulted in significant reductions in arm reach for backward reach only (180.2 ± 1.9 vs 176.8 ± 1.9, 169.1 ± 5.2, 164.5 ± 1.3). When compared to empty backpack, load high (30, 50% BW) in the backpack resulted in significant reductions in arm reach (all directions; Low = 137 ± 1.1 vs 124.3 ± 6.7, 115.5 ± 7.7; Up = 163.9 ± 10.6 vs 159.9 ± 9.3, 155.3 ± 12.9; Left = 194.8 ± 8.6 vs 181.6 ± 7.3, 173.4 ± 4.5; Right = 194.7 ± 8.7 vs 181.7 ± 8.0, 175.3 ± 4.8; Backward = 177.9 ± 7.4 vs 160.9 ± 5.9, 153.5 ± 7.7; Forward = 215.1 ± 11.3 vs 208.9 ± 8.1, 200.9 ± 10.1) and load low (50% BW) in the backpack resulted in significant reductions in backward reach only (177.9 ± 7.4 vs 164.5 ± 1.3).

CONCLUSIONS: Backpack load weight and height differentially affects arm reach. The use was funded in part by the Douglas A. & Phyllis G. Smith Student Faculty Collaborative Research Fund.

The use of electromyography biofeedback (EMG-BF) is frequently incorporated among patients with neurological and musculoskeletal injury to restore neuromuscular function and improve real-time awareness of muscle function. Its effects on central nervous system function are not well documented in lower leg models, leaving its efficacy in certain populations unclear. PURPOSE: This study aimed to measure reflexive and cortical excitability before and after a balance training intervention with and without EMG-BF. METHODS: Nineteen healthy participants volunteered for this study (183.0 ± 20.1 cm; 69.0 ± 13.1 kg; 21.1 ± 2.3 yrs). Reflexive excitability was assessed using the Hoffmann reflex from the tibialis anterior (TA), peroneus longus (PL), and soleus (SOL) through peripheral stimulation of the sciatic nerve in the popliteal fossa to obtain Hmax/Mmax ratios. Cortical excitability was assessed via transcranial magnetic stimulation to quantify motor evoked potential (MEP) size at 110 percent of TA resting motor threshold. Neural excitability was measured before and after two magnetic stimulations to quantify motor evoked potential (MEP) size at 110 percent maximum voluntary contraction (maxMVC) of SOL, PL, and TA muscle activation in participants. Reflexive and cortical excitability before and after a balance training intervention with and without EMG-BF.

RESULTS: No differences between groups were observed for reflexive excitability (F = 0.80, p = 0.48) or MEP size after stimulation (F = 0.03, p = 0.86). EMG-BF decreased SOL MEP size after stimulation by 0.045%Mmax to 0.040%Mmax. CONCLUSIONS: EMG-BF with short-term balance training decreased cortical excitability to SOL compared to balance training alone, perhaps representing reciprocal inhibitory mechanisms to the postural plantarflexors. These findings may have implications when considering interventions for dystonic or spastic populations.

The Y Balance Test (YBT) is an assessment of dynamic balance that requires participants to maintain a single-leg stance while performing three lower extremity reaching tasks. Research has shown that an anterior reach distance difference ≥ 4 cm and a normalized composite score (NCS) ≥ 95% are associated with an increased risk of non-contact lower extremity (NCLE) injury in collegiate athletes; however, few studies have examined this relationship in high school (HS) athletes. PURPOSE: To determine the association between YBT performance (asymmetry and CS) and NCLE injury in HS athletes. METHODS: A total of 88 HS male athletes (16.3 ± 1.4 yrs, height: 181.9 ± 7.6 cm, weight: 82.7 ± 15.2 kg) underwent YBT prior to the start of the 2016 season (football (n=53), lacrosse (n=25), or baseball (n=10). An injury history questionnaire was completed to identify previous history of lower extremity injury. Incidence of NCLE injuries was tracked throughout the season. All participants performed 3
ABSTRACTS

2321
Board #155
June 1 11:00 AM - 12:30 PM
Influence of Inflatable Anti-fatigue Mats on Center of Pressure Displacement during Prolonged Standing
Seann E. Higinbotham1, Adam E. Jagodinsky1, John W. Fox2, David C. Grieshaber2
1Illinois State University, Normal, IL. 2Methodist University, Fayetteville, NC. (Sponsor: David Thomas, FACSM)

Introduction: Many workers are exposed to prolonged periods of standing, which has been linked to musculoskeletal pain, discomfort and other serious health conditions. Additionally, standing desks that do not promote regular bouts of movement may also lead to prolonged standing exposures and increase the risk for pain and discomfort. Traditional foam anti-fatigue mats have been shown to increase foot pressure displacement during prolonged standing and mitigate factors associated with pain and discomfort. However, the purported efficacy of novel inflatable anti-fatigue mats to promote foot pressure displacement has not been investigated.

Purpose: The aim of this study was to evaluate the effect of inflatable anti-fatigue mats on center of pressure (COP) displacement compared to foam mat and hard surface conditions during prolonged standing.

Methods: 18 healthy individuals (Ht: 1.77±0.11m, Wt: 79.41±19.60kg, Age: 20.5±1.6yrs) stood for one hour on one of three floor conditions: Inflatable mat (IM, 3psi), foam mat (FM; EVA foam, 16mm), and hard surface (HS; force platform). Participants were instructed to stand normally at a standing desk and perform office work tasks with their feet inside the dimensions of the force platform. COP data were collected (100Hz) for one minute at 0, 15, 30, 45 and 60min. COP data were normalized to foot position, and root mean square (RMS) values were calculated for each condition. A mixed ANOVA was conducted to investigate the between group (condition) and within group (time) differences.

Results: A significant main effect of condition was observed for RMSy variable [F (2, 15) = 8.24, p = .004, partial η² = .52]. Post-hoc tests revealed that IM (0.006 ± 0.001m) swayed less than CONC1 (0.007 ± 0.001m*; p < 0.01) and CONC1 (0.008 ± 0.001m*) swayed less than CONC2 (0.009 ± 0.001m*) during EC. Also, NON (0.004 ± 0.001m) swayed less than CONC2 (0.006 ± 0.001m) in EC (p < 0.05). Furthermore, NON (0.003 ± 0.001m) swayed less than CONC1 (0.005 ± 0.001m) and CONC2 (0.005 ± 0.001m; p < 0.05) in the EO condition.

Conclusion: These data suggest that among those who have a history of 2 or more sport-related concussions (SRC) postural control is affected when compared to those who do not have a history of SRC. The deficits in the AP direction may suggest that due to the increased degrees of freedom, the athletes that have multiple concussions may lack the ability to control their postural sway around their ankle.

2322
Board #156
June 1 11:00 AM - 12:30 PM
Effects of Stroboscopic Vision on Reactive Balance
Kyung-Min Kim1, Joo-Sung Kim1, Dustin Grooms2
1University of Miami, Coral Gables, FL. 2Ohio University, Athens, OH. (Sponsor: Arlette Perry, FACSM)

Introduction: Stroboscopic Vison (SV) is characterized by intermittent visual obstruction via the use of goggles with lenses that can switch between opaque and transparent. Recently, SV was found to disrupt balance during upright posture. However, the strength of this tool is that visual feedback can be perturbed during more complex reactive maneuvers that require environmental interaction, but no study has quantified the SV effect on reactive balance control. Purpose: To determine effects of SV on reactive balance. Methods: Nineteen healthy subjects (9 males, age=22±2.2yrs, height=170.8±9.2cm, mass=68.9±14.2kg) participated. All participants performed the Motor Control Test (MCT) with and without SV (random order), created by specialized eyewear that intermittently cycled between opaque and transparent for 100 milliseconds at a time. MCT assesses reactive balance by measuring the time between onset of external perturbation and initiation of reaction to recover balance: the shorter milliseconds at a time. MCT assesses reactive balance by measuring the time between onset of external perturbation and initiation of reaction to recover balance: the shorter

Results: Mean CS was 86.8±8.0%. No significant associations were found between SV and NCLE injury. Logistic regression models adjusted for sex, age and sport and found no significant interactions between SV and injury. However, the strength of this tool is that visual feedback can be perturbed during more complex reactive maneuvers. Additionally, the underlying mechanisms of age differences. Methods: Fourteen older adults (OA: mean 74y) and 15 young adults (YA: mean 24y) participated in a familiarization session followed immediately by a testing session. For the RLDs, each participant was seated with their leg passively raised to full extension and supported by an elastic band held by the investigator. Each participant performed two trials of 5sec for each of the three floor conditions: Inflatable mat (IM, 3psi), foam mat (FM; EVA foam, 16mm), and hard surface (HS; force platform). Participants were instructed to kick to full extension as fast as possible once they felt the lower leg dropping. Drop angle, measured with an electro-goniometer secured to the knee, was measured

The reactive leg drop (RLD) is a test designed to assess the rapid sensory-motor integration necessary to recover from a slip and avoid a fall. The lowest drop angle from the RLD has shown to be sensitive to age-related changes, but the underlying mechanisms for this are unknown. Purpose: The purpose of this study was to examine the various subcomponents of the RLD to elucidate the underlying mechanisms of age differences. Methods: Fourteen older adults (OA: mean 74y) and 15 young adults (YA: mean 24y) participated in a familiarization session followed immediately by a testing session. For the RLDs, each participant was seated with their leg passively raised to full extension and supported by an elastic band held by the investigator. Each participant performed two trials of 5sec for each of the three floor conditions: Inflatable mat (IM, 3psi), foam mat (FM; EVA foam, 16mm), and hard surface (HS; force platform). Participants were instructed to kick to full extension as fast as possible once they felt the lower leg dropping. Drop angle, measured with an electro-goniometer secured to the knee, was measured

Abstracts were prepared by the authors and printed as submitted.
as the difference in angle between the start position and the lowest point achieved.

**METHODS:**
- Healthy young adults (21M, 23F, mean age 23.8) were recruited.
- The participants were asked to discriminate between four possible medial-lateral sway extents. Extent movements were made commencing from the neutral standing position and moving either left or right until contact on a stop bar at the greater trochanter (Extent 1=4cm, Extent 2=4.5cm, Extent 3=5cm, and Extent 4=5.5cm).
- Involuntary postural sway control test required the participants to stand as still as possible on a force plate.
- **RESULTS:**
  - Voluntary lateral sway extent AUC discrimination scores (SD) for Day 1 and Day 8: 0.706 for sway to the left and 0.871 for sway to the right, representing good to excellent test-retest reliability. Left and right voluntary lateral sway discrimination scores were 0.706 for sway to the left and 0.645 (0.059) and 0.644 (0.063) for sway to the right. There was no significant difference in AUC scores between Day 1 and Day 8 (p = 0.05). ICC(3,1) values were 0.706 for sway to the left and 0.871 for sway to the right, representing good to excellent test-retest reliability. Left and right voluntary lateral sway discrimination scores were significantly correlated (r=0.669, p<0.01); however, there was no significant relationship between voluntary lateral sway AUC scores and postural sway displacement scores (all r=0.14, p>0.05).

**CONCLUSIONS:**
Voluntary lateral sway measurement showed good to excellent test-retest reliability. Because of the low correlations, voluntary postural sway and involuntary postural sway appear to be subserved by different neural mechanisms. Voluntary lateral sway sensitivity is magnitude dependent, with greatest sensitivity in the most-used sway region.
E-35 Free Communication/Poster - Injury
Friday, June 1, 2018, 7:30 AM - 12:30 PM
Room: CC-Hall B

2327 Board #163 June 1 9:30 AM - 11:00 AM
Descriptive Epidemiology Of Injuries in National Collegiate Athletic Association Water Polo: 2012/13 - 2015/16
(No relevant relationships reported)

Water polo is a contact sport, but it also involves repetitive motion, increasing risk of overuse injuries. However, little is known about the injury incidence in water polo, previous reports have focused on specific diagnoses or a single tournament.

PURPOSE: Describe injury incidence, common diagnoses, and outcomes in men’s and women’s National Collegiate Athletic Association (NCAA) water polo.

METHODS: Athletic trainers reported injury and athlete-exposure (AE) data as part of the NCAA Injury Surveillance Program. Data for men’s water polo were reported across 4 team-seasons from 2012/13 - 2015/16. Data for women’s water polo were reported across 6 team-seasons from 2012/13 - 2015/16. Injuries occurred during a school-sanctioned practice or competition and required medical attention. Injury frequencies, rates per 1,000 AEs and 95% Confidence Intervals (CI) were calculated.

RESULTS: In men’s water polo, 26 injuries were reported in 9,964 AEs (2.61/1,000 AEs, 95% CI:1.61-2.61, 6.5 injuries/team/season). In women’s water polo, 36 injuries were reported in 15,000 AEs (2.40/1,000 AEs, 95% CI:1.62-3.18, 6 injuries/team/season).

The most common mechanism of injury for both men and women was player contact (men:13/26, women:18/36), followed by ball contact in women (9/36) and overuse in men (4/26). Among men, 23 of 25 injuries with a known outcome resulted in time loss - 24 hours compared to 28/36 among women. Conclusions comprised nearly half of reported women’s injuries (17/36), but only 2/26 reported men’s injuries were concussions.

CONCLUSIONS: Although water polo is a contact sport with repetitive motion, preliminary data indicate that injury rates are low relative to other contact sports. Injury rates are similar between men’s and women’s water polo, but a larger proportion of reported women’s water polo injuries are concussions. Further research is needed to determine if the reporting of injuries varies by gender or if there is a true difference in concussion incidence.

The Injury Surveillance Program is funded by the NCAA. The content of this abstract is solely the responsibility of the authors and does not necessarily represent the official views of the NCAA.

2328 Board #164 June 1 9:30 AM - 11:00 AM
Comparison of Orthopedic Injuries in American Flag Football to American Tackle Football.
Ajit Vakharia1, Michael Mijares2, Rushabh M. Vakharia1, Tsun Law1, Fernando Manalac, Jr3, Martin Roche, Jr3.1Morehouse School of Medicine, Atlanta, GA. 2University of Miami, Miami, FL. 3Holy Cross Hospital, Fort Lauderdale, FL.
(No relevant relationships reported)

Purpose: Comparison of American Flag Football (AFF) to American Tackle Football (ATF) with respect to their injuries is not well documented. The purpose of this study was to compare orthopedic injuries between the two sports.

Materials and Methods: A retrospective analysis of patients having injuries from AFF or ATF were identified from 2009-2016, using the Pearl Diver database (Pearl Diver Technologies, West Conshohocken, PA, USA). International Classification of Diseases, ninth and tenth edition (ICD-9 and ICD-10) were used to query our cohort. Our query found patients having injuries in AFF (ICD-9-D-E0070;ICD-10-D-Y9361) and ATF (ICD-9-D-E0071;ICD-10-D-Y9362). The sample size was further narrowed searching for fractures of the upper (FUE) and lower extremities (FLE), dislocations (D1), sprains and strains (S&S), and concussions (CO). Statistical analysis was done between the sports.

Results: 7,896 (696 = AFF; 7,200 ATF) patients with injuries were found. 15-19 (n = 3,169) was the most injured age group in AFF and ATF. Fractions of middle or proximal phalanges/phalanges of hand was the most common FUE in AFF (n = 54), whereas fractures of distal end of radius was predominant in ATF (n = 263). Fractions of the ankle were the most common FLE in both groups (AFF = 11; ATF = 155), along with tear of the medial cartilage of the knee (AFF = 19; ATF = 170). Sprains of the cruciate ligament of the knee was commonly seen in AFF patients (n = 42), whereas in ATF patients, ankle sprains of unspecified sites were commonly seen (n = 383). Conussion rates were higher in the ATF group (n = 883) compared AFF (n = 47), with 15-19 (n = 484) year olds comprising 54% of concussions in AFF, followed by 10-14 years old (n = 399, 46%). Statistical analysis found a p-value of 0.01 when comparing injuries between AFF and ATF.

Conclusion: Appropriate protection such as ACL injury prevention program, ankle taping or bracing, and training should be given when engaging in either sport. Children and adolescents interested in seeking to play either AFF or ATF should be thoroughly equipped, perform an injury prevention program prior to play, seek appropriate medical counseling prior to and after injury, and be educated of the potential sequelae from playing these sports.

2329 Board #165 June 1 9:30 AM - 11:00 AM
Sport-related Injuries In Elite Para Powerlifters: A Prospective Analysis Of 1410 Athlete-days At The Rio 2016 Summer Paralympic Games
Kimberly E. Ona Ayala, B.A., Patrick Huang, B.A., B.S., Yetsa A. Tuvali-Wosornu, M.D., M.P.H., Yale School of Medicine, New Haven, CT.
(No relevant relationships reported)

Purpose: To describe the injury epidemiology of Para powerlifters during the Rio 2016 summer Paralympic Games. METHODS: This cohort study was a sub-analysis of the comprehensive WEB-IISS study (WEB-based Injury and Illness Surveillance System) carried out at the Rio 2016 Paralympic Games by the International Paralympic Committee (IPC) Medical Committee. The WEB-IISS survey was administered to the Chief Medical Officers of each Para powerlifting federation daily. Injury data was prospectively collected and securely housed by the IPC. The main outcome measures were injury incidence rate (IR; number of injuries per 1,000 athlete-days) and injury incidence proportion (IP; number of injuries per 100 athletes), assessed against demographic data, type of injury, and anatomical location of injury. RESULTS: 141 athletes participated in the 7-day Para powerlifting competition period, accounting for 1410 athlete-days. The most commonly injured anatomical region was chronic overuse in nature (63.6%). The most commonly injured region was the shoulder (45.5%; IR=10.1), followed by the neck (13.6%; IR=3.0), and the chest and elbow (each 9.1%; IR=2.0). There were no significant differences in injury patterns between male and female powerlifters [IRr=0.8 (95% CI: 0.3-2.0)]. The oldest age group (age 35-75) had the highest IR [IR=21.8 (95% CI: 11.4-32.2), followed by the middle age group (age 26-34) [IR=10.0 (95% CI: 12.1-18.8)]. CONCLUSIONS: Data from this study indicate that 1. IRs were lower than those reported at the London 2012 Paralympic Games, 2. chronic overuse injuries, as opposed to acute traumatic, remain most common among elite Para powerlifters at Games-time, 3. the shoulder remains the most commonly injured anatomical site, 4. age was a significant risk factor for injury in Rio, which was not shown in London. Comparative data can be collected at future Games’ settings and in combination with current data, used to inform injury prevention programs. As upper extremity injuries impact Para powerlifters’ ability...
to participate in sport as well as activities of daily living, this study helps open an important door for the development of injury prevention protocols in this high-risk Para sport.

2330 Board #166 June 1 9:30 AM - 11:00 AM

Injuries Related To Fitness Trends: Is CrossFit The Newest Contributor?
Nicole D. Rynecki, Brianna L. Siracuse, Joseph A. Ippolito, Kathleen S. Beebe. Rutgers New Jersey Medical School, Newark, NJ.

(No relevant relationships reported)

Purpose: Over the past decade, high intensity interval training (HIIT) and high intensity power training (HIP) have become popularized by programs like CrossFit. The objective of this study was to determine injury incidence coinciding with increased popularity of CrossFit and identify ways physicians can advise patients prior to participation.

Methods: The National Electronic Injury Surveillance System (NEISS) was queried from 2007 through 2016 to estimate injury incidence related to exercise equipment most frequently utilized in programs like CrossFit. Injury incidences were calculated and compared between 2007-2011 and 2012-2016. Over the same time period, Google Trends was used to determine the popularity of CrossFit

Results: There were an estimated 3,988,903 injuries, mostly in males (58%) aged 20 to 39 years (39%). Most commonly, injuries were in the lower extremity (35.35%), trunk (28.5%), and upper extremity (19.6%). From 2012-2016 versus 2007-2011, there was a 144% increase in all injuries including a 159% increase in trunk injuries, a 137% increase in lower extremity injuries, and a 132% increase in upper extremity injuries. There was also a 127% increase in lower extremity strains and a 124% increase in upper extremity strains. Additionally, knee and ankle sprains increased 125%. These increases in injury incidence correlated with a 203% increase in CrossFit interest.

Conclusion: Given increases in injuries related to high-intensity workout programs like CrossFit, athletes should be educated on how to minimize preventable injuries. With particularly high rates of knee and ankle sprains and strains, neuromuscular training and pre-strengthening programs as previously demonstrated among young athletes may be particularly worthwhile in prospective participants. Physicians must be up to date with current fitness trends to best advise patients appropriately.

2333 Board #169 June 1 9:30 AM - 11:00 AM

Epidemiology of Lower Extremity Musculoskeletal Injury in US High School Girls’ Soccer and Basketball
Daniel R. Clifton1, R. Dawn Comstock2, Thomas Best3, Ajit Chaudhari4, Andrew Persch5, Jie Zheng Yang6, James A. Onate7

1 The Ohio State University, Columbus, OH. 2University of Colorado-Anschutz, Aurora, CO. 3University of Miami, Coral Gables, FL. 4Nationwide Children’s Hospital, Columbus, OH.

(No relevant relationships reported)

Purpose: The rate of major trauma due to participation in sport and recreation has increased over the past 10 years in Victoria, which was largely attributable to equestrian activities, motor sports and cycling. Study findings highlight the need to prioritize investment in the prevention of trauma in these activities.

RESULTS
- Participation-adjusted major trauma and death rate was 12.2 per 100,000 participants per year.
- There was an 8% increase in the rate of major trauma (IRR=1.08, 95%CI: 1.06, 1.10; p<0.001), and a 7% decrease in the death rate (IRR=0.93, 95%CI: 0.90, 0.97; p<0.001).
- Out of all sports, there were significant increases in the rate of major trauma (including deaths) in equestrian activities, motor sports and cycling.

CONCLUSIONS
- The rate of major trauma due to participation in sport and recreation has increased over the past 10 years in Victoria, which was largely attributable to equestrian activities, motor sports and cycling. Study findings highlight the need to prioritize investment in the prevention of trauma in these activities.

Sports injuries which result in major trauma or death are associated with significant health-care burden and societal costs. Understanding changes in injury trends, and their drivers, is needed to implement policy aimed at risk reduction and injury prevention. To date, there has been no population-level reporting on trends in serious sport and recreation injuries anywhere in Australia over such an extended period, nor any studies of this length capturing comprehensive data on all sports-related major trauma internationally.

METHODS: The aim of this study was to describe the incidence of sport and active recreation injuries resulting in major trauma or death for a 10-year period from July 2005-June 2015 in Victoria, Australia.

RESULTS: There were 2,847 non-fatal major trauma cases and 614 deaths (including 96 in-hospital deaths) over the 10-year study period. The highest frequencies of major trauma cases and deaths were in cycling, motor sports and equestrian activities. The participation-adjusted major trauma and death rate was 12.2 per 100,000 participants per year. There was an 8% increase in the rate of major trauma (IRR=1.08, 95%CI: 1.06, 1.10; p<0.001), and a 7% decrease in the death rate (IRR=0.93, 95%CI: 0.90, 0.97; p<0.001). Out of all sports, there were significant increases in the rate of major trauma (including deaths) in equestrian activities, motor sports and cycling.

CONCLUSIONS: The rate of major trauma due to participation in sport and recreation has increased over the past 10 years in Victoria, which was largely attributable to equestrian activities, motor sports and cycling. Study findings highlight the need to prioritize investment in the prevention of trauma in these activities.
(MSK) injury. Effectively reducing the risk of LE MSK injury in high school girls’ soccer and basketball may require sport-specific interventions, but minimal research has compared patterns of injury in these sports.

**PURPOSE:** Describe the epidemiology of LE MSK injuries in high school girls’ soccer and basketball athletes.

**METHODS:** Data from the 2012/2013 through 2015/2016 academic years were collected from High School Reporting Information Online (HS-RIO). Certified athletic trainers (ATs) from participating high schools reported injury incidences and athlete exposures (AE). Injury was defined as an event causing an athlete to seek care from an AT or physician and resulting in at least one missed practice or competition. AE was defined as one athlete’s participation in one practice or competition. Injury rates per 1000AE were calculated. Injury proportions were calculated to assess distributions of injuries by body part, diagnosis, injury mechanism, and time loss. Injury rate ratios (IRR) and injury proportion ratios (IPR) were calculated to compare differences between sports. IRRs and IPRs with 95% confidence intervals (CI) not including 1.00 were considered statistically significant.

**RESULTS:** The injury rate was higher in soccer than basketball (IRR = 1.31, 95%CI = 1.19, 1.44). The most common injuries were sprains or strains (73.86% basketball, 68.96% soccer); most injuries affected the ankle (47.20% basketball, 35.03% soccer) and knee (32.64% basketball, 29.38% soccer). The proportion of injuries affecting the hip (IPR = 1.74, 95%CI = 1.06, 2.88) or thigh/upper leg (IPR = 1.97, 95%CI = 1.44, 2.70) was greater in soccer than basketball. Injuries for both sports were most commonly caused by player contact (27.70% basketball, 40.80% soccer) or noncontact mechanisms (41.35% in basketball, 34.15% soccer).

**CONCLUSIONS:** Injury patterns were similar between sports suggesting both sports should emphasize preventing sprains and strains affecting the ankle and knee, specifically those resulting from player contact or noncontact mechanisms. Additional efforts are needed to prevent hip and thigh/upper leg injuries in soccer.

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**Board #170**

June 1 9:30 AM - 11:00 AM

**Opiate Knowledge Among High School Athletes**

Elton Li, Adam N. Van Horn, Jacob W. Poynter, Jonathan Im, Jennifer Hertoma, Carrol Janney1, Michigan State University Center, Midland, MI.

**PURPOSE:** To investigate the incidence of anterior cruciate ligament (ACL) injury in Missouri High School male and female soccer players during the 2011-2013 seasons, using a retrospective method for calculating athletic exposures. **Methods:** A web-based survey was created and sent to every high school soccer coach in Missouri using the Missouri State High School Activities Association (MSHSAA) database. The survey investigated the number of athletic exposures over the course of the season and the number of ACL injuries for each team in both the 2011-2012 and 2012-2013 seasons. The primary outcome measure was ACL injuries. Secondary endpoints included specific characteristics of each ACL injury including contact or non-contact, position, practice or game, school grade, and playing surface. **Results:** During the study period 330,062 athletic exposures (163,511 male; 166,551 female) were reported. 36 ACL tears (28 female and 8 male) occurred. ACL injury rates were calculated per 1000 estimated athletic exposures: Female: total, 0.17; match, 0.47; practice, 0.02. Male: total, 0.05; match, 0.18; practice, 0. Female high school soccer athletes had a 3.4 times greater risk of ACL tear than male high school soccer athletes. Female athletes were 27x more likely to tear their ACL in a match compared to practice. **Conclusions:** Female high school soccer athletes had an increased susceptibility to ACL tear compared to male athletes. For both female and male athletes, a large majority of ACL tears occurred during matches.

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**Board #172**

June 1 9:30 AM - 11:00 AM

**Prevalence Of Musculoskeletal Injuries And Dysfunction Amongst Physical Education Teachers In Singapore**

Swarp Mukherjee, Muhammad Ridhuan Jothari, Ying Hwa Kee. Nanyang Technological University, Singapore, Singapore.

No relevant relationships reported

Ocational demands in PE teachers (PETS) require them to cope with heavy workloads, subject their bodies to impact-loading activities like running and jumping, carrying loads, asymmetrical and stressful postural techniques. This subjects the PETS to a high risk of musculoskeletal (MSK) injuries and dysfunction-related problems that can affect PE teaching and quality-of-life in the long-term. **Purpose:** To determine the prevalence of injuries and MSK dysfunction in PETS in Singapore.

**Methods:** A retrospective injury registration questionnaire and Short Musculoskeletal Function Assessment (SMFA) was used. 152 full-time PETS (116 male; 36 female) participated in the study.

**Results:** 66 PETS reported 75 injuries over a 6-month recall period. In both males and females, knee was the most commonly injured body part, followed by the lower back and shoulder in males and foot and the patella in females. 21 (28.7%) new injuries, 22 (30%) recurrences of an old injury and 27 (36.9%) aggravations of pre-existing injuries were documented. Incomplete ligament sprain followed by muscle tendon strain were the most common injuries. 48 (65.7%) injuries did not lead to any absence from work, 11 injuries (15%) led to 1-2 days of absence while 14 cases (19.1%) led to 3-15 days of absence. 51 injuries did not affect teaching PE, while 15 injuries lead to some PE teaching time loss (range, 1-10 days). In five cases, the injuries were severe enough to require surgery and these PETS were unable to teach PE for the entire term. 31 PETS reported to be continuing to teach PE with some pain and discomfort due to effect of injury. On the SMFA, 132 PETS reported sub-optimal functional index while 112 reported sub-optimal bothersome index. 95 PETS had sub-optimal standardized mobility score, 132 had sub-optimal standardized functional score and 112 PETS had sub-optimal standardized bothersome score. Scores on all three scales were comparable between males and females. However, MSK dysfunction was more prevalent in primary PETS compared to secondary school PETS.

**Conclusions:** There is a high prevalence of injuries and MSK dysfunction amongst PETS in Singapore. Knee, shoulder and foot are at the highest risk of injury. This can adversely affect their PE teaching capacities as well as quality of life in both short and long-term.
The incidence of and risk factors for cold weather injury (CWI) in the US Army have been well characterized. Unlike the “heat season,” when the risk of heat illness is highest and application of risk mitigation procedures is mandatory, there is no definition of the “cold season” and the proportion of CWI that occur outside of a defined cold season is unknown. PURPOSE: To identify the cold season and to determine the within-year seasonal distribution of CWI at select Army installations.

METHODS: The 10 US Army installations with the highest frequency of CWI from 1 July 2008-30 June 2013 were identified and used for analysis. In- and out-patient CWI data (ICD-9-CM codes 991.0-991.9, first, second or third diagnoses only) were obtained from the Defense Medical Surveillance System. Piecewise regression analysis was utilized to determine the critical cut points at which trends in CWI significantly increased or decreased, indicating the start and end, respectively, of the cold season. The proportional distribution of EHI within the cold season, overall and by installation, was determined.

RESULTS: During the study period there were 1,012 CWI and the overall rate was 0.79 per 10,000 person-months. The highest rate occurred during the month of February (2.16 per 10,000 person-months) and the installation with the highest rate was Ft Drum, NY (5.40 per 10,000 person-months). There was at least one CWI during every week of the 5 year study period. Piecewise regression analyses indicated that on average the cold season started during week 14 (Sept 30) and ended during week 39 (March 24). Using this definition, 83.2% (842/2012) of CWI occurred during the cold season. The longest cold season occurred at Ft Wainwright, AK (34 weeks) and the shortest at Ft Carson, CO (17 weeks), illustrating the considerable variability between locations.

CONCLUSIONS: Our data suggest that the risk of CWI exists year round at select Army installations, though further research sub-grouped by type of CWI is warranted. Based on the piecewise regression analysis, we recommend that the “cold season” start 1 October and continues through March, as ~83% of CWI occurred during this period.

2388 Board #174 June 1 9:30 AM - 11:00 AM Seasonal Distribution Of Cold Weather Injuries In The U.S. Army
David W. DeGroot, FACSM, Catherine Rappole, Cotyyn Markow, Tripler Army Medical Center, Honolulu, HI; Army Public Health Center, Aberdeen Proving Ground, MD, MINaval Health Research Center, San Diego, CA.

In the past, serious injuries have been attributed to playing on artificial turf. Newer generation injuries have been well characterized. Unlike the “heat season”, when the risk of heat illness is highest and application of risk mitigation procedures is mandatory, there is no definition of the “cold season” and the proportion of thoracoabdominal injuries that occur outside of a defined cold season is unknown. PURPOSE: To quantify incidence and severity of game-related thoracoabdominal injuries collegiate football injuries on artificial turf vs natural grass.

METHODS: A total of 24 universities were evaluated over 8 competitive seasons for injury incidence rates (IIRs) across injury severity, injury category, injury mechanism and situation, primary type of injury, anatomical location, type of tissue injured, elective imaging and surgical procedures, and turf age. RESULTS: Of the 1,237 collegiate games documented, 628 (50.8%) were played on artificial turf vs 609 (49.2%) played on natural grass. A total of 379 thoracoabdominal injuries were reported with 147 (38.8%) occurring on artificial turf, and 222 (61.2%) on natural grass. MANOVs per 10 game indicated a significant playing surface effect by injury severity (F(1,19) = 7.505, P = .001), primary type of injury (F(1,19) = 4.412, P = .000), tissue type (F(1,19) = 9.412, P = .000), elective imaging and surgical procedures (F(1,19) = 3.517, P = .007), and turf age (F(1,19) = 91.093, P = .000), but not by injury category (F(1,19) = 2.175, P = .089), injury mechanism (F(1,19) = 1.439, P = .133), or injury situation (F(1,19) = 1.329, P = .181). Univariate analyses indicated significantly lower P = .005 - .001) IIRs across severity, both in 1st degree injuries (0.9-1.8), 2nd degree injuries (0.2-2.3), and 3rd degree injuries (0.1-1.0). 1st severity (P = .07). 0.5-0.9); positions, 0.8 (95% CI, 0.6-1.1) vs 1.4 (1.2-1.7); contusions, 1.3 (95% CI, 1.1-1.6) vs 2.0 (1.7-2.3); muscle, 2.2 (95% CI, 1.7-2.7) vs 3.0 (2.6-3.4); MRI, 0.1 (95% CI, 0.0-0.2) vs 0.2 (0.1-0.4); and turf lasting 4-7 years, 0.8 (95% CI, 0.6-1.1) vs 0.9 (0.7-1.2), and 8+ years 0.1 (95% CI, 0.1-0.2) vs 0.5 (0.4-0.8). Since minimal differences existed between antithetical turf and natural grass over an 8-year period of competitive play, artificial turf is a practical alternative when comparing thoracoabdominal injuries in collegiate football.
New Board #178 June 19:30 AM - 11:00 AM
Head Impacts In Female Professional Mixed Martial Arts

Mixed martial arts (MMA) is a full-contact combat sport, which in recent years has experienced an increase in participation of female athletes. Previous research has indicated knockouts (KO) and technical knockouts (TKO), which are typically associated with head trauma, are frequent occurrences (46.2% of match outcomes are determined by KO and TKO) in male MMA competitions. However, the occurrences and context of KOs and TKOs have not been investigated in MMA female competitions. PURPOSE: To characterize the occurrences and context of KOs and TKOs in female professional MMA competition. METHODS: Publicly available score card and video data of female Ultimate Fighting Championship (UFC) competitions that occurred between November 2014 (UFC 180) and July 2016 (UFC 200) were analyzed. Score card information from www.ufc.com and www.sherdog.com was used to determine the occurrences of KOs and TKOs of female UFC fights. The MMA Knockout Tool was used to analyze video of the female UFC fights that ended in KO or TKO. The MMA Knockout Tool allows for coding of the context of a KO and TKO as well as coding the number of head and body strikes sustained by the loser in the 30 s prior to the KO or TKO. RESULTS: Two out of a total of 29 matches ended in KO while 4 ended in TKO due to repetitive strikes. One other TKO was due to a musculoskeletal injury and was not included in the analysis. The combined incidence of KOs and TKOs from head trauma was 103.4 per 1000 athlete exposures (AEs). Video analysis of the KOs and TKOs revealed that in 5 of the 6 KO/TKOs the loser was standing and not clinched with the winner, and in 1 fight the loser was on the ground. In the 30 s prior to TKO the loser sustained a mean of 15.5 ± 7.6 impacts to the head with a mean 9.0 ± 3.6 strikes to the head occurring in the final 10 s. The head regions that sustained the greatest number of strikes within the 30 s prior to KO or TKO were the mandibular and temporal regions, which received 34.7 and 30.7 % of all head strikes, and were not included in the analysis. CONCLUSION: The combined incidence of KOs and TKOs from head trauma was 103.4 per 1000 athlete exposures (AEs). Video analysis of the KO and TKOs revealed that in 5 of the 6 KO/TKOs the loser was standing and not clinched with the winner, and in 1 fight the loser was on the ground. In the 30 s prior to TKO the loser sustained a mean of 15.5 ± 7.6 impacts to the head with a mean 9.0 ± 3.6 strikes to the head occurring in the final 10 s. The head regions that sustained the greatest number of strikes within the 30 s prior to KO or TKO were the mandibular and temporal regions, which received 34.7 and 30.7 % of all head strikes, and were not included in the analysis. CONCLUSIONS: KO and TKO events may represent a conservative estimate of concurrent events in MMA competition. The incidence of 103.4 TKO/ KO per 1000 AE is less than that observed for professional female boxers and male MMA competitions. Furthermore, our data suggest that engaging in a standup versus ground fight is associated with greater incidences of KO/TKO.
incurred injuries than did females (20.3% of males vs. 8.7% of females, Rao-Scott χ² = 30.66, p < 0.001). On the other hand, a significantly higher proportion of females than males sustained elbow injuries (4.7% of males vs. 11.0% of females, Rao-Scott χ² = 25.46, p < 0.001) and wrist injuries (4.8% of males vs. 8.5% of females, Rao-Scott χ² = 9.55, p < 0.01). The logistic regression model showed that these results held true even after adjusting for age.

Conclusion:

The results of this study suggest mountain biking injuries are commonly seen in emergency departments, and injuries are often severe. The shoulder is the most commonly injured anatomical location, with different injury patterns seen among males and females. Further research is needed to determine specific mechanisms of injury that might inform injury prevention strategies.

Over the past two decades, newer generations of artificial turf have been developed to duplicate the playing characteristics of natural grass. Few turf-related studies have been published comparing hand and wrist trauma. PURPOSE: To quantify incidence and severity of game-related collegiate football hand and wrist injuries on artificial turf vs natural grass. METHODS: 24 universities were evaluated over 8 competitive seasons for injury incidence rates (IIRs) across injury severity, injury category, injury season, and turf vs natural grass. RESULTS: Of the 1,237 collegiate games documented, 628 (50.8%) were played on artificial turf vs 609 (49.2%) played on natural grass. A total of 536 hand and wrist injuries were reported with 212 (39.6%) occurring on artificial turf, and 324 (60.4%) on natural grass. MANOV As (Wilks’ λ) indicated a significant playing surface effect by injury severity (F[2,478] = 12.421; p < .0001), but not by injury category, position playing, injury mechanism, or situation. Post hoc analyses indicated significantly lower IIRs (P ≤ .05 to 0.001) observed across 2nd degree trauma, 0.2 (95% CI, 0.1-0.3) vs 0.6 (0.4-0.8); ligament sprains, 1.4 (95% CI, 1.2-1.7) vs 2.0 (1.7-2.3), and subluxations, 0.4 (95% CI, 0.3-0.6) vs 0.3 (0.3-0.5); joint; 2.1 (95% CI, 1.8-2.4) vs 2.5 (2.2-2.9), and muscle trauma, 0.6 (95% CI, 0.5-0.9) vs 2.0 (1.7-2.3); MRI’s, 0.0 (95% CI, 0.0-0.1) vs 0.2 (0.1-0.3), and x-rays ordered, 1.7 (95% CI, 1.4-2.0) vs 2.2 (1.8-2.5); during adverse weather conditions, 0.3 (95% CI, 0.2-0.6) vs 1.2 (0.8-1.6); and turf lasting 4-7 yrs, 0.9 (95% CI, 0.7-1.2) vs 1.3 (1.1-1.6), and 8+ yrs, 0.1 (95% CI, 0.1-0.2) vs 0.8 (0.7-1.1) when comparing artificial turf to natural grass, respectively.

CONCLUSION: Although similarities existed between both surfaces over an 8-year period of competitive play, artificial turf is in many cases safer than natural grass when comparing hand and wrist trauma in college football.

PURPOSE: There is a lack of injury data on women’s rugby, and less on the Olympic format of Rugby-7s. Reporting medical-attention injuries may provide a more complete picture of the true burden of injury and illness in sport. The aim was to determine medical attention injury incidence in U.S. women’s Rugby-7s. METHODS: A prospective epidemiology study of U.S. women Rugby-7s (6,768 players; 564 teams), in multi-level USA Rugby and USA Sevens LLC tournaments (2010-2014). Incidence (per 1000 player-hour (ph)) and biomechanism of medical attention injuries were captured via the Rugby Injury Survey & Evaluation (RISE) Report methodology.

RESULTS: Medical attention injury rate was found at 8.44/1000 ph (p = 0.356). Amongst positions, injuries were found at similar rates (backs: 60%, 59.3/1000ph, n=143; forwards: 40%, 53.6/1000ph, n=97; RR=1.11; P=0.447). Most injuries were acute (95%) occurring during the tackle (67%). Most match injuries were from a shoulder tackle (70%) (backs 72%; forwards 62%; RR=1.32; P=0.113). Recurrent injuries occurred at 25%. Lower extremity ligament sprains (53%) were most common, among injury types, muscle/tendon injuries were most common overall at 41% (backs 41/1000ph; forwards 42/1000ph; P<0.998). Knee injuries occurred more frequently in forwards (23%) than backs (16%; P=0.213). Head/neck injury rates, were 22% of all injuries. The sub-acute head contusion, where players were permitted to return to sport was 6% (3.5/1000ph). CONCLUSIONS: Documentation of medical-attention incidents is recommended in the literature, as this is likely to capture a far greater number of ailments, than time loss injuries alone and will therefore, provide a more inclusive picture of the true burden of injury and illness in a population. A panoptic view of rugby-7s injury rates, provides fundamental gender injury data, to guide injury prevention protocols by stakeholders to guide player welfare. Head-neck and upper extremity injury rates (both at 21%) support an emphasis on tackling techniques for injury reduction. A program, including contact-based-avoidance, for women newly introduced to this collision-sport, would nurture injury prevention. Furthermore, adherence on return to play protocols would decrease recurrent injury rates seen in this gender-specific cohort.

Golf is a popular sport worldwide, however, the tendency of players to be older and in poor physical condition contributes to its injury risk. Although golf has a moderate injury incidence, few studies have illustrated the extent of golfing injuries, and only one study has focused on female golf injuries. PURPOSE: To examine the injury profile of female golfers and investigate differences in injury epidemiology by age, handicap, experience, and participation. METHODS: Female golfers over 18 years with a registered handicap documented their 12-month injury status and associated golfing demographics. RESULTS: 1803 female golfers (median age: 51.3 years; handicap: 12.4; experience: 13.7 years) reported 671 injuries (37.2%) over a 12-month period, with the majority of injuries sustained during play (72.9%). The most common injury sites were the shoulder (23.2%), lower back (22.9%), and elbow (18.1%). Strains were the most frequent type of injury (43.0%), with overuse injuries most prevalent (24.0%), followed by a technical error (24.8%). Over half of all injuries required treatment from a healthcare professional (57.8%), and 1358 (75.3%) of the injured golfers reported an impact on their performance or participation. Over two-thirds of the injured golfers missed participation time due to their injury, and 187 of the injured golfers (10.4%) needed time off school or work. Chi-square analysis showed golfers’ handicap (χ² = 23.747, p ≤ 0.001), hours of play (χ² = 35.735, p ≤ 0.001), hours of practice (χ² = 30.137, p ≤ 0.001), and experience (χ² = 28.003, p ≤ 0.001) were significantly associated with their injury status. Handicap, hours of play, and experience level were also significant independent predictors of injury. The Hosmer and Lemeshow test indicated acceptable goodness of fit (p = 0.905).
Although similarities exist between both surfaces during competitive play, artificial turf is in many cases safer than natural grass when comparing this specific artificial surface and level of play.

2352 Board #188 June 1 9:30 AM - 11:00 AM Epidemiology Of Sports-related Facial Injuries Treated In The United States Emergency Departments Between 1997-2016.

Natalie Ronshaugen, Morteza Khodae, FACSMM, University of Colorado, Aurora, CO.

(No relevant relationships reported)

Purpose: Worldwide, facial injuries in sports make up a large number of emergency room visits each year. The purpose of this study was to describe the epidemiology of sports related facial injuries presented to the United States Emergency Department (EDs). Methods: This was a retrospective analysis of the data of facial injuries in the ED related to sports from the National Electronic Injury Surveillance System (NEISS) from 1997-2016. Results: A total of 183,985 people presented to US EDs for sports related facial injuries from 1997-2016. The average age was 19 years. About three quarters of patients were male. The most common injury was facial laceration (30%), followed by contusion/abrasion (27%), fracture (12%), followed by eyelid injuries (10%). The majority did not require admission and were discharged from the ED (97%). The most common sports associated with facial injuries were biking (19%), basketball (16%), baseball (11%), football (6%), softball (4%), and soccer (4%). The most common sport associated with male facial injuries was biking (19%), followed by basketball (18%), baseball (12%), softball (8%), and soccer (4%). The most common sport associated with female facial injuries was biking (21%), followed by softball (10%), baseball (8%), softball (7%), and soccer (5%). Conclusion: This study identifies common facial injuries in sports and which sports are more likely to cause them. Biking and basketball have the highest incidence of facial injuries overall though softball is the second most common sport associated with female injuries. Most injuries occurred in males. Most injuries were minor in nature and did not require hospitalization. <EndFragment>
were related to tackling amongst the upper extremity (35%), and head/neck (26%), making these areas a focus to reduce risk in the U.S. and support tackle-technique evaluations especially with positional focus and its target area (lateral hip). Proper medical assessments, need to scrutinize return to play post-competition to reduce recurrent injury risk in the U.S. men’s hockey. Investigations such as this will aid in understanding the current needs and allocation of medical resources for Rugby-7s.

**2354** Board #190  June 1 9:30 AM - 11:00 AM  
Perfectionist Concerns Predict Injury Risk in Collegiate Distance Runners - Preliminary Findings From A Prospective Study  
Lace L. Leckel, Brian J. Wallace, Maya L. Pulcro, Mitchell J. Rauh, FACSM. 1University of Wisconsin - Oshkosh, Oshkosh, WI 2San Diego State University, San Diego, CA. (Sponsor: Mitchell J Rauh, FACSM)  
(No relevant relationships reported)

Distance runners have a high incidence of running-related injury (RRI). While anatomical, biomechanical, and training load have been associated with RRRs, psychological factors like perfectionism may also contribute to injury risk. Perfectionist strivings (high personal standards [PS]) can be adaptive, but perfectionist concerns (concerns over mistakes [COM]) and doubts about actions (DAA) are considered maladaptive. The combination of high PS with high COM and DAA is considered unhealthy perfectionism and may increase a runner's risk of RRI.

**PURPOSE:** To determine whether perfectionist concerns were associated with RRI occurrence in distance runners. We hypothesized that runners with higher PS and COM and/or DAA would have a higher incidence of RRI during the season. **METHODS:** Thirty-four NCAA Division III collegiate cross country runners (18 males, 16 females; mean age of 19.6±1.2 years; BMI of 20.6±1.8) completed the Sport Multidimensional Perfectionism Scale-2 (Sport-MPS-2) on the first day of their competitive season. Runners were followed prospectively during the first 8 weeks of their season for any RRs resulting in limited or missed practices or competitions. Fifteen runners (44.1%) experienced a time loss RRI. Independent t-tests were used to compare mean differences of PS, COM and DAA scores between runners who experienced a RRI and runners without RRI. Odds ratios (OR) and 95% confidence intervals (CI) assessed the risk of RRI between runners with and without perfectionist concerns.

**RESULTS:** Injured runners rated their COM higher (23.5±4.9 points) than uninjured runners (19.9±5.3 points) (p=0.05). Injured runners also rated their DAA higher (14.5±4.2 points) higher than uninjured runners (11.4±3.6 points) (p=0.03). Runners with perfectionist concerns (high PS and high COM and/or DAA) were 17 times more likely to experience a RRI during the season (OR=17.0, 95% CI 2.8-104.5, p<0.001). **CONCLUSIONS:** Runners reporting Sport-MPS-2 scores classifying them as having unhealthy perfectionism were more likely to incur a RRI than runners with lower Sport-MPS-2 scores. Further study is needed to determine whether interventions can modify perfectionist concerns and whether training load modifications for those with unhealthy perfectionism affect injury rates.

**2355** Board #191  June 1 9:30 AM - 11:00 AM  
Video Corroboration Of Player Incurred Impacts Using Trunk Worn Sensors Among National Ice-hockey Team Members  
Aaron Pilotti-Riley, Davor Stoyanov, Muhammad Sohaib Arif, Stephen J. McGregot, Eastern Michigan University, Ypsilanti, MI. (Sponsor: Mark Peterson, FACSM)  
(No relevant relationships reported)

Wearable sensors (WS) have been increasingly used to quantify training loads in team sports but can also be used to identify impacts incurred by players in ice hockey using trunk-worn sensors.

**PURPOSE:** To use video to corroborate impacts identified by trunk-worn WS and incurred by players in ice hockey using trunk-worn sensors. Use of these devices should allow a more complete understanding of the whole-body impacts incurred by players participating in ice hockey.

**Supported by USA Hockey Foundation**

**2356** Board #192  June 1 9:30 AM - 11:00 AM  
Pain and Overuse in High School Baseball Pitchers During a Season  
Michael P. McNally1, James A. Onate2, Jingzhen G. Yang2, Kevin E. Klingele2, Ajit MW Chaudhari, FACSM2. 1Ohio State University College of Medicine, Columbus, OH. 2Nationwide Children’s Hospital, Columbus, OH. (Sponsor: Ajit Chaudhari, FACSM)  
(No relevant relationships reported)

Over half of adolescent baseball pitchers retrospectively recall throwing arm pain during a baseball season, leading to the institution of pitch count regulations across high school baseball; however, how pain varies throughout the season is unknown.

**PURPOSE:** The purpose of this study was to determine the prevalence of pain and overuse symptoms occurring in high school baseball pitchers throughout a high school baseball season.

**METHODS:** 97 pitchers were enrolled in the research study from eight central and southern Ohio high schools. Weekly surveys were sent via text message to assess overuse and pain using a validated questionnaire throughout the season (11 weeks). 44 of the 60 participants who met all inclusion criteria responded a minimum of 80% of the time and were included in the analysis. Descriptive statistics and prevalence of overuse and pain were calculated weekly throughout the season.

**RESULTS:** The final participant pool maintained an average weekly completion rate of 91.8±0.2%. 34.8±7.9% of participants reported symptoms of overuse each week, with peak prevalence occurring in the 4th week of practice (45.5%), and trending downwards with 26.2% reporting overuse in the final week of the season. Prevalence of severe overuse, determined by a report of moderate or greater effect on training or performance, was low throughout the season (4.0±1.8%). Of those who did experience any symptom of overuse, the mean weekly overuse score was 22.0±3.3 of 100 (mild overuse). Pain prevalence showed similar trends, with 28.5±7.6% of participants reporting pain during the season, the peak occurring in week 4 of practice (40.9%), and trending down with 19.0% experiencing pain in the final week. The majority who experienced pain reported mild pain (81.3±7.1%), with few experiencing moderate pain (18.0±7.1%), and only one report of severe pain occurring in week 3.

**CONCLUSION:** Prevalence of pain and overuse symptoms varies over the course of a high school baseball season, peaking within the first five weeks of the season, though pain is mild. Further research is needed to determine whether increases in pain at this time are preceded by an initial period of chronic overuse or more acute changes in workload.

**2357** Board #193  June 1 9:30 AM - 11:00 AM  
Evaluating Methods For Utilizing Time-loss Data In Sports Settings Using A Sample Of US Collegiate Soccer-related Injury Observations  
(No relevant relationships reported)

Time-loss has featured heavily in assessments of sports-related injury severity, and has been helpful in identifying sport-specific injury severity patterns.

**PURPOSE:** To compare inferences from distinct approaches for conditional, multifactorial modeling of time-loss due to injury in sports settings.

**METHODS:** Data from the NCAA-ISS for the 2004/2005/2013/2014 years were used for this analysis. For unadjusted analyses, time-loss was considered a count outcome, following a Poisson distribution and some underlying intensity. Time-loss was examined across categories of potential time-loss determinants, by assuming a distribution-free random effect that accounted for the heterogeneity introduced by latent ‘injury severity.’ Then, the random effect was incorporated into multifactorial Poisson models. A second approach was considered for building multifactorial models of time-loss, where time-loss was considered a continuous outcome and Accelerated Failure Time (AFT) models were built with frailties to capture latent ‘injury severity.’ Both approaches for regression modeling were used to derive conditional parameter estimates.

**RESULTS:** In both modeling approaches, injury site, injury mechanism and has been helpful in identifying sport-specific injury severity patterns.
and injury history had the strongest overall associations with time lost due to injury. The direction and magnitudes of conditional estimates obtained from both regression approaches were also comparable. For example, in the Poisson approach, time lost due to a contact injury was significantly lower than time-loss due to a ‘similarly severe’ non-contact injury (Adj. TLR= 0.835, 95% CI= 0.787, 0.885). Similarly, in the AFT approach, a non-contact injury seemed more (~17%) deleterious (in terms of time spent injured) than a ‘similarly severe’ contact injury (β= -0.1906, p<0.0001).

Importantly, post-hoc residual analyses (for the Poisson approach), and examinations of AICs (for the AFT approach) revealed that the random-effects based models fit these time-loss data better than models with only fixed effects. CONCLUSIONS: Although using time-loss as an indicator to define ‘injury severity’ may be justifiable, comparing time lost due to ‘similarly severe’ injuries to 2 different sites, or resultant of 2 different mechanisms using the approaches described here, may be more scientifically salient.

E-36 Free Communication/Poster - Walking for Better Health

Friday, June 1, 2018, 7:30 AM - 12:30 PM
Room: CC-Hall B

Classification Accuracy Of A Moderate Intensity Cadence (steps/min) Threshold During Overground Walking

Zachary R. Gould1, Elroy J. Aguiar1, Scott W. Ducharme1, Christopher C. Moore1, John M. Schuna1, Tiago V. Barreira1, Stuart R. Chipkin2, Catrine Tudor-Locke, FACSM1. 1University of Massachusetts Amherst, Amherst, MA. 2Oregon State University, Corvallis, OR. 3Syracuse University, Syracuse, NY. (Sponsor: Dr. Catrine Tudor-Locke, FACSM)

No relevant relationships reported

Purpose: Few studies have evaluated the association between pre-participation psychological symptoms and concussion. The purpose of the current analysis was to evaluate the relationship between previous concussions, incident concussions, and Brief Symptom Inventory-18 (BSI-18) among U.S. military service academy cadets.

Methods: Data were analyzed from the Concussion Assessment, Research and Education (CARE) Consortium at three U.S. Service Academy sites. Between August 2014 and June 2017, 10,603 participants were enrolled and completed the BSI-18 assessing three psychological domains: somatization, depression, and anxiety. The total number of previous concussions (diagnosed or undiagnosed) was extracted from participant self-reports at baseline screening. Incident concussions were captured prospectively via the CARE protocol. Pearson correlations assessed associations between total number of prior concussions and BSI-18 scores. Analyses controlling for sex, age, service academy, previous concussions, and freshman status evaluated the association between baseline BSI-18 total score and odds of incident concussion.

Results: Total concussions and “diagnosed” prior concussions did not have a significant correlation with baseline BSI-18 scores. Statistical but not clinically significant correlations were observed between the total prior undiagnosed concussions and somatization (r = 0.05, p < 0.01), depression (r = 0.05, p < 0.01), and anxiety (r = 0.04, p < 0.01), and total BSI-18 score(r= 0.06, p < 0.01). While significant, each of the correlations are small. Multivariable analyses estimating the odds of incident concussion based on BSI-18 total score were significant (X²(7) = 271.68; p < 0.01). BSI-18 total score was a significant estimator of incident concussion odds (p = 0.02) even after controlling for all covariates (all p’s < 0.01). For each point increase in BSI-18 score, the odds for incident concussion increased 2% (OR = 1.02; 95% CI: 1.01-1.03).

Conclusions: Univariate analyses demonstrate a limited association between previous self-reported undiagnosed concussions and BSI-18 scores. Pre-participation BSI-18 scores may be predictive of subsequent concussion likelihood. These results highlight the interaction between the functional concussive and psychological health.
While it is becoming less and less common for four-year colleges and universities to require physical activity courses as part of student curricula, many schools continue to offer elective physical activity courses. These elective courses are important given the benefits associated with physical activity and the low levels of physical activity found within the college student population. College and universities also stress the importance of community engagement within their courses, suggesting that addressing the physical activity needs of others, such as shelter dogs, within activity-based courses may benefit multiple entities.

**PURPOSE:** The purpose of this study was to assess the physical activity levels of students enrolled in a service-learning fitness walking course in which students walk local shelter dogs. **METHODS:** Ten college students (age = 20.8 years (SD = 1.23); 80% female; 90% White), enrolled in a fitness walking course that met at the county animal shelter, were asked to wear NL-1000 pedometers twice a week for 50 minutes for a duration of 10 weeks. Students will complete a survey about their experience at the end of the semester. **RESULTS:** Preliminary results indicate that, on average, students acquired approximately 4726.5 steps (SD = 299.14; range 2167-6212 steps) per walking session and walk an average of 2.26 miles (SD = 1.14; range 1.06-3.23 miles). Of the time spent on these walks, approximately 28% (range 11.32-43.44 minutes) was moderate physical activity. **CONCLUSIONS:** Students enrolled in this course are currently reaching approximately 40% of their recommended daily physical activity requirements during class time. To date, student perceptions of the course have been overwhelmingly positive suggesting that incorporating shelter dogs into a physical activity elective course at a college or university can promote physical activity amongst college students. The local shelter dogs also benefited from being physically active demonstrating the utility of community engagement when seeking new and fun ways to promote physical activity among college students.

### Table 1: Classification accuracy of optimal OG and original TM heuristic cadence thresholds forcorr

<table>
<thead>
<tr>
<th>Cadence (steps/min)</th>
<th>True Positive</th>
<th>True Negative</th>
<th>False Positive</th>
<th>False Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Optimal OG</strong></td>
<td>103</td>
<td>11 (13.5%)</td>
<td>14 (17.7%)</td>
<td>46 (61.3%)</td>
</tr>
<tr>
<td><strong>Heuristic (TM-based)</strong></td>
<td>100</td>
<td>6 (8.0%)</td>
<td>8 (10.7%)</td>
<td>49 (65.3%)</td>
</tr>
</tbody>
</table>

**PURPOSE:** To examine whether aerobic physical activity mediates the association between neighborhood walkability and overweight/obesity among Latino adults.

**METHODS:** We used cross-sectional 2015 National Health Interview Survey data on Latino participants 18 years of age and older (N=4,765). Neighborhood walkability was assessed based on self-reported measures of built environment (e.g., presence of sidewalks, presence of paths/trails) and neighborhood safety (e.g., presence of traffic, crime). A neighborhood walkability score was created by combining the built environment and neighborhood safety items, with a higher score indicating higher walkability. Self-reported height and weight were used calculate body mass index categories (overweight/obesity versus normal weight). Aerobic physical activity was measured continuously based on self-reported total minutes of moderate-to-vigorous aerobic activity per week. Multivariate logistic regression models, accounting for the complex survey design, were used to estimate the association between neighborhood walkability and overweight/obesity, with covariates adjusting for age, sex, education, and acculturation. Indirect effects were assessed using bootstrap methods outlined by Preacher and Hayes, to quantify the extent to which aerobic physical activity mediates the association of neighborhood walkability with overweight/obesity (BMI ≥ 25 kg/m²).

**RESULTS:** On average the sample was 44 years old, 56% were female, 36% had less than a high school education, and 58% were foreign-born. After adjusting for covariates, a one-unit higher neighborhood walkability score was associated with significantly lower odds of overweight/obesity (OR: 0.98; 95% CI: 0.93, 0.99), relative to normal weight. Results indicated that aerobic physical activity accounted for 0.7% of the total effect of neighborhood walkability on overweight/obesity among Latino adults, but was not significant (p = 0.46).

**CONCLUSION:** These findings suggest neighborhood walkability contributes to overweight/obesity among Latino adults. However, mediation results indicate aerobic physical activity does not account for the impact of neighborhood walkability on overweight/obesity, suggesting other factors may play a role.

**2363 Board #199**

**June 1 9:30 AM - 11:00 AM**

**The Effect ofa Web-based Physical Activity Promotion Program on SEDENTARY BEHAVIOR:**

**The WALK 2.0 Trial**

Gregory S. Kolt, FACSM1, Tanya Wood1, Mitch J. Duncan1, Cristina M. Capernichione1, Anthony J. Maeder1, Richard R. Rosenknz, FACSM2, Trevor N. Savage3, Anetta Van Italie1, W Kerry Mummery1, Corneel Vandelanotte4, Emma S. George1. 1Western Sydney University, Sydney, Australia. 2University of Newcastle, Newcastle, Australia. 3University of British Columbia, Kelowna, BC, Canada. 4Flinders University, Adelaide, Australia. 5Kansas State University, Manhattan, KS. 6Griffith University, Gold Coast, Australia. 7Central Queensland University, Rockhampton, Australia. 8University of Alberta, Edmonton, AB, Canada.

(No relevant relationships reported)

**PURPOSE:** To investigate the effectiveness of the WALK 2.0 intervention on sedentary behaviour. **METHODS:** Participants were 504 (728 female and 176 male, mean age 50.8±13.1 years) adults randomised to one of two web-based interventions or a paper-based Logbook group. Those in the Web 1.0 group participated in the existing 10,000 Steps program and those in the Web 2.0 group participated in a Web 2.0-enabled physical activity intervention that included social networking capabilities. Sedentary behaviour was assessed using Actigraph GT3X activity monitors and was recorded in terms of total minutes of sedentary time per day and number of bouts (>10 minutes) of sedentary time per day. **RESULTS:** For total daily minutes of sedentary behaviour, repeated measures analysis showed no significant group x time interactions in either the unadjusted model (p=0.46) or the model adjusted for gender, age at baseline, BMI, education, and accelerometer wear time (p=0.58). No significant group x time interactions were shown for daily bouts of sedentary time in either the unadjusted (p=0.21) or adjusted (p=0.21) models. There were no significant changes in total minutes or number of bouts of sedentary behaviour within groups or across time. **CONCLUSIONS:** The WALK 2.0 intervention is not effective in reducing sedentary behaviour. Specific behavior strategies targeting both sedentary behaviour and physical activity are necessary and their implementation requires careful consideration in the design phase.

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**S484 Vol. 49 No. 5 Supplement**

**MEDICINE & SCIENCE IN SPORTS & EXERCISE®**

**ACSM May 29 – June 2, 2018 Minneapolis, Minnesota**

**FRIDAY, JUNE 1, 2018**

**Dogs in an Activity Course: A Pilot Study**

Melanie Sartore-Baldwin, Bhibha M. Das, Lacey Schwab, Katrina DuBose, FACSM. East Carolina University, Greenville, NC. (Sponsor: Katrina DuBose, FACSM)

(No relevant relationships reported)

While it is becoming less and less common for four-year colleges and universities to require physical activity courses as part of student curricula, many schools continue to offer elective physical activity courses. These elective courses are important given the benefits associated with physical activity and the low levels of physical activity found within the college student population. College and universities also stress the importance of community engagement within their courses, suggesting that addressing the physical activity needs of others, such as shelter dogs, within activity-based courses may benefit multiple entities.
Evaluation of Step Rate of Walking Corresponding to Moderate Intensity

Woam Bae, So Mi Yun, Yun Bin Lee, Min Ji Jung, Da Hye Lim, Ah Reum Jung, Woong Hee Lee, Yun Bin Lee, Eun Jin Hwang, Il Jin Kwon, Dae Taek Lee, Yoo'Koon University, Seoul, Korea, Republic of. 'Chung-Ang University, Seoul, Korea, Republic of.

(No relevant relationships reported)

PURPOSE: To evaluate associations between obesity and walking efficiency in adults of childhood ALL. METHODS: ALL survivors (N=351, mean±SD age: 28.5±6.0 years, 51.6% male) and 342 age-, sex- and race-matched controls (N=342, 29.0±7.5 years, 51.2% male) were assessed for body mass index (BMI: kg/m^2), body fat percentage (%BF) using dual x-ray absorptiometry, and completed the six minute walk test. Walking efficiency was characterized with the physiological cost index (PCI). PCI is calculated using the formula: (Maximal heart rate (HR) during walking – HR at rest)/(distance walked; expressed as beats per meter (normal range 0.13-0.49 in adults). RESULTS: ALL survivors with BMI ≥40 kg/m^2 had higher PCI values compared with normal weight survivors (0.63±0.40 vs. 0.50±0.019, p<.01), adjusting for age, sex, physical activity, and cranial radiation exposure. ALL survivors with excess %BF (defined as > 25% for men and > 33% for women) also had higher PCI values compared to survivors with normal %BF (0.54±0.03 vs. 0.47±0.017, p<.01). No associations between obesity and PCI were evident among controls. CONCLUSIONS: Obesity is associated with reduced walking efficiency in ALL survivors but not in healthy controls, suggesting that ALL survivors do not have the same capacity to compensate for excess body weight as their peers with no cancer history. Weight loss interventions may have a significant impact on daily activity in this population.

2367 Board #203
June 1 9:30 AM - 11:00 AM
Process Evaluation of a Multi-Component “Sit Less, Walk More” Workplace Intervention for Office Workers
Yun-Ping Lin, Shu-Hua Lu, Wei-Fen Ma, Kwo-Chen Lee, Chu-Chu Lin, Meei-Maan Chen. 'China Medical University, Taichung, Taiwan. "Kaohsiung Medical University, Kaohsiung, Taiwan. 'National Taipei University of Nursing and Health Sciences, Taipei, Taiwan.

(No relevant relationships reported)

Sit Less, Walk More (SLWM) workplace intervention was designed for office workers with demonstrated efficacy in improving walking and some cardiometabolic biomarkers. However, little is known about the participants’ perceptions of the program and each program component’s contribution to observed program effects. PURPOSE: To evaluate participants’ perceptions of and engagement with the program components in the SLWM to understand program effects. METHOD: Process evaluation data were collected during and immediately after the 12-week intervention period. The SLWM included multi-components: three monthly newsletters, six biweekly motivational tools, a team-based 10,000 steps challenge, environmental prompts, and walking routes and resources. A survey contained both closed and open-ended questions assessing frequency of use and perceptions of program components; factors that hindered the use of program components; and recommendations for improving program components. Qualitative data were analyzed using content analysis. RESULTS: Fifty-one (100%) intervention participants completed the post-intervention survey. Their ages ranged from 30 to 62 (mean = 52.1, SD = 6.57). The majority of participants were married (92.2%) and highly educated (60.8%) had a college or graduate degree. Most participants were satisfied with the SLWM program (84.3%) and thought the program to be beneficial (78.4%) and effective (74.5%) to them in increasing physical activity and decreasing sitting behavior. Participants reported the 10,000 steps challenge to be the most helpful component because of the motivation and encouragement elicited by the pedometer and Step Log (79.6%), goal setting (45.5%), and the use of the support group approach as well as rewards and recognition for group competition (29.6%). The walking route was not received well by the participants. The reasons for this included time constraints due to work or family obligations (54.1%), physical environment issues primarily due to weather (21.6%), and using their own preferred methods of exercise or walking routes (13.5%). CONCLUSIONS: The findings provide a better understanding of the use and preference for different program components and how future SLWM workplace intervention for office workers could be provided. Supported by MOST Grant.
These results suggest that sex-specific strategies to accomplish motor tasks exist.

CONCLUSIONS

An interaction between RVD and peak torque was observed in all measures (p<0.05). With better performances in all measures independent of peak torque, and a significant association noted in 6m-usual (p<0.0001). In women, higher RVD was significantly associated with greater during 135° and 180° turn conditions compared to 0-90° turn conditions (p<0.05).

CONCLUSION: The GT9X gyroscope, when low-pass filtered at 0.25 Hz, can be used to detect the number of turns and estimate turn degree. The magnetometer was only useful for detecting the number of turns. Future work should explore the gyroscope use for turn detection during activities other than walking and running.

PURPOSE: Efficiency of movements depends on both muscle strength and movement velocity. Men have higher muscle strength than women but whether strength and velocity contribute differently to walking performance in men and women remains unclear. Using data from the Baltimore Longitudinal Study of Aging, we investigated whether knee extension rate of velocity development (RVD) and peak torque differently contribute to walking performance measures in men and women.

METHODS: We assessed the effect of sex on associations of RVD and peak torque with physical performance independent of demographics, body composition and subjective knee pain in 868 BLSA participants (48.2% women; aged 26 to 96 years). We measured peak torque and RVD for age, race, body height, appendicular lean mass, whole body fat mass, and knee velocity during a 6m walk at usual and fast pace (6m-usual and fast) and during a 400m walk at fast pace (400m), and the distance covered in a 2.5-minute walk at normal speed (2.5min).

RESULTS: In men, RVD was associated with 6m-usual (p=0.001), while higher peak torque was significantly associated with better performances in 2.5min walk, 6m-fast, and 6m-fast (p=0.05). A significant interaction between RVD and peak torque was observed in 6m-usual (p=0.001). In women, higher RVD was significantly associated with better performances in all measures independent of peak torque, and a significant interaction between RVD and peak torque was observed in all measures (p<0.05).

CONCLUSIONS: RVD predicts walking performance in women but less in men. These results suggest that sex-specific strategies to accomplish motor tasks exist. Future studies are needed to identify the mechanisms underlying this sex difference.

Step It Up! The Surgeon General’s Call to Action to Promote Walking and Walkable Communities calls on Americans to work together to increase walking and improve walkability. Well-connected, safe, and attractive sidewalks is one common feature of walkability. The Environmental Protection Agency National Walkability Index (NWI) provides a composite index of walkability at the block group level but does not include a direct measure of sidewalks. Knowing the associations between the NWI and sidewalk presence and quality may help assess the utility of the NWI to facilitate the planning of walkable communities. PURPOSE: To determine the association between a nationwide geographic measure of walkability and features of sidewalks.

METHODS: We surveyed adults from 20 Community Transformation Grant sites. Respondents (n=20,918) reported on the presence of individual sidewalk features (11.2±0.1 vs. 11.8±0.1). The NWI was lower (p<0.05) for sidewalks separated from street by grass/dirt (7.4±0.1 vs. 11.6±0.1 vs. 11.5±0.1 vs. 9.6±0.1). NWI scores were higher (p<0.05) for those reporting (versus not reporting) sidewalks on most streets (11.6±0.1 vs. 9.6±0.1), well-maintained sidewalks (11.5±0.1 vs. 11.1±0.1), and sidewalks separated from traffic by parked cars (11.9±0.1 vs. 10.3±0.1). The NWI was lower (p<0.05) for sidewalks separated from street by grass/dirt (11.2±0.1 vs. 11.8±0.1). CONCLUSIONS: The NWI was moderately associated with sidewalk presence; however, associations with individual sidewalk features were week. The NWI may not be useful to identify individual features of sidewalk quality or locations where sidewalks are lacking. Future studies may want to assess its utility to facilitate planning in other locations.
Increases in collegiate distance runners using Branched-Chain Amino Acids

Miyamoto, Mayumi, FACSM, Yukiko Oike, FACSM, Keisuke Ono, FACSM

PURPOSE: To examine the response of BCAA on stress perception of trained collegiate distance runners using DHALDAA. METHODS: Twenty-four elite rowers (27.0 ± 5.6 years) who participated in the 10-week non-placebo-controlled trial were randomized to one of the following 4 groups: GC: 3 g BCAA (222 mg leucine (L), 232 mg isoleucine (I), 248 mg valine (V)), P: placebo; GCR: Creatine HCl for 6 weeks, and P + HMB: Creatine/HMB for 10 weeks. RESULTS: The results showed that lean mass increased in both moments when intragroup values were compared (CMG Pre 53.81 ± 6.67 and Post 54.98 ± 6.28 p=0.000025; HCig Pre 54.81 ± 5.96 and Post 55.29 ± 6.07; p=0.002). Regarding fat percentage, creatine hydrochloride supplementation showed significant decrease (HCig Pre 5.28 ± 1.44 and Post 4.37 ± 1.32; p=0.0001). There were similar strength gains between the two supplements in the post-period (CMG Pre 93.09 ± 18.66 and Post 96.64 ± 16.20; p=0.00014; HCig Pre 96.91 ± 15.35 and Post 102.00 ± 14.94; p=0.0018). Finally, the psychophysiological analysis (RPE) showed changes in the athletes’ perception regarding the training only at the end of the creatine hydrochloride period (HCig Pre 3.27 ± 0.90 and Post 2.18 ± 0.75; p=0.0003). CONCLUSIONS: We concluded that both creatines were effective in relation to muscle mass gains (p<0.05), but only HC1 catabolism was able to promote body composition and self efficacy perception changes.

Exercise-induced fatigue may be caused by increases in cerebral serotonin resulting in symptoms of central fatigue (i.e. decreased mood, and increased stress and sleepiness). Branched-chain amino acid (BCAA) supplementation is one intervention that can reduce symptoms of central fatigue by competing for the tryptophan transporter reducing serotonin synthesis. Psychological monitoring tools such as The Daily Analysis of Life Demands for Athletes (DALDA) Questionnaire can be used to study symptoms of central fatigue by identifying sources of general and sport-specific stress as well as an athlete’s reaction to stressors. PURPOSE: To examine the response of BCAA on stress perception of trained collegiate distance runners using DHALDAA. METHODS: Twenty-four elite rowers (27.0 ± 5.6 years) who participated in the 10-week non-placebo-controlled trial were randomized to one of the following 4 groups: GC: 3 g BCAA (222 mg leucine (L), 232 mg isoleucine (I), 248 mg valine (V)), P: placebo; GCR: Creatine HCl for 6 weeks, and P + HMB: Creatine/HMB for 10 weeks. RESULTS: The results showed that lean mass increased in both moments when intragroup values were compared (CMG Pre 53.81 ± 6.67 and Post 54.98 ± 6.28 p=0.000025; HCig Pre 54.81 ± 5.96 and Post 55.29 ± 6.07; p=0.002). Regarding fat percentage, creatine hydrochloride supplementation showed significant decrease (HCig Pre 5.28 ± 1.44 and Post 4.37 ± 1.32; p=0.0001). There were similar strength gains between the two supplements in the post-period (CMG Pre 93.09 ± 18.66 and Post 96.64 ± 16.20; p=0.00014; HCig Pre 96.91 ± 15.35 and Post 102.00 ± 14.94; p=0.0018). Finally, the psychophysiological analysis (RPE) showed changes in the athletes’ perception regarding the training only at the end of the creatine hydrochloride period (HCig Pre 3.27 ± 0.90 and Post 2.18 ± 0.75; p=0.0003). CONCLUSIONS: We concluded that both creatines were effective in relation to muscle mass gains (p<0.05), but only HC1 catabolism was able to promote body composition and self efficacy perception changes.

Purpose of the present study was to experimentally investigate the effect of supplementation with creatine (Cr) and/or L-β-hydroxy-β-methylbutyrate (HMB) on muscle recovery in elite rowers using anabolic and catabolic hormones. The hypothesis was that supplementation with both HMB + Cr for 10 weeks would improve muscle recovery, as measured by testosterone and T/C ratio, to a greater degree than would each individual supplements alone. METHODS: Twenty-four elite rowers (27.0 ± 5.6 years) who participated in the 10-week non-placebo-controlled trial were randomized to one of the following 4 groups: GC: Control group; GCR: Group supplemented with Cr 0.04 g / kg / day; GHMB: Group supplemented with HMB (3 g / day); and, GCR + HMB (supplemented with the same doses as individual). RESULTS: There were significant differences in testosterone behavior, as well as in the Testosterone / Cortisol ratio (T/C) between groups. Higher testosterone levels were observed in GCR + HMB than in the others (p < 0.05). A smaller decrease in the T / C ratio in the GCR + HMB than in the others was also observed (p < 0.05). CONCLUSIONS: This study indicates that combined supplementation with Cr (0.04 mg / kg) together with β-hydroxy-β-methylbutyrate (HMB) (3 g / kg) in elite rowers favors endogenous recovery through an increase in total testosterone and maintenance of the T / C ratio.
PURPOSE: Creatine supplementation before and after resistance training may be an important strategy for increasing aging muscle health; however, it is unknown whether the timing of creatine ingestion influences aging bone health.

METHODS: Using a double-blind, repeated measures design, aging adults were randomized to one of two groups: Creatine-Before (CB: n=15; 52.2 ± 2.5 yrs, 170.1 ± 9.9 cm, 77.1 ± 15.6 kg; creatine [0.1g kg⁻¹] immediately before resistance training and placebo [0.1g kg⁻¹ corn-starch maltodextrin] immediately after resistance training) or Creatine-After (CA: n=12; 55.2 ± 3.5 yrs, 173.4 ± 8.2 cm, 86.8 ± 20.1 kg; placebo immediately before resistance training and creatine immediately after resistance training). Resistance training (11 exercises) was performed 3 days/week for 8 months. Prior to and following training and supplementation, bone mineral content (BMC) and density (BMD) of the whole body, femoral neck, lumbar spine, and hip was measured by dual energy x-ray absorptiometry.

RESULTS: There was a main time effect (p=0.04) for femoral neck BMC (CB: pre 0.80 ± 0.11g, post 0.79 ± 0.11g; CA: pre 0.87 ± 0.15g, post 0.86 ± 0.13g) and a group x time interaction for hip BMD (p=0.02). Hip BMD was preserved in the CA group overall (pre 1.01 ± 0.15g/cm², post 1.00 ± 0.10g/cm²) whereas the CB group experienced a slight reduction (pre 0.98 ± 0.12g/cm², post 0.96 ± 0.12g/cm²). There were no other differences (p>0.05).

CONCLUSIONS: Creatine supplementation immediately following resistance training helps preserve hip BMC. Creatine supplementation only on training days has no effect on bone mineral in aging adults.

2377 Board #213 June 1 11:00 AM - 12:30 PM
Effect of Preand Post-Exercise Creatine Supplementation on Bone Mineral in Aging Adults
Darren Glenn Candow, Sarah Johannsmeyer. University of Regina, Regina, SK, Canada.

(No relevant relationships reported)

PURPOSE: The effect of whey protein enriched with leucine compared to whey protein plus calcium-β-hydroxy, β-methylbutyrate (HMB) on skeletal muscle strength, mass, and recovery during 12 weeks of an undulating periodized resistance training (RT) program in young men.

METHODS: Twenty-six recreationally trained men (26±2y, RT aged 23±2y, lean mass 63.0±2.6kg) performed 12 weeks of a 3-phase RT program. Participants underwent 8 weeks of undulating periodized RT (Phase 1), followed by a 2-week overreaching period (Phase 2), and a 2-week taper (Phase 3). During the 12-week RT program, participants were randomized to ingest: whey protein (25g) with added HMB (1.5g) (Whey+HMB; n=13) or whey protein (25g) with added leucine (1.5g) (Whey+LEU; n=13), twice daily. One-repetition maximum (1-RM) strength tests were conducted throughout Phase 1, Phase 2 and upon completion of Phase 3. Fat and bone-free mass (FBFM) was measured with dual-energy X-ray absorptiometry (DXA) scans at weeks 0,4,8,10,12. B-mode ultrasound was performed to assess muscle thickness (MT) and cross sectional area (CSA) at weeks 0,8,12.

RESULTS: Systemic hormone concentrations were measured at weeks 0,4,8,9,10,12. In response to RT, participants increased their 1-RM for squat, bench-press and deadlift (p<0.01), with no significant differences between groups. FBFM increased similarly in Whey+HMB and Whey+LEU (2.3±1.2kg and 2.6±1.9kg, respectively; ANOVA indicated a significant group by time interaction for LM, bench press 1RM, and leg press 1RM (p<0.05). LM increased by 4% (+2.3 ± 0.2kg) in the PAPRE group, while increases in bench and leg press 1RM were 23% (+14.7 ± 0.7kg) and 50% (+132.1 ± 13.9 kg), respectively. There were no other group by time interactions for any of the variables assessed (p>0.05). LM (p< 0.05), bench press (p= 0.001), and leg press 1RM (p<0.01) indicated a significant time effect (+0.93 ± 0.02kg, +6.3 ± 0.9kg, and +68.2 ± 2.5kg, respectively). Body fat percentage showed a trend for decreasing over time (p<0.05), while FM was significantly reduced over the 8-week training period (p<0.05). Bench press increased 20% (+13.0 ± 2.0kg) from baseline for the APRE group, while leg press increased 13% (+32.9 ± 7.3kg), 18% (+43.1 ± 8.5kg), and 20% (+64.6 ± 28.8kg) for CON, PO, and APRE groups, respectively.

CONCLUSION: The synergistic effects of protein plus exercise can be seen with the PAPRE group out-performing all other groups given the significant increases in LM and muscular strength over 8 weeks.

2379 Board #215 June 1 11:00 AM - 12:30 PM
Branched-chain Amino Acid Supplementation May Produce Marginal Reductions in Muscular Soreness in Collegiate Distance Runners
Asher Flynn, Tara Whiton, Kimikate Sato. East Tennessee State University, Johnson City, TN.

(No relevant relationships reported)

Branched-chain Amino Acid Supplementation May Produce Marginal Reductions in Muscular Soreness in Collegiate Distance Runners
Asher Flynn, Tara Whiton, Kimikate Sato
East Tennessee State University

INTRODUCTION: A normal response to a rigorous training program is delayed onset muscle soreness (DOMS) often characterized by painful, tender, and swollen muscles with reduced range of motion and strength loss. These symptoms can take 24-48 hours to appear and dissipate within 5 to 7 days. Ingesting branched-chain amino acids (BCAA) has been shown to mitigate symptoms of DOMS by reducing muscle damage factors, sparring protein, and increasing muscle protein synthesis. PURPOSE: The purpose of this study was to investigate the influence of BCAA on perception of muscular soreness in collegiate runners.

METHODS: 8 collegiate distance runners (men n=4, women n=4) took BCAA supplement (SUP) (0.08g/kg) or placebo (PLA) daily for 6 weeks, alternating conditions each week. Each morning prior to training, athletes filled out a 10-point scale Soreness Chart in which they rated soreness of all major muscle groups on both anterior (ANT) and posterior (POST) body segments 1 (no pain at all) to 10 (excruciating pain). Responses were totaled for each condition (SUP or PLA) and body segment (ANT or POST). Preliminary analyses for data, upper extremity data were excluded. Data were analyzed using paired-samples T-test to compare mean scores between PLA and SUP phases. RESULTS: Statistical significance ranged from p=0.09 – 0.89 depending on lower extremity segments. Based on descriptive analyses, athletes reported higher ratings of soreness in the ANT segment of the lower body. Overall soreness ratings were lower in SUP weeks vs PLA in both ANT and POST (SUP: ANT= 98.0 ± 7.18%, POST= 97.18% ± 39.72% and PLA: ANT= 108.72% ± 38.41%, POST= 110.32% ± 38.60%) but did not reach statistical significance. CONCLUSION: Although significance was not met, some note-worthy changes were captured. For instance, leg muscles, the primary movers involved in running, had a greater tendency to be less sore while...
on the supplement. Since gains in athletic performance can often be marginal, it is possible that marginal reductions of DOMS can eventually lead to an improvement training experiences.

2380 Board #216 June 1 11:00 AM - 12:30 PM The Effects of Creatine Loading on Dynamic Balance, Mobility and Strength in Older Adults Joseph Reale, John Petrizzo, John Wygand, FACSM, Melhaney Reichelt, Glen Reid, Robert M. Otto, FACSM. Adelphi University, Garden City, NY. (Sponsor: Robert M. Otto, FACSM) (No relevant relationships reported)

Aging often attenuates balance and strength regardless of activity profile, thus resulting in an increased risk of falling. Older populations taking part in a resistance training program tend to minimize the loss of lean body mass, but still may suffer decrements.

Creatine (Cr) supplementation has been studied extensively for almost 20 years and is a popular supplement of choice by athletes. Cr purportedly provides an enhancement of the phosphocreatine energy system allowing users to maintain a greater work intensity for an extended time. PURPOSE: To determine if acute Cr supplementation (20g of Cr/kg body mass for 5 days) improves balance, mobility, and strength in older adults.

Methods: Ten subjects (age 64.4±5.2 yr., ht. 168 ± 5.6 cm, body mass 76.3 ± 8.1 kg, 96%) participated in familiarization trials conducted on the Biodex Balance SD (four conditions: normal stance w/ eyes open (NEO), N w/ eyes closed (NEC); and closed stance w/ eyes open (CEO), and C w/ eyes closed (CEC)), isokinetic knee extension (KE) and knee flexion (KF) peak torque (N/lbs) and the Timed Up and Go Test (TUG) expressed in seconds. The battery of tests were conducted in the same sequence for each of the four assessments (pre control [PC], post control [PoC], pre Cr [PCr], and post Cr [PoCr]). Subjects were randomly assigned to 5 days of either 20 g of Cr or a matched placebo in a double blind protocol with a washout period of 14 days between treatments. Cr and placebo were indistinguishable in volume, taste, flavor, texture and color. Results: Statistical analysis by ANOVA revealed NSD (p>.05) between treatments.

Conclusions: The acute use of Cr loading for individuals aged ≥50 is ineffective in altering muscular strength, balance or mobility for moderately active adults. It may require a longer period of loading or larger doses for creatine to be effective in older populations.

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2381 Board #217 June 1 11:00 AM - 12:30 PM The Effect of Pre-sleep Protein Supplementation After Resistance Exercise on Next Day Performance and Recovery Margaret Morrissey, Andrew McKune, Michael Ormsbee, FACSM. Florida State University, Tallahassee, FL. University of KwaZulu-Natal, Durban 4000, South Africa. University of Canberra, Bruce, Canberra ACT 2601, Australia. (Sponsor: Michael Ormsbee, FACSM) (No relevant relationships reported)

PURPOSE: To evaluate the effect of pre-sleep protein supplementation after an acute bout of resistance training on performance and post-exercise recovery the following day. METHODS: Eighteen athletic men performed a single bout of eight sets of eight repetitions of weighted barbell squats and weighted barbell chest press immediately followed by an exercise recovery drink (60g carbohydrate, 20g whey protein). The participants received either a pre-sleep protein supplement (PRO) containing 40g of casein protein (n=10; mean ± SD; age = 24.0 ± 3.6 years; height = 1.81 ± 0.08m; weight = 84.91 ± 9.45kg) or a non-caloric, flavor matched placebo (PLA; n=8; age = 28.38 ± 9.97yrs; height = 1.81 ± 0.07m; weight = 86.68 ± 10.93kg) 30 min before sleep (1 hour after recovery drink). Blood samples were obtained at baseline (BL), pre- and post-exercise, prior to pre-sleep supplementation, and the following day to assess creatine kinase and C-reactive protein. Visual analog scales were utilized to assess perceived pain, hunger, and recovery. One-RM tests for bench and squat were performed at BL and the day following resistance exercise. Jump performance was assessed at BL, immediately post-exercise, and the day following resistance exercise. Statistical analyses were performed using SPSS (V.23) and p ≤ 0.05 was considered statistically significant; values reported as mean ± SD. RESULTS: PRO reported significantly less hunger the following day compared to PLA, which represented a moderate and probably beneficial effect (PRO: 3.61 ± 2.85, PLA: 6.94 ± 2.22, 95% C.I. = 0.1, 2.0; p=0.04; d = 1.1; 95% C.I. = 0.1 – 2.0). Although perceived recovery was not significantly different (p=0.14), the effect of PRO was interpreted as moderate and possibly beneficial (PRO:7.36 ± 1.71, PLA: 5.76 ± 2.13; d = 0.8; 95% C.I. = -0.1, 1.8). There were no significant differences between groups in post-exercise recovery biomarkers or muscular performance assessments. Jump squat power was significantly higher in PLA at 6 hours post-exercise compared to PRO (16.4 W.kg⁻¹, 22.9 ± 18.4 W.kg⁻¹, respectively; p=0.02). CONCLUSIONS: Pre-sleep protein supplementation after resistance exercise may improve perceived rate of recovery and hunger the following day with no effect on next day performance. This study was supported by Dymatize Nutrition.

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2382 Board #218 June 1 11:00 AM - 12:30 PM The Effects Of Leucine-enriched Branched-chain Amino Acid Supplementation On Exercise-induced Muscle Damage Gabriela Juache, Adam Osmond, Dean Directo, Michael Wong, Edward Jo. Cal Poly Pomona, Pomona, CA. (No relevant relationships reported)

A significant degree of efficacy of branched-chain amino acid (BCAA) supplements in attenuating the symptoms of exercise-induced muscle damage (EIMD) and accelerating recovery from intense exercise have been demonstrated. Of the BCAA, leucine is evidently most contributory to the anabolic and anti-catabolic properties of BCAA in skeletal muscle. The speculation that supplementary leucine alone would likewise attenuate the symptoms of EIMD is within scientific reason. However, a leucine-enriched BCAA supplement (LBCCA) or a free-form leucine supplement (LEU) further attenuates EIMD when compared to a conventional BCAA supplement remains of significant debate. PURPOSE: To examine the effects of LBCCA and LEU supplementation on select markers of EIMD elicited by a bout of damaging exercise.

METHODS: Participants completed a bout of damaging eccentric-based resistance exercise (ECRE) following a 7-day supplementation period with either a conventional BCAA supplement (BCCAA), LBCCA, or LEU. Muscle soreness, mean average power (MAP), mean peak power (MPP), lower body flexibility, and pressure-pain threshold were measured immediately before ECRE (0 hours) and at 24, 48, and 72 hours following ECRE. RESULTS: MAP (45 ± 56%, p<0.01) and MPP (41 ± 20%, p<0.05) decreased at 48 hours post-ECRE in LEU only. Additionally, at 48 hours post-ECRE, MPP in LEU was significantly lower than BCAA (41 ± 20% vs. 98 ± 15%, p<0.05). During restesting conditions, LBCCA reported increased soreness from 0 to 48 hours post-ECRE (p<0.05), while LEU reported increased soreness from 0 to 24 hours post-ECRE (p<0.05), and LBCCA exhibited no changes from 0 hours. During a contracted state, both LBCCA and LEU demonstrated increased soreness from 0 to 24 and 48 hours post-ECRE (p<0.05) while BCAA only exhibited an increase from 0 to 48 hours post-ECRE (p<0.05). All groups returned to baseline soreness levels at 72 hours post-ECRE. There were no other differences in lower body flexibility and pressure-pain threshold among supplementation groups. CONCLUSION: LBCCA and LEU failed to afford any discernible advantages to recovery from a bout of damaging exercise over BCAA.

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2383 Board #219 June 1 11:00 AM - 12:30 PM BCBA Supplementation Improves Mental Performance Following a Soccer-Specific Conditioning Session Beau K. Greer, Matthew S. Manzo. Sacred Heart University, Fairfield, CT. (No relevant relationships reported)

The efficacy of branched-chain amino acid (BCBA) supplementation on exercise performance has been researched extensively, but influence on post-exercise mental performance remains understudied. PURPOSE: The present study sought to determine the efficacy of BCBA supplementation on cognitive and psychomotor performance after a high-intensity conditioning session, as well as on post-exercise rating of perceived exertion (RPE). METHODS: In a double-blind manner, 14 male Division I collegiate soccer players performed a smartphone-based Stroop test (EncephalApp) immediately before and after a conditioning-heavy, 80-minute soccer practice. Before and during practice, subjects ingested a water-based solution containing either BCBA (SUPP; n=7) or an isocaloric amount of maltodextrin (PLAC; n=7) at fixed time intervals. The Stroop treatment regimen contained a total of 18 grams of BCBA, with a 3:1:1 ratio of leucine, isoleucine, and valine, respectively. Paired t-tests were used to assess within-group differences. Session RPE was assessed 30 minutes post-exercise, and between-group comparisons were made via a Mann-Whitney U test. RESULTS: Subjects in the SUPP group had significantly (p<0.05) improved performance on the EncephalApp following exercise (11.1 ± 1.5 s) as compared to before exercise (13.4 ± 3.6 s). There was not a significant difference (p>0.05) between pre-exercise (12.5 ± 2.2 s) and post-exercise (11.0 ± 1.4 s) performance in the PLAC group. No between-group difference was found for session RPE (p>0.05).

CONCLUSIONS: This evidence suggests that BCBA supplementation before and during exercise may improve certain aspects of post-exercise cognitive and psychomotor performance, but without influencing session RPE.

Abstracts were prepared by the authors and printed as submitted.
PURPOSE: To compare the effects of timing supplementation with creatine monohydrate in isometric strength in male college soccer players.

METHODS: Fifteen male college soccer players were supplemented with creatine monohydrate for 26 days with a load phase (5 days 20 g creatine/d) and a maintenance phase (21 days 5 g creatine/d). In the maintenance phase subjects were assigned, in a randomized and double blind form, to either consume 5 g of creatine before training and 5 g of maltodextrin after training (CRB) or 5 g of maltodextrin before training and 5 g of creatine after training (CRA) diluted in flavored water. At the same time a physical conditioning program was carried out (resistance training + soccer training 2 d/week; soccer training only 3 d/week). Before and after intervention, isometric strength in biceps, back, legs and forearms were evaluated through dynamometry. Similarly, nutritional intake was evaluated (before and after) through 24-h dietary recalls. The strength and nutritional variables were compared by group (CRB vs CRA) and by time (PRE vs POST).

RESULTS: There were no significant differences in strength variables between groups at the beginning nor at the end of the study. However, CRB group had a significant increase in leg strength at the end of the study. The CRA group also had significant changes at the end of the study; an increase in back strength and leg strength were found. However, CRB group had a significant increase in strength in biceps, back, legs and forearms. were evaluated through dynamometry. Similarly, nutritional intake was evaluated (before and after) through 24-h dietary recalls. The strength and nutritional variables were compared by group (CRB vs CRA) and by time (PRE vs POST).

CONCLUSIONS: Both CRA and CRB showed similar strength gains in legs but CRA helped to increase strength in back, considering that energy and protein intake for markers of renal, hepatic and muscle function (aspartate transaminase; alanine aminotransferase; alkaline phosphatase; lactate dehydrogenase; albumin; globulin; creatinine; estimated glomerular filtration rate and creatine kinase). Data were analysed using mixed model ANOVA. RESULTS: There were no significant differences in creatine content at Week 0 (BA: 13.67 ± 18 mmol·kg\(^{-1}\)·dm; PL: 27.75 ± 4.86 mmol·kg\(^{-1}\)·dm; p = 0.21). There was a significant main effect of group (p = 0.04) on muscle creatine, with overall lower values in PL, although there was no main effect of time or interaction effect (both p > 0.05; BA, Week 12: 35.93 ± 8.79 mmol·kg\(^{-1}\)·dm and Week 24: 35.42 ± 6.16 mmol·kg\(^{-1}\)·dm; PL, Week 12: 27.67 ± 4.75 mmol·kg\(^{-1}\)·dm and Week 24: 31.99 ± 6.00 mmol·kg\(^{-1}\)·dm). There was no effect of treatment, time or any interaction effects on any blood marker (all p > 0.05) and no self-reported side effects in these participants throughout the study. CONCLUSION: The current study showed that twenty-four weeks of BA supplementation at 6 g·day\(^{-1}\) did not affect muscle tissue content, clinical markers of renal, hepatic and muscle function, nor did it result in chronic sensory side-effects, in these healthy individuals. Since athletes are likely to engage in chronic supplementation, these data provide important evidence to suggest that supplementation with BA at these doses for up to 24 weeks do not adversely affect these markers in healthy individuals.
area under curve (AUC) tended to be different between treatments (P=0.061), and I-FABP AUC was significantly different in the post-exercise period (P<0.006). Post hoc testing showed significantly lower I-FABP AUC in SUC vs PLA (1096±2182 vs 3900±3731, P=0.022). No differences were observed between NIT and PLA (P=1.0).

Conclusions: Sucrose but not nitrate ingestion lowers gut injury evoked during high-intensity exercise. These results suggest that sucrose, but not nitrate, may prevent hyperperfusion-induced GI damage during exercise and, as such, may prevent or lower exercise-related GI symptoms.

Supported by a grant from the Dutch Technology Foundation STW

2387
Board #223 June 1 11:00 AM - 12:30 PM The Effect Of Nitrate Supplementation Through Powdered Beetroot Juice In Endurance Athletes Over The Time Required To Complete A 10-km Bicycle Time-trial.
Alexia Wiegandt Rohde. Universidad Iberoamericana Mexico City, Mexico City, Mexico.

(No relevant relationships reported)

It has been found that nitrate supplementation in the diet of athletes may have ergogenic effects, such as a decrease in the cost of oxygen when exercising at low or moderate intensity. Significant improvement has also been observed in the results of several time trials or incremental exercise tests after nitrate supplementation. Nitrate supplementation is achieved through beetroot consumption, since it is one of the nitrate-richest foods, containing over 250 mg. of nitrate per 100 g gross weight.

PURPOSE: Analyze if a group of endurance athletes reduce their time to complete a 10km time-trial on a stationary bicycle after a 5-day supplementation period with powdered beetroot juice.

METHODS: Amateur runners, cyclists and triathletes who participate regularly in sports events in any of the disciplines mentioned before participated in this study. Two groups were performed: the subjects arrived at the laboratory having taken the last dose of either placebo or supplement 2 hours earlier. This supplement should have been taken daily during the previous four days. After remaining seated for 10 minutes blood pressure and cardiac rhythm was measured. A 10 kilometer time-trial on the stationary bicycle was performed, during which oxygen volume, cardiac rhythm and pedaling power was measured. Subjects were asked periodically at what level in the Scale of Perceived Exertion (6-20) they felt the heart rate frequency to be restored to its initial value was measured. RESULTS: Participants were able to increase their power significantly after supplementation with beetroot juice powder 159.2 (27.3-287.3) Watts, as compared to the placebo 130.85 (26.7-260.3) Watts (p=0.041). A significant reduction of approximately 56 (15:12-22.34) seconds was also achieved in the time the participants required to cover 10 Km on the stationary bicycle (p=0.41).

CONCLUSIONS: Beetroot juice in powder or liquid form may improve athlete’s performance, since it increases considerably the power that may be exerted during a sub maximal exercise test, such as that of 10 Km by bicycle. It still remains to be determined whether these effects are consistent with those in professional athletes, since there are no studies to prove it, and whether these effects are just as efficient in longer distances.

2388
Board #224 June 1 11:00 AM - 12:30 PM The Effects of Beetroot Juice Supplementation on Cycling Time-Trial Performance in Normoxia and Moderate Hypoxia
Samantha Fessler. East Stroudsburg University, East Stroudsburg, PA. (Sponsor: Shala Davis, FASCM)

(No relevant relationships reported)

Recent research has shown that Beetroot Juice (BR) ingestion assists in Nitric Oxide (NO) production and may increase exercise efficiency, decrease muscular fatigue, increase mitochondrial respiration, increase calcium handling, elevate glucose uptake, and aid vasodilatation. Also, given evidence for the detrimental effects of environmental hypoxia on exercise due to decreases in partial pressure of arterial oxygen, it has been found that nitrate supplementation in the diet of athletes may have ergogenic effects, such as a decrease in the cost of oxygen when exercising at low or moderate intensity. Significant improvement has also been observed in the results of several time trials or incremental exercise tests after nitrate supplementation.

PURPOSE: To investigate the effect of inorganic nitrate (NO-3) supplementation on O2 uptake (VO2), and deoxy-hemoglobin (Hb) kinetics at contrasting muscle depths during the onset and offset of submaximal cycle exercise.

METHODS: In a randomized, cross-over study, eight males completed step cycle tests at a work rate equivalent to 50% of the difference (Δ) between the gas exchange threshold and peak VO2 over 4-day supplementation periods with NO-3-rich beetroot juice (BR; providing 8.4 mmol NO3- ‘day’) and NO3-depleted placebo (PLA) beetroot juice. Pulmonary VO2 was measured and absolute deoxy-Hb+Mb was determined in the superficial and deep vastus laterals (i.e. VL-s and VL-d, respectively).

RESULTS: Whereas primary VO2 kinetics (i.e. on versus off) were symmetrical, the primary deoxy-Hb+Mb mean response time (MRT)3 slowed within the VL-s during the off- compared to on- transient (P < 0.05). There were no significant differences (P > 0.05) between the PLA and BR trials in the deoxy-Hb+Mb MRTs, within the VL-s at exercise onset (PLA: 21 ± 5 vs. BR: 22 ± 5 s) or offset (PLA: 32 ± 4 vs. BR: 32 ± 9 s). Likewise, whilst the primary deoxy-Hb+Mb amplitude was asymmetrical within the VL-d (i.e. off > on, P < 0.05), there were no significant differences (P > 0.05) between supplementation conditions at exercise onset (PLA: 27 ± 3 vs. BR: 16 ± 20 µM) or offset (PLA: 37 ± 4 vs. BR: 21 ± 26 µM).

CONCLUSIONS: Dietary NO3- supplementation does not affect the dynamic asymmetry of muscle deoxy-Hb+Mb kinetics (and by extension the matching between O2 delivery to utilization) within deep and superficial sites during intense submaximal exercise.

2389
Board #225 June 1 11:00 AM - 12:30 PM Effect Of Inorganic Nitrate Supplementation On O2 Uptake And Quadriceps Deoxygenation During The Onset And Offset Of Exercise.
Brynmor Breese1, David Poole, FASCM3, Dai Okushima1, Stephen Bailey2, Andrew Jones, FASCM, Narihiko Kondo3, Tatsuro Amano4, Shunsaku Koga2, ’Plymouth University, Plymouth, United Kingdom. ’Kansas State University, Manhattan, KS. ’Kobe Design University, Kobe, Japan. ’Loughborough University, Loughborough, United Kingdom. ’Exeter University, Exeter, United Kingdom. ’Kobe University, Kobe, Japan. ’Niigata University, Niigata, Japan.

(No relevant relationships reported)

PURPOSE: To investigate the effect of inorganic nitrate (NO-3) supplementation on O2 uptake (VO2), and deoxy-hemoglobin (Hb) kinetics during intense submaximal exercise.

METHODS: Using a double-blind, repeated measures crossover design, 11 Division III collegiate distance runners (mean ± SD: age = 20.3 ± 1 yr, VO2peak = 55.5 ± 8.1 ml kg-1 min-1) consumed either 120 ml day-1 of BR or placebo (PL) for 4 days. On day 5 of each 4-day supplementation period, subjects completed an exercise trial on a motorized treadmill consisting of five minutes of running at 65%, 85%, and 100% of volume of oxygen uptake reserve (VO2R) separated by 2 minutes each. BR and PL supplementation protocols were separated by a 7-day washout period. Thirty breaths repeated measures ANOVAs were used to determine the effect of treatment (BR or PL) and exercise intensity (65%, 85%, and 100% VO2R) on VO2R, heart rate (HR), respiratory exchange ratio (RER), and rating of perceived exertion (RPE).

RESULTS: There were no statistically significant interactions between treatment and exercise intensity for VO2R, HR, RER, or RPE. The main effect of treatment was not statistically significant for HR, F(1, 10) = 0.514, p = 0.490; RER, F(1, 10) = 0.590, p = 0.462; or RPE F(1,10) = 0.562, p = 0.471. However, the main effect of treatment was statistically significant for VO2R, where BR (2.43±0.18 L·min-1) was lower compared to...
2391 Board #227  
June 1 11:00 AM - 12:30 PM  
Acute Dietary Nitrate Supplementation has no Significant Effect on Wasted Left Ventricular Energy in Young Healthy Individuals  
Jozelyn Rascon1, Francisco J. Morales1, Brycen J. Ratcliffe2, Caleb D. Harrison2, Evan J. Bockover2, Sierra Crowe1, Colin R. Carriker1, Alvaro N. Gurovich, FACSM1. 1The University of Texas at El Paso, El Paso, TX. 2Indiana State University, Terre Haute, IN. 3High Point University, High Point, NC.  
(No relevant relationships reported)  

Cardiovascular disease is the leading cause of death worldwide and is associated with low levels of Nitric Oxide (NO) bioavailability. NO is a vascular protective agent, which bioavailability could increase through dietary nitrate supplementation. Wasted left ventricular energy (LVEw) represents the added workload the ventricle must produce during the duration of the reflecting pressure wave within a cardiac cycle. This energy is wasted because there is no blood flow gain produced by the extra work being exerted by the ventricle. LVEw is associated with arterial stiffness, left ventricular hypertrophy, and refractory angina syndrome. Higher levels of NO are associated with lower cardiovascular disease risks. Therefore, an increase in NO through dietary nitrates might reduce LVEw.  

METHODS: A double-blind, cross-over study design was performed in 17 young, healthy subjects (18 to 24 years old). Four lab visits were scheduled within 10 days; the first 2 visits in back to back days and the last 2 visits one week after. Subjects were asked to follow a low-nitrate diet for 3 days (NHBL: 7 East Low-Nitrate Diet), starting two days prior to the first and third lab visits. Two hours before visits 2 and 4, subjects were asked to drink 800 mg of nitrate or placebo (solutions randomly assigned). LVEw was calculated using LVEw = ((π/4) x (Ps-Pi) x (ED - ΔTp) x 1.333) where ED is ejection duration, Ps and Pi represent central systolic pressure and the central incident pressure reflecting pressure wave, respectively, and ΔTp is the round trip travel time of the reflecting pressure wave. PWA was measured non-invasively with a cuff-based PWA device (Sphygmocor Xcel®). A two-way repeated measurements ANOVA (time x sex) was performed and significance was set at alpha=0.05.  

RESULTS: LVEw ranged from 736 ± 644 dynes·cm⁻² at baseline in males to 977 ± 917 dynes·cm⁻² after placebo, also in males and there was no significant interaction (time x sex).  

Conclusions: These results show that an acute dose of dietary nitrate supplementation has no effect on LVEw in young healthy individuals. Further studies including the elderly or patients with hypertension should be performed to assess more clinical effects of dietary nitrates.

2392 Board #228  
June 1 11:00 AM - 12:30 PM  
Changes in Oxidative Stress and Resting Metabolic Rate after Acute Dietary Nitrate Supplementation  
Brycen J. Ratcliffe1, Caleb D. Harrison1, Evan J. Bockover2, Sierra Crowe1, Alberto Friedmann1, Francisco J. Morales1, Colin R. Carriker1, Alvaro N. Gurovich, FACSM1. 1Indiana State University, Terre Haute, IN. 3High Point University, El Paso, TX. 3High Point University, High Point, NC.  
(No relevant relationships reported)  

BACKGROUND: Cardiovascular disease is the leading cause of preventable death in the United States and the Western world. A major component of cardiovascular disease is the deterioration of the cardiovascular system by increased oxidative stress. Dietary nitrate supplementation could increase nitric oxide bioavailability, decreasing oxidative stress.  

PURPOSE: The purpose of the present study is twofold: 1) to determine the impact of an acute dietary nitrate supplementation on oxidative stress and 2) to assess the oxygen dependent nature of a dietary nitrate supplementation.  

METHODS: Eighteen (7 females and 11 males) apparently healthy subjects, aged 18-30 years of age, participated in a randomized, double blind, placebo-controlled crossover study. Following a 12-hour fast and adherence to an NIH-approved low-nitrate diet for 48 hours, subjects visited the lab on 4 occasions (identical protocols) within 2 weeks. A resting blood draw preceded 15 minutes of supine rest followed by a 20-minute period of metabolic gas analysis for determination of resting metabolic rate; RMR (True One, ParvoMedics, Sandy, Utah, USA). Visits 2 and 4 served as baseline controls for the placebo or dietary nitrate treatments (negligible and 800mg nitrate, respectively) which were consumed 2.5 hours prior to visits 3 and 5. The resting concentration of the oxidative stress marker 8-isoprostanate (8-ISO) was determined by ELISA testing using a commercial available kit (Cayman Chemical, USA). A 2-way repeated measures ANOVA was used to determine differences between protocols and over time, with an alpha of 0.05.  

RESULTS: There was no significant difference between placebo and dietary nitrate supplementation in oxidative stress (Placebo: 158±59 vs. 181±62 µmol/l; Active: 176±74 vs. 171±59 µmol/l; p=0.84) or in RMR (Placebo: 1839±308 vs. 1700±307 kcal/day; Active: 1828±318 vs. 1859±324 kcal/day; p=0.20).  

CONCLUSION: These data showed that acute dietary nitrate supplementation does not decrease resting oxidative stress. The conversion of nitrate to nitrite to nitric oxide has been previously described to be oxygen-independent. Our data supported this statement, as RMR did not change following the dietary nitrate supplementation.

2393 Board #229  
June 1 11:00 AM - 12:30 PM  
Effect of Increased Nitric Oxide Bioavailability on Endothelial Function and Pulse Wave Velocity  
Evan J. Bockover1, Sierra Crowe1, Brycen J. Ratcliffe1, Caleb D. Harrison1, Alberto Friedmann1, Francisco J. Morales1, Colin R. Carriker1, Alvaro N. Gurovich, FACSM1. 1Indiana State University, Terre Haute, IN. 3The University of Texas at El Paso, El Paso, TX. 2High Point University, High Point, NC.  
(No relevant relationships reported)  

BACKGROUND: Dietary nitrate supplementation is believed to increase the long-term bioavailability of nitric oxide (NO) within the body. This increase in NO bioavailability should lead to a decrease in arterial stiffness and an increase in endothelial function due to the vasodilator characteristics of NO.  

PURPOSE: The purpose of this experiment was to evaluate whether an increased NO bioavailability, achieved through dietary nitrate supplementation, improves pulse wave velocity (PWV) and flow-mediated dilation (FMD).  

METHODS: In a randomized double blind, placebo-controlled crossover design, eighteen (7 females, 11 males) apparently healthy subjects aged 18-30 years old visited the lab 4 times within 2 weeks. All subjects were required to fast for 10 to 12 hours prior to testing and each visit consisted of a resting blood draw followed by peripheral blood pressure acquisition, PWV and assessment of brachial FMD. Visits 2 and 4 (separated by a 1-week washout) were baseline controls and, 24 hours after, on visits 3 and 5 participants consumed a concentrate nitrate beverage or placebo (900mg and negligible nitrate, respectively) 2.5 hours prior to testing. Plasma nitrate/nitrite (NOx) concentration was determined by ELISA testing using a commercially available kit (Cayman, USA). A 2-way repeated measures ANOVA was used to determine differences between conditions and over time, with an alpha of 0.05.  

RESULTS: There was an acute increase in NOx concentration after dietary nitrate supplementation compared to the baseline control (1.2±1.3 vs. 27.1±10.8 µmol/l, p<0.01) while no difference was seen following consumption of the placebo: 1.7±1.5 vs. 1.7±1.1 µmol/l, p=0.311). No changes were observed for PWV (Placebo: 6.2±0.6 vs. 6.2±0.7 m/s; Active: 6.1±0.6 vs. 6.1±0.8 m/s, p=0.81), or FMD (Placebo: 9.7±6 vs. 9.6±0.2 %; Active: 10.4±5.9 vs. 9.9±7.3 %, p=0.96) between nitrate and placebo conditions.  

CONCLUSION: The data from this experiment illustrates that the dietary nitrate supplementation did provide an acute increase of NO bioavailability. However, this acute increase in NO bioavailability did not result in acute benefits to arterial stiffness or endothelial function measured via PWV and FMD, respectively.

2394 Board #230  
June 1 11:00 AM - 12:30 PM  
Effects of Beet Juice on Anaerobic Exercise Performance  
Clare Zamzow1, Matthew E. Darnell1, Philip Ford1, Scott A. Conger1, 1Boise State University, Boise, ID. 2University of Pittsburgh, Pittsburgh, PA. (Sponsor: Dawn P. Coe, FACSM)  
(No relevant relationships reported)  

Research suggests dietary nitrate contained in beet juice is beneficial during aerobic exercise. Its impact during anaerobic (i.e. short duration, high power) exercise has received much less attention. PURPOSE: To determine the effects of acute beet juice supplementation on anaerobic performance during 30-s and 60-s maximal effort cycling sprints. METHODS: Fourteen male hockey players participated in this study. The exercise protocol included maximal effort 30-s and 60-s tests (Wingate), on a stationary bike with a fixed amount of resistance applied relative to body weight. In addition to two familiarization trials, each participant completed in random order 30-s placebo and beet juice trials and 60-s placebo and beet juice trials. The beet juice supplement contained ~88mml/496 mg of dietary nitrate. Apple-cherry-cranberry juice served as the placebo, containing a negligible amount of dietary nitrate. Paired t-tests were run to compare performance in both the 30-s and 60-s trials, analyzing peak and mean power (W), peak and mean RPM, relative power (W/kg), total work (J), and fatigue index (FI, %). A one-way ANOVA was utilized to compare the change between the beet juice and placebo trials of the 30-s test, to the change between beet juice and placebo trials of the 60-s test. RESULTS: Beet juice supplementation yielded no statistical differences in any of the measured variables during the 30-s or 60-s tests.
A trend occurred during the 30-s test (p = 0.059), showing a decreased FI (53.44% vs. 56.01%), suggesting less fatigue occurred after beet supplementation, while there was no statistical difference in FI during the 60-s trials. The percent change for FI was significantly different between the 30 and 60-s tests (30-s: -5.24 9.70, 60-s: 0.50 5.94, p = 0.02). No other significant differences emerged between the 30-s and 60-s tests. CONCLUSIONS: A dose of ~8 mmol of beet juice did not improve anaerobic exercise performance during a 30-s or 60-s maximal effort cycling sprint. The performance differences were similar when comparing the 30-s and 60-s bouts after beet juice supplementation. Beet juice supplementation during high power, anaerobic exercise does not produce similar improvements in performance that have been reported during aerobic exercise.

Effect of Beet Root Juice on Delayed Onset Muscle Soreness Following Eccentric Loading.

The increase in prevalence of super foods, such as beet root, in popular culture has necessitated research into their effectiveness. Betalains, a prominent phytoneutrient in beet root, have proven to have both antioxidant and anti-inflammatory properties. Due to these qualities, betalains have the potential to augment the natural process of enhanced relaxation rates during ischemic exercise in post-menopausal women.

Methods:

Nineteen healthy, normotensive, post-menopausal women (57-64 years) performed intermittent handgrip exercise (10% of MVC, 30 per min) during progressive upper arm cuff inflation (+20 mmHg per min) on 3 study visits, with 7 to 10 days between visits. Approximately one week following visit 1, participants randomly consumed beet juice concentrate or a placebo (PLA) group. Prior to eccentric loading, participants were dosed twice daily (2x70mL) for six days. They were then subjected to an eccentric only load protocol (5 sets of 10 repetitions) on the biceps brachii using a Biodex Dynamometer. Several variables reflective of DOMS were measured including: maximal isometric voluntary contraction (MIVC), flexed arm angle (FAA), relaxed arm angle (RAA), subjective pain, point tenderness, and maximal contractile force. The indicators were measured at baseline and three time points following eccentric loading (24, 48, and 72 hrs). Dosing continued through the 72hr time point. Results: A significant treatment effect (p<0.03) was seen in reducing the angle at the elbow while being flexed (FAA) at all post exercise timepoints (24, 48, and 72 hrs) while being dosed with beet root juice concentrate. A trend toward a significant treatment effect (p=0.09) was observed in increasing isometric biceps brachii strength (MIVC). A significant time effect was observed (p<0.001) for all measured variables. Conclusion: This evidence suggests that BRJ has the potential to provide improvement in recovering from exercise induced muscle damage.

3296 Board #232 June 11 11:00 AM - 12:30 PM
Nitrates Supplementation Influences Contraction-Relaxation Rates During Ischemic Exercise in Post-Menopausal Women
Swapan Mookerjee1, Jin-Wang Kim2, Kristina Neely2, Jacqueline Tucker2, Yasina Sornani2, Michael P. Flanagan1, Daniel B. Kim-Shapiro. 1Penn State University, University Park, PA. 2Penn State University, University Park, PA. (Sponsor: David Nathan Proctor, FACSM)

Purpose: Recent studies suggest that dietary nitrate supplementation can increase contractile force development and relaxation rates in electrically-stimulated human and rodent muscles, particularly at low stimulation frequencies (i.e., conditions associated with enhanced SR Ca++ release). In the present study we retrospectively examined handgrip force recordings from a prior study in which we observed a nitrate-associated enhancement of ischemic exercise tolerance in older women. We hypothesized that rates of handgrip force development and relaxation would be increased during their nitrate supplement visit relative to their placebo visit.

Methods:

Nine healthy, normotensive, post-menopausal women (57-64 years) performed intermittent handgrip exercise (10% of MVC, 30 per min) during progressive upper arm cuff inflation (+20 mmHg per min) on 3 study visits, with 7 to 10 days between visits. Approximately one week following visit 1, participants randomly consumed 140 mL of nitrate-concentrated (0.6 g of nitrate; BrJ) or nitrate-depleted (BrJ) beetroot juice (James White Beet-It Organic; IND19978), with handgrip exercise beginning two hours post-consumption. Grip force recordings (1,000 Hz sampling rate) were subsequently analyzed and time to 90% peak force (90%) as well as half relaxation time (hrt) were determined.

Results:

Compared to responses observed during the BrJ, visit, BrJ consumption increased time to volitional fatigue (526±46 vs. 567±50 sec) (p<0.05). Significant Δ (BrJ-placebo - BrJ-nitrate) effects were noted for Δ 90% (mean 27 ± 31.15 msec, p<0.03) as well as a hrt (27.8 ± 31.6 msec, p<0.03), indicating a faster rate of force development as well as a faster relaxation rate with BrJ consumption. Visit order (i.e., practice) did not influence exercise tolerance. Conclusion: Acute dietary nitrate supplementation increases rates of muscle force development and relaxation during ischemic, very exercise in the older women, possibly implicating improved calcium handling as a mechanism underlying their enhanced fatigue resistance under these conditions.

Funding: Penn State Hershey Family and Community Medicine (JAFFE endowment)

3297 Board #233 June 11 11:00 AM - 12:30 PM
The Integrative Benefits Of Oral Nitrate Supplementation On Supra-Maximal Cycling Work Demands
Craig E. Broeder, FACSM1, Victoria Flores1, Bill Julian, Frank Wojan1, Rachel Tauber1, Laurie Schubert1, Amanda Salacinski1. 1Exercising Nutritionally, LLC, Naperville, IL. 2Northern Illinois University, DeKalb, IL. 3University of Massachusetts, Lowell, MA.

Purpose: This study investigated the effects beet nitrate supplementation had on cycling performance (power, force, cadence (Cad) speed (Spd), distance, time to fatigue, kJ (L) expended) during repeated high intensity intervals (HIIT). METHODS: Eight cyclists participated (Age: 41.4 ± 9.1; WT: 83 ± 9.6 kg; BF%: 21.7 ± 0.3; VO2 max: 4.20 ± 0.58 L/min, functional threshold power (FTP): 245 ± 6.43 watts). This study was a randomized, double-blind, crossover, matched pair design. Prior to the HIIT sessions, subjects consumed for 7-days placebo (PL) or an oral beet nitrate (BN) supplement. On the day of testing, after completing baseline measurements & 45 mins prior to the HIIT session, 10g of the treatment week’s supplement was consumed by each rider. The HIIT workload was set at a wattage 1.5 times greater than a cyclist’s baseline FTP, e.g., FTP = 200 watts; HIIT work interval = 300 seconds. Each HIIT segment was 75-secs and followed by a 2-min recovery at 50% of FTP. Cyclists were instructed to do as many intervals as possible. A matched pair t-test’s was used to compare each treatment for the summary data (i.e., total secs completed under the placebo versus beet supplementation conditions), HIIT trial total work data, and HIIT trial total recovery data. When a significant difference was observed, Cohen’s d effect size (ES) procedures were used to determine the magnitude. RESULTS: BN supplementation improved time to exhaustion (PL: 1,251 ± 562 secs, BN: 1,475 ± 504 secs; p = 0.02; ES = 0.423) and total energy expended (PL: 251.3 ± 48.6 secs, BN: 306.6 ± 55.2 kJ; p = 0.01; ES = 1.079) compared to PL. Subjects during the BN trials completed more intervals (BN: 8.14 ± 2.4, PL: 7.00 ± 2.5, p = 0.03, ES = 0.42) and cycled 23.9% further (BN: 13.5 ± 3.9 km, PL: 10.9 ± 4.0 km, p = 0.01, ES = 0.65). During the work segments, BN enhanced cadence and speed by 2.0% at the same force level as the force compared to PL (Cad: p = 0.02; ES = 0.20; Spd: p = 0.02; ES = 0.20). During recovery, comparing BN to PL, force was lower (PL: 68.2 ± 15.6 N, BN: 65.5 ± 13.7 N, p = 0.01, ES = 0.23). Cad was higher (PL: 91.8 ± 10.9 rpm, BN: 93.9 ± 7.4 rpm, p = 0.01, ES = 0.23). Spd was greater (PL: 30.7 ± 3.3 kph, BN: 31.4 ± 1.9 kph, p = 0.02, ES = 0.27). CONCLUSIONS: BN enhanced HIIT work and recovery performance allowing a more efficient maintenance of Cad, force, & Spd.

FRIDAY, JUNE 1, 2018

The consumption of beet juice has become particularly popular among athletes, due to the fact that dietary nitrate has been shown to enhance exercise capacity. This has resulted in many companies marketing beet juice products to the consumer demand. Depending on growing conditions, however, the nitrate content of beets can vary significantly. This makes it difficult for athletes to know how much nitrate they are actually ingesting. PURPOSE: To determine the quantity of nitrate (and nitrite) present in beet juice products marketed towards, or easily available to, athletes. METHODS: Samples from 26 different lots of 11 different beet juice products produced by 10 different companies were purchased locally or via the internet. After reconstituting (if necessary) and diluting each sample 1000x in water, nitrate and nitrite concentrations were measured using a dedicated high performance liquid chromatography system. The amount of nitrate and nitrite per serving was then calculated based on the measured concentrations and either 1) the manufacturer’s recommended serving size (for prepackaged/single dose products) or 2) a volume of 500 mL (for beet juice sold in bulk containers).

RESULTS: There was moderate-to-large variability in nitrate content between samples of the same product, with a mean coefficient of variation of 14.9±21.2% (range 2.3 to 60.6%). However, there was even

Abstracts were prepared by the authors and printed as submitted.
Exercise intolerance is a frequent complaint and an important predictor of mortality in patients with Chronic Obstructive Pulmonary Disease (COPD). Though several factors have been implicated in the development of muscle dysfunction with COPD, chronic oral fluoride (CF) ingestion has been suggested as a key factor in impaired muscle function. Thus, restoration of the redox balance and NO bioavailability using tetrahydrobiopterin (BH$_4$), an essential cofactor involved in the production of NO and free-radicals, appears to represent a novel therapeutic target for improving muscle oxygenation and metabolism in patients with COPD. PURPOSE: The aim of this study was to determine the effects of an acute BH$_4$ supplementation (10 mg•kg$^{-1}$) on peripheral O$_2$ delivery and muscle metabolism in the plantar flexor muscles of patients with COPD. METHODS: 5 patients with clinically diagnosed COPD performed dynamic plantar flexion exercise at 40% of maximal work rate with phosphorus magnetic resonance spectroscopy (P-MRS), near-infrared spectroscopy (NIRS), and vascular Doppler ultrasound assessments following oral supplementation of BH$_4$ or placebo (PL). RESULTS: Following BH$_4$ supplementation, exercise-induced changes in Phosphocreatine (PL: 4.1% ± 1.4%, P<0.05), inorganic phosphate (PL: 8.4% ± 2.2%, BH$_4$: 6.1% ± 1.4%, P<0.05), and pH (PL: 6.89 ± 0.12, BH$_4$: 6.97 ± 0.04, P<0.10) attenuated responses. In contrast, end-exercise limb blood flow was not significantly different between BH$_4$ and PL. CONCLUSION: Acute oral BH$_4$ supplementation in patients with COPD appears a promising therapy to, at least partially, restore skeletal muscle metabolism, thus potentially contributing to improved exercise tolerance and quality of life.

Purpose: To investigate the effects of sodium bicarbonate (SB) delivery method (gastro-resistant or gelatin capsules) and dosage on bicarbonate increase and side-effects in healthy men. METHODS: Forty men (age 27 ± 5 y; body mass [BM] 76.1 ± 11.4 kg; height 1.75 ± 0.06 m) participated in a double-blind and crossover study, composed of five laboratory visits. During each visit they received a different treatment: 0.3 g•kg$^{-1}$ BM of SB in gastro-resistant (RES3) and gelatin capsules (GEL3); 0.1 g•kg$^{-1}$ BM of SB in gastro-resistant (RES1) and gelatin capsules (GEL1); and 0.3 g•kg$^{-1}$ BM of corn flour (PL) at the start of each visit. Following an overnight fast subjects consumed a standardised breakfast one hour before ingesting the supplements. Blood samples were taken before and every 10-min following supplement ingestion for 3 h and then every 20 min for a further 1 h and were analysed for bicarbonate concentration (RAPIDLab 348, Siemens). Area under the curve (AUC), and peak bicarbonate were recorded. Side-effects were assessed using a modified questionnaire. Data were analysed using mixed-model ANOVA for blood variables and Friedman test for side-effects. RESULTS: There was a significant main effect of treatment on AUC and peak bicarbonate (both p<0.001), with greater values in RES3 (AUC: 1594.5; peak: 36.4 mmol•L$^{-1}$) and GEL3 (AUC: 1641.6; peak: 35.1 mmol•L$^{-1}$) compared to RES1 (AUC: 1069.6; peak: 31.8 mmol•L$^{-1}$), GEL1 (AUC: 888; peak: 31.5 mmol•L$^{-1}$) and PL (AUC: 849.3; peak: 29.7 mmol•L$^{-1}$); there were no differences between types of capsules. Side-effects were significantly different between treatments (X$^2$ =13.545; p<0.009), with higher incidence in RES3 and GEL3 than RES1, GEL1 and PL, with no differences between capsule types. CONCLUSIONS: The current study showed that blood variables were not different when SB was delivered in gastro-resistant and gelatin capsules, nor were any associated side-effects. The only differences shown were due to dose and not the type of capsule. SB supplementation in gastro-resistant capsules did not lead to greater increases in circulating bicarbonate or less side-effects compared to gelatin capsules.

Purpose: To evaluate the efficacy of a commercially available topical transdermal sodium bicarbonate (TSB) lotion (Topical Edge™) which is claimed to be in athletes. However, gastrointestinal side effects limit the use of sodium bicarbonate. PURPOSE: This study evaluated the efficacy of a commercially available topical transdermal sodium bicarbonate (TSB) lotion (Topical Edge™) which is claimed to be

Caffeine (CF) is the most widely used psychotropic drug in the world and has wide spread use in sport performance. The benefit in short, powerful activities may be possible that the 48 hour abstinence from CF was insufficient for some of the runners to reduce their CF tolerance, and thus the acute effect of CF was attenuated.
time trial performance test, with 5 minutes of recovery between tests. On a separate day subjects completed a 1-hour time trial. Heart rate, RPE, blood lactate and pH were assessed before, during, and after performance testing.

RESULTS: Heart rate and RPE were significantly (p<0.05) lower for TSB compared to placebo at the 15-min mark of the 1-hour time trial, but not at other time points. When TSB was applied, lactate was higher (p<0.05) after the high-intensity ramp, sprint and 5-min time trial series (10.8±3.2 mmol/L versus 9.7±3.1 mmol/L for TSB and placebo, respectively). Similar effects were observed after the 1-hour time trial. Significance was not reached when examining performance differences (p>0.05).

CONCLUSIONS: Overall, the findings from this study provide evidence that TSB can significantly impact blood lactate, heart rate and RPE during performance tests of varying intensity/length. These significant findings support the ability of this lotion to transdermally deliver sodium bicarbonate, which could allow athletes to avoid the side-effects of oral bicarbonate use. Further research is warranted to substantiate these findings and determine the most effective use for this commercially available transdermal sodium bicarbonate lotion.

**CONCLUSIONS:** The present findings indicated that one or two servings of the pre-workout supplement had no significant effect on rates of fat oxidation during 30 minutes of moderate-intensity treadmill running in aerobically-trained females when compared to placebo.

**Purpose:** The aim of this study was to carry out a systematic review and meta-analysis of the effects of carbohydrate supplementation on moderate to high-intensity closed-loop time-trial performance and associated physiological responses.

**Methods:** 32 studies met the inclusion criteria of adopting double-blind, randomized, crossover designs that included a closed-loop time-trial of moderate to high-intensity aerobic exercise performed under a standard caffeine dose of 3.6 mg·kg⁻¹ administered 30–90 minutes prior to performance. Meta-analyses were completed using a random-effects model, with effects on time-trial performance presented as standardized mean difference (SMD) and with physiological responses presented as raw mean difference (RD). 95% confidence limits (CL) were calculated for all estimates.

**Results:** Relative to placebo, caffeine had a significant positive effect on time-trial performance (RD = 0.43; CL = [0.26, 0.60]; p < 0.0001; n = 329). Moreover, the effects of caffeine on time-trial performance corresponded with significant increases in heart rate (RD = +1.31 b·min⁻¹; CL = [+0.46, +2.16]; p < 0.0001; n = 164), blood lactate (RD = +1.53 mmol·L⁻¹; CL = [+1.21, +1.84]; p < 0.0001; n = 209), and blood glucose (RD = +1.12 mmol·L⁻¹; CL = [+0.80, +1.43]; p < 0.0001; n = 95). In contrast, caffeine had no effect on time-trial measures of oxygen uptake (RD = +0.07 L·min⁻¹; CL = [-0.01, +0.16]; p = 0.31; n = 96), respiratory exchange ratio (RD = +0.01 L·kg⁻¹·min⁻¹; CL = [-0.01, +0.03]; p = 0.37; n = 78), or ratings of perceived exertion (RD = +0.06; CL = [+0.14, +0.26]; p = 0.54; n = 196). **Conclusion:** The results of this analysis reveal a clear effect of caffeine on moderate to high-intensity time-trial performance; an effect which is accompanied by significant increases in heart rate, blood lactate, and blood glucose. When considered in conjunction with research using fixed-intensity exercise, the caffeine-induced increase in time-trial intensity likely explains all of the associated increase in heart rate, and part of the increase in blood lactate and blood glucose.

**Purpose:** This study evaluated the efficacy of a commercially available, topical transdermal sodium bicarbonate (TSB) lotion (Topical Edge®), which is claimed to be delivered through the skin using a novel patent-pending transdermal delivery system for impacting DOMS.

**Methods:** 20 trained cyclists (Category 1-3) and professional triathletes participated in this randomized, cross-over, double-blinded, placebo-controlled study. After application of TSB or a placebo, subjects completed a variety of exercise and performance tests varying in duration. On one day subjects completed a series of high-intensity exercises which included a ramped protocol to a rating of perceived exertion (RPE) of 17 out of 20, a 30-sec sprint performance test, and a 5-min time trial. Subjects completed DOMS questionnaires 24- and 48-hours after exercise sessions. Muscle soreness was rated on a scale of 0-100 where 0 = “no soreness”, 25 = “mild pain”, 50 = “moderate pain”, 75 = “severe pain” and 100 = “the worst pain you can imagine”.

**Results:** DOMS was reduced following the high-intensity series with TSB compared to placebo. Similar effects were not observed following the 1-hour exercise bout. From the first to second day following the high-intensity exercise series, subjects using TSB experienced a 54% reduction in DOMS versus an increase in DOMS of 34% with placebo (p=0.007). **Conclusions:** Findings from this study suggest that TSB can significantly shorten recovery from DOMS following high-intensity exercise. Findings also support the effectiveness of the transdermal system in delivering sodium bicarbonate topically and may allow athletes to achieve these results while avoiding the side-effects of oral bicarbonate. Furthermore, we believe this study is the first to provide a direct link between sodium bicarbonate use and DOMS in athletes. Additional research is underway to further substantiate these findings.

**Purpose:** The purpose of the present study was to examine the effects of acute doses of a thermogenic, pre-workout supplement on fat oxidation rates during moderate-intensity treadmill running in females.

**Methods:** Twelve aerobically-trained females (mean ± SD: age = 25.3 ± 9.4 years; body mass = 61.2 ± 6.8 kg) volunteered to visit the laboratory on four occasions. For the first visit, each subject completed an incremental treadmill test to exhaustion to determine their ventilatory threshold (VT) using a metabolic cart. On the second visit, each subject consumed a standardized meal following overnight fasting (8 hours) 30 minutes prior to ingestion of the pre-workout supplement (S2) or placebo (P). One serving of the supplement contained caffeine anhydrous (150 mg), beta alanine (160 mg), arginine AKG (1000 mg), as well as tyrosine, L-carnitine, green coffee bean extract, and velvet bean extract at unspecified quantities. The placebo was a non-caloric mix that was flavored for flavor and consistency. Thirty minutes post-ingestion, the subjects performed a 30-minute constant-intensity treadmill run at 90% of their VT with ventilatory parameters expressed as 5-min averages. The subjects then returned to the laboratory for their third and fourth visits to ingest the remaining conditions (S1, S2, or P) and underwent the same testing procedures (including time of day) as the second visit. A two-way ANOVA with repeated-measures was used to compare the rates of fat oxidation among the conditions (S1, S2, P) at the common time points (5, 10, 20, 30, 40, 50, 60, 90, 120 min).

**Results:** For the rates of fat oxidation, there was no significant (p > 0.05) condition x time interaction or main effect for condition, but there was a main effect for time. Specifically, the marginal means (collapsed across conditions) for fat oxidation rates were significantly (p < 0.05) greater at 5-min (0.35 ± 0.20 g·min⁻¹) and 30-min (0.35 ± 0.16 g·min⁻¹) than 10-min (0.28 ± 0.13 g·min⁻¹), 15-min (0.29 ± 0.13 g·min⁻¹), 20-min (0.28 ± 0.14 g·min⁻¹), and 25-min (0.31 ± 0.15 g·min⁻¹).

**Conclusions:** The present findings indicated that one or two servings of the pre-workout supplement had no significant effect on rates of fat oxidation during 30 minutes of moderate-intensity treadmill running in aerobically-trained females when compared to placebo.

**Purpose:** A prior investigation from our laboratory reported that a caffeine mouthrinse (CMR) enhanced 3-km cycling performance during trials conducted in the early morning (before 10:00), but not in the late-morning. However, interpretation of these findings was complicated by the fact that early-morning trials were predominantly completed after an overnight fast, whereas late-morning trials were all post-prandial. Thus, the purpose of the present study was to test the caffeine-induced increase in time-trial performance in the fed-state, at different times of day.

**Methods:** 12 recreational cyclists (VO₂peak = 51 ± 8 ml·kg⁻¹·min⁻¹) completed a simulated 3-km time trial on four occasions; twice in the morning (before 10:00) and twice in the afternoon (after 16:00). 25 ml of a mouth-rinse solution, containing either 300 mg of caffeine (CMR), or a placebo (PL) was swirled in the mouth for 5 s on three occasions during a 10 min
two additional pieces of Military Energy Gum for 5 min. Following the second treatment, subjects arrived at the Exercise Science Laboratory cycle ergometer to determine maximal oxygen consumption (VO_{2max}). Procedures included a circular warm-up consisting of a plain bagel and a sports drink then rested for 10 min. Thereafter two visits (experimental testing) were conducted in the morning and afternoon. Magnitude-based inferences were used to evaluate treatment effects on performance time.

**RESULTS:**

CMR did not improve cycling performance in the morning [PL = 343 ± 33 s; CMR = 348 ± 32 s; 'possibly' impaired performance (62% likelihood)] or in the afternoon [PL = 346 ± 42 s; CMR = 341 ± 34 s; 'possibly' impaired performance (43% likelihood)]. Treatment effects were similar between the morning and afternoon trials, with no clear effect of time of day. **CONCLUSIONS:** CMR provided in the fed state did not improve 3-km cycling performance, and responses were similar during trials conducted in the morning and afternoon. When considered in the context of our prior study, these findings suggest that the efficacy of CMR on cycling performance may be influenced by feeding state, but not time of day.

**PURPOSE:**

The study evaluated the effects of varying caffeine dosage on free throw accuracy before and after exhaustive intermittent exercise. **METHODS:** Fourteen NCAA Div 2 collegiate female basketball players participated (mean ± SD; age = 19.9 ± 1.04 yrs; body mass = 67.25 ± 8.17 kg; height = 171.45 ± 8.41 cm; BMI = 22.85 ± 1.72; percent body fat = 22.45 ± 4.16%). Participants each completed baseline tests with a familiarization session and three randomized double-blind intermittent exercise trials of the study. The experimental trials included ingestion of placebo (0 mg·kg·BW^{-1}), or caffeine at 1.5 mg·kg·BW^{-1}, and of caffeine at 3 mg·kg·BW^{-1}. Each trial was administered following 12h overnight fasting, separated by at least one week, and with no moderate to heavy exercise 48h prior to the trial. At the lab, subjects consumed a standard breakfast and 500ml of fluid, with a varying caffeine dose or placebo. Subjects performed 20 free throws, rested 1 min, then ran 20m sprints at full speed, with 20sec recovery. They rested 1 min, and performed 20 free throws again. All free throws were performed with a soundtrack playing music and recorded crowd noise at high volume in the background. **RESULTS:** Our results found that only the 3 mg·kg·BW^{-1} caffeine dosage showed significant improvement (Δ=7.17%) in free throw performance following exhaustive intermittent exercise (P<0.05). No change was observed in free throw performance with 1.5 mg·kg·BW^{-1} caffeine dosage and placebo (P>0.05).
CONCLUSIONS: This study demonstrated that a moderate dose of caffeine can improve free throw ability following exhaustive intermittent exercise compared to low dose and placebo conditions in NCAA Division 2 female basketball players.

2411 Board #247 June 1 11:00 AM - 12:30 PM Caffeine and Citrate Aurantium Supplementation After Resting Cardiac Autonomic Function but Not During Recovery
Emily Bechke, Cassie Williamson, Paul Bailey, Wade Hoffstetter, Cherilyn McLester, Brian Kisliczewicz. Kennesaw State University, Kennesaw, GA. (Sponsor: Mark Tillman, FACSM) (No relevant relationships reported)

Purpose: To examine the combined effects of the pre exercise complex Citrate Aurantium and Caffeine (CA+C) on cardiac autonomic activity following ingestion and immediately after high-intensity anaerobic exercise in habitual caffeine users. Methods: Ten physically active males (25.1± 3.9 years; mass 78.7± 9.5 kg) who habitually consume caffeine (≥ 1 serving a day [95mg] 4 days a week) participated. This was a double-blind crossover design, where each a CA+C or a placebo capsule was consumed followed by a 45-min ingestion period, a repeated Wingate protocol, and a 45-min recovery period. Cardiac autonomic activity was assessed through Heart Rate (HR), plasma epinephrine (E) and norepinephrine (NE), and markers of Heart Rate Variability (HRV): root mean squared of successive R-R differences (RMSSD), Standard Deviation of R-R intervals (SDNN), High-Frequency (HF), Low-Frequency (LF), and its ratio (LF/HF). Markers were taken at four time points: pre-Ingestion (PRE-ig), 40-45-min post (Post-ig); Wingate recovery (PRE-rev), 40-45-min post recovery (Post-rev). Results: Markers that violated normality were naturally log transformed prior to further analysis (ln). Pre-planned comparisons were performed to assess differences between pre and post time points as well as the corresponding time point of the other trial within their respective phase. During the CA+C trial, an increase in HR, lnSDNN, lnLF, EPI, and NE were observed at Post-ig compared to Pre-ig (p≤0.05). Significant differences were observed in all markers, except LF/HF, during the CA+C and PLA trials from the PRE-rev to Post-rev (p≤0.05). Conclusion: The consumption of CA+C stimulates sympathetic activity during rest (e.g. ingestion phase) without influencing parasympathetic activity. CA+C provides no influence over cardiac autonomic recovery.

2412 Board #248 June 1 11:00 AM - 12:30 PM Effects of Energy Drinks on Resting Cardiovascular Measures
Will Peveler1, Andy Bosak, Gabe Sanders2. 1Liberty University, Lynchburg, VA. 2Northern Kentucky University, Highland Heights, KY. (Sponsor: James Schoffstall, FACSM) (No relevant relationships reported)

The use of energy drinks among athletes has risen greatly. Reviews of energy drink related health complications have highlighted adverse cardiovascular events. PURPOSE: To examine the effects of three commercially available energy drinks on resting cardiovascular measures prior to exercise. METHODS: Twenty-five healthy subjects participated in this study. Subjects reported to the laboratory on four separate occasions where they ingested a placebo or one of three commercially available energy drinks (energy drink 1, energy drink 2 and energy drink 3). Trials were conducted subject blinded and counterbalanced. During each trial blood pressure and heart rate were measured at three key points: prior to beverage ingestion, at 30 minutes post ingestion and 60 minutes post ingestion. Subjects remained seated and in a relaxed state for the duration of the 60 minutes trial. Means for dependent measures were analyzed using repeated measures ANOVA with an alpha of 0.05 to determine significance. RESULTS: Heart rate was found to be significantly increased from pre-ingestion measures to 60 minute measures for both energy drink 2 (Pre = 65.12 ± 9.81 bpm and 60 min = 73.08 ± 10.82 bpm at p<0.010) and energy drink 3 (Pre = 65.76 ± 8.44 bpm and 60 min = 73.52 ± 11.25 bpm at p<0.005). Systolic blood pressure was found to be significantly increased from pre-ingestion to 60 minutes for energy drink 1 (Pre = 114.84 ± 9.33 mmHg and 60 min = 120.80 ± 9.43 mmHg at p<0.003), energy drink 2 (Pre = 113.56 ± 8.55 mmHg and 60 min = 121.44 ± 8.86 mmHg at p<0.004), and energy drink 3 (Pre = 113.24 ± 7.09 mmHg and 60 min = 119.40 ± 10.58 mmHg at p=0.037). CONCLUSION: These findings demonstrate that energy drinks impact cardiovascular measures by increasing both heart rate and blood pressure during a resting state. While the demonstrated increases may not be dangerously high, users should be aware of the impact of these drinks on cardiovascular measures.

2413 Board #249 June 1 11:00 AM - 12:30 PM Menstrual Phase Influence and Oral Contraceptive Use on the Ergogenic Effects of Caffeine during Cycling
David L. Wenos, Annette M. Lemanski, Nicholas D. Luden, Christopher J. Womack, FACSM, Michael J. Saunders, FACSM. James Madison University, Harrisonburg, VA. (Sponsor: Michael J. Saunders, FACSM) (No relevant relationships reported)

It is suggested that inter-individual differences in the ergogenic effects of caffeine may be attributed to individual variability in caffeine absorption and metabolism. It is known that menstrual status and oral contraceptive (OCs) use affects caffeine metabolism, but it is not clear whether these factors mediate the ergogenic effects of caffeine consumption. PURPOSE: To determine whether menstrual phase or OCs use influence the effects of caffeine ingestion on 3-km cycling performance. METHODS: Sixteen recreational cyclists completed two 3-km time trials (TT) during both the follicular (early) and luteal (late) phases. Riders ingested either a placebo or 15mg/kg caffeine capsule one hour prior to each trial. Subjects were divided into a non-OCs users group (n = 8; age, 20.9± 2.1 yr; VO2max = 50.9 ± 7.8 ml/kg/min) and an OCs users group (n=8; age = 21.4± 1.4 yr; VO2max = 48.0 ± 4.0 ml/kg/min). Magnitude-based inferences were used to evaluate the effects of treatment (placebo versus caffeine), menstrual phase (follicular versus luteal) and group (OCs users versus non-users) on power output during the cycling TT. RESULTS: Overall, caffeine improved power output during the TT, regardless of menstrual phase or OCs use. Among non-OCs users, caffeine ‘likely’ improved power output in the follicular phase (6.7 ± 6.1%), and ‘very likely’ improved power output in the luteal phase (6.7 ± 4.8%). In the OCS users, caffeine ‘likely’ increased power output in the follicular phase (4.7 ± 5.6%), and ‘very likely’ improved power output during the luteal phase (7.2 ± 3.7%). Differences in the ergogenic effects of caffeine between the two groups (OCs users versus non-users) and between menstrual phases were ‘unclear’. CONCLUSION: Caffeine ingestion improved power output during a 3-km cycling TT. However, the magnitude of the ergogenic effects of caffeine were not affected by OCs use, or menstrual phase.

2414 Board #250 June 1 11:00 AM - 12:30 PM The Influence Of Caffeine And A CYP1A2 Polymorphism On The Ventilatory Threshold - A Pilot Study
Paul R. Nagelkirk1, Liam F. Fitzgerald1, James Sackett2, Ahmed El-Sohemy3, Christopher J. Womack, FACSM, 1Ball State University, Muncie, IN; 2University of Toronto, Toronto, ON, Canada; 3James Madison University, Harrisonburg, VA. (Sponsor: Christopher J. Womack, FACSM) (No relevant relationships reported)

Previous research suggests acute caffeine supplementation may alter substrate utilization and/or ventilatory responses that influence the ventilatory threshold (VT). Caffeine metabolism is influenced by a single nucleotide polymorphism at intron 1 of the cytochrome P450 (CYP1A2) gene, which may influence the ergogenic effects associated with caffeine use. PURPOSE: The purpose of this study was to examine the influence of caffeine on exercise responses at the VT, and determine the effect of the CYP1A2 polymorphism on those responses. METHODS: 17 healthy men (age 24.8 ± 2.7 yr; weight 79.5 ± 9.2 kg) participated in this study. Subjects performed graded maximal exercise tests on a cycle ergometer after consuming either 6 mg/kg of caffeine or placebo. Subjects were categorized as possessing the C allele (C allele carriers) (n = 8) or being homozygous for the A allele (AA homozygotes) (n = 9). VT was determined using the V-slope method. The effects of caffeine (CAF) vs placebo (PL), genotype, and treatment x genotype were assessed using a two-factor ANOVA. RESULTS: At the VT, caffeine significantly augmented workload (CAF = 220 ± 43 Watts, PL = 211 ± 46 Watts), VO2 (CAF = 33.5 ± 8.2 L/min, PL = 32.2 ± 7.7 L/min/kg), VO2 max as a % of VO2 max (CAF = 69.0 ± 8.2%, PL = 64.8 ± 9.6%), RER (CAF = 0.98 ± 0.06, PL = 0.95 ± 0.07), and HR (CAF = 155 ± 16, PL = 151 ± 16 bpm), compared to placebo (all p<0.05). A significant treatment x genotype interaction was observed for RER (AA group: CAF = 0.98 ± 0.07, PL = 0.91 ± 0.08; C allele: CAF = 0.97 ± 0.07, PL = 0.97 ± 0.09). A non-significant between group trend was observed for VO2 as a % of VO2 max (AA group 62.5 ± 6.6%, C allele = 67.2 ± 9.6% = p=0.10, eta2=0.17) and workload (AA group 196.4 ± 37.7, C allele = 214.1 ± 40.0 Watts, p<0.10, eta2=0.17). CONCLUSION: Caffeine enhances exercise performance at the VT. The CYP1A2 polymorphism likely modulates substrate utilization and exercise intensity at the VT. Additional research is needed to verify these preliminary findings.

Abstracts were prepared by the authors and printed as submitted.
The diuretic effects of caffeine and its subsequent role on fluid balance have been highly debated for years. Given the lack of mechanistic understanding behind many of its effects, it is important to determine if caffeine presents a risk to normal thermoregulatory patterns during exercise in hot, humid conditions. PURPOSE: To determine if caffeine (CAFF) ingestion increases core body temperature in physically active subjects exercising in a hot, humid environment during repeated endurance exercise tests (EET). METHODS: This study used a placebo-controlled, double-blind, cross-over experimental design to investigate the effects of caffeine ingestion on heart rate (HR) and core body temperature in physically active males when exercising in a hot and humid environment. Twenty-one healthy male subjects (age 27.7±0.9 yrs; height 1.76±0.10m; weight 74.19±10kg) performed a maximal graded exercise test (GXT) and two endurance exercise tests (EET) separated by at least 48hrs. Subjects were randomly assigned to consume either 6mg/kg of body weight of a placebo (PLA) or CAFF supplement for one EET and the opposite substance (PLA or CAFF) for the second test. In addition, the subjects consumed a CoreTemp® core body temperature sensor to measure core body temperature throughout each test. Each EET consisted of cycling on a cycle ergometer at 65% of their VO2max for 40min in a controlled hot, humid environment (36.3±0.5°C; 59.4±6.5% RH). RESULTS: Results indicated no significant difference between groups for core body temperature or heart rate at any time point, with the exception of an elevated HR 5min post-exercise in the CAFF group when compared to PLA (136.8±7.5 vs. 127.6±5.1; p<0.05; C). A significant increase in HR from baseline was observed to 40min in both groups (CAFF: 84.2±7.4 to 149.0±5.1; PLA: 79.2±3.4 to 162.7±3.2; p<0.01), but CAFF consumption elicited no synergistic effects on HR or core body temperature before, during, or after exercise. Interestingly, CAFF consumption did elicit a diminished HR recovery within the first 5min of recovery, potentially indicating a greater degree of heat stress in the CAFF group. CONCLUSION: Based upon this evidence, caffeine consumption does not impair normal thermoregulatory patterns during exercise in a hot, humid environment.

Athletes are at an increased risk for acute sleep loss due to the physiological and psychological tolls of heavy training and competition. We recently reported that a single night of sleep restriction (SR) may result from a single night of SR compared to a full night of sleep. However, the effects of SR on subsequent performance may result from a single night of SR compared to a full night of sleep. In contrast to our previous report, this interpretation is weakened by the fact that EX1 and EX2 performances were similar between SR and FULL. Regardless, athletes may want to consider caffeine supplementation as a viable strategy to offset the negative impact of occasional sleep restriction.

Although the benefits of caffeine on aerobic performance have been well-established, knowledge about the effects of caffeine on different doses of caffeine related to calcium release, such as inhibition of specific phosphodiesterases and antagonistic actions at the level of adenine receptors are lacking. We aimed to analyze these effects on resistance exercises. PURPOSE: Analyze the acute effect of different doses of caffeine on strength and calcium release in recreationally trained men. METHODS: The effect of different doses of caffeine on strength, calcium release, RPE, and TG were assessed in 13 recreationally active young adults (age 19 ± 2 yrs), who performed three tasks on different occasions with a washout of 14 days between sessions. Day one involved collecting baseline data and acclimatizing participants to the protocol to determine the weight loads at each subject’s 10 RM. Participants were instructed to avoid food or beverages that may contain caffeine two days before the tests. The effect of different doses of caffeine on strength was evaluated in three different resistance exercises: bench press (BP); deadlift (DL); and squats (SQ). Blood samples were collected immediately upon arrival to the laboratory, followed by consumption of a standardized isocaloric shake along with capsules containing different doses of caffeine: 0mg/kg (CF1); 2mg/kg (CF2); or placebo (CG). A additional blood samples were collected 45 minutes after caffeine/ placebo consumption and immediately after the execution of each exercise. The supplementation followed a double-blind, randomized model. RESULTS: The strength on BP, DL and SQ statistically improved between CG and CF2 (BP 94.3±5.2 to 101.4±3.4; DL 120.7±7.7 to 136.3±7.09; SQ 119.4±7.4 to 132.1±5.2 p<0.05). Although a strength increase was found at CF2 compared to CF1, no other statistical differences were found (BP 98.1±3.8 to 101.4±3.4; DL 130.2±8.3 to 136.3±7.09; SQ 129.5±8.01 to 132.1±5.2 p<0.001). Calcium release statistically improved in CF2 in comparison to CF1 and CG (10.9±0.9 to 12.9±0.4 and 10.9 to 8.3 ±0.2 p<0.02). CONCLUSION: An 8 mg • kg-1 dose of caffeine seems to be more effective than 6 mg • kg-1 for improving strength levels in the BP, DL and SQ; these enhancements were directly related to improvements in calcium release during CF2.

The global prevalence of metabolic syndrome (MetS) and its associated components (high fasting glucose, waist circumference, blood pressure, triglycerides, and low HDL) have increased over the past few decades. In addition, abnormal thyroid hormone levels have been found to manifest in a cascade of metabolic dysfunction, which may be linked to MetS in youth. PURPOSE: The purpose of the study is to investigate the association between MetS, its components, and markers of thyroid function in a nationally-representative sample of adolescents. METHODS: The National Health and Nutrition Examination Survey III (1988-1994) collected data on the components of metabolic syndrome and thyroid function in 1,322 adolescents aged 12-18.9 years (613 males and 709 females). Participants were grouped based on MetS status, number of MetS components, and markers of thyroid function in a nationally-representative sample of adolescents. RESULTS: The prevalence of metabolic syndrome was 5.4% in the full sample. The logistic models indicated the MetS positive group had a significantly lower odds of having a low TSH (OR = 0.06, 95%CI [0.01, 0.5], p = 0.005) compared to the MetS negative group. However, follow-up analyses revealed adolescents with ≥ 2 MetS components were more likely to have high TSH (OR = 5.0, 95%CI [1.4, 18.2], p = 0.013) and be...
positive for AMA (OR = 2.6, 95% CI [1.1, 6.7], p = 0.042), while being less likely to have low TSH (OR = 0.07, 95% CI [0.01, 0.31], p = 0.001) compared to those with 1 or 0 components. No associations were found between high/low T4 or TgAb and MetS or MetS components (all p > 0.05). CONCLUSION: In this nationally-representative sample of adolescents, those with multiple MetS components were more likely to have elevated TSH and be positive for AMA, while being less likely to have low TSH. T4 and TgAb values were similar, regardless of MetS status. Even in adolescence, metabolic dysfunction appears to be associated with some markers of thyroid function.

Moderate exercise with an intensity near the lactate threshold (LT) is beneficial to human health and one of the possible underlying mechanisms of this may be exercise-induced activation of the hypothalamus with enhanced stress and metabolic responsiveness. In general, adrenocorticotropic hormone (ACTH) secretion, a potential systemic stress marker, is regulated by the hypothalamic corticotropin-releasing hormone (CRH) through the CRH type 1 receptor (CRHR1), which is enhanced by hypothalamic arginine vasopressin (AVP) via the AVP V1a receptor (V1aR). Conversely, it has been suggested that ACTH secretion during exercise above the LT is mainly regulated by AVP, not CRH. However, to date there is no clear evidence for how exercise-induced ACTH secretion is enhanced via these factors. PURPOSE: To elucidate whether AVP and/or CRH regulates exercise-induced ACTH secretion using specific receptor antagonists.

METHODS: Rats acclimatized to treadmill running were randomly divided into four groups: Vehicle, SSR (V1aR antagonist), CP (CRHR1 antagonist), and SSR+CP injection groups, based on i.p. injection of these drugs before running on a treadmill at just above LT (21.5 m/min) for 30 min. Blood was collected from a catheter inserted into the right external jugular vein before the injection and pre- and post-running to measure blood lactate and plasma ACTH levels. RESULTS: Baseline lactate and ACTH levels in all groups were unaffected irrespective of drug treatment. Post-running blood lactate levels were significantly higher than pre-running (p<0.0001, all groups) with no inter-group difference. Plasma ACTH levels did not increase after running in the SSR+CP group (p>0.05 for SSR+CP group, cp. p<0.0001 for Vehicle, SSR and CP groups). Post-running ACTH levels were lower in all antagonist groups compared to the Vehicle group (p<0.0001 for SSR, CP, and SSR+CP vs. Vehicle group). ACTH levels for the SSR+CP group decreased compared to those for the SSR and CP groups (p<0.05 for SSR+CP vs. SSR and CP, respectively).

CONCLUSIONS: We revealed for the first time that exercise-induced ACTH secretion is regulated by both AVP and CRH with concomitant blood lactate increase. Further, our results suggest that AVP and CRH cooperatively enhance exercise-induced ACTH response independent of metabolic response.

CONCLUSIONS: These results show that ~1 year of cross-sex hormone treatment results in increased muscle strength in transmen. However, transwomen maintain their strength levels throughout the treatment period. We conclude that the altered sex hormone pattern induced by gender-reversing treatment differentially affect muscle strength in trans men vs. trans women.

PURPOSE: Sex hormone physiology (e.g., estradiol, testosterone) may be affected by soy and/or whey protein consumption. Alterations in sex hormones due to resistance training (RT) and/or protein supplementation may explain meaningful variation in adipocyte and skeletal muscle size alterations. Consequential molecular signaling in these cell types remain unclear. Therefore, we examined effects of RT and soy (SPC), whey (WPC), or placebo (PLA) supplementation in young men.

METHODS: 47 healthy, young men were partitioned into PLA, SPC, or WPC groups and completed 12 weeks of RT. Body composition, serum hormones, androgen signaling markers in myocytes, and estrogen signaling markers in adipocytes were examined using DXA, ELISA, western blotting, PCR, and immunohistochemistry. RESULTS: Testosterone increased over time, but more so in subjects consuming WPC (p<0.05). Adipocyte mRNA expression of the estrogen receptor alpha increased (p<0.05), as did hormone sensitive lipase over time (p<0.05). Skeletal muscle androgen receptor mRNA expression increased while ornithine decarboxylase mRNA decreased over time (p<0.05). Alterations in body composition, adipocyte, and myocyte morphology were not significantly different between groups (p<0.05). Changes in 17β-estradiol and testosterone explained <3% of alterations in adipocyte and myocyte size.

CONCLUSIONS: These data suggest primarily RT-mediated effects with little influence of protein type and hormonal changes.
**Variables**

<table>
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<tr>
<th></th>
<th>Low-Moderate (n=13)</th>
<th>HEPA-Active (n=12)</th>
<th>Low-Moderate (n=12)</th>
<th>HEPA-Active (n=13)</th>
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</thead>
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<tr>
<td><strong>JH (inches)</strong></td>
<td>13.43 ± 3.10</td>
<td>14.13 ± 2.69</td>
<td>11.12 ± 2.52</td>
<td>11.20 ± 3.33</td>
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<td><strong>Velocity</strong> (m/s)</td>
<td>0.99 ± 0.13</td>
<td>1.04 ± 0.09</td>
<td>0.94 ± 0.13</td>
<td>0.94 ± 0.09</td>
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<tr>
<td><strong>Jump Power</strong> (watts)</td>
<td>647.40 ± 107.99</td>
<td>698.13 ± 141.61</td>
<td>622.91 ± 142.39</td>
<td>593.20 ± 127.62</td>
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<td><strong>RJP (watts/kg)</strong></td>
<td>9.85 ± 1.30</td>
<td>11.44 ± 3.69</td>
<td>9.22 ± 1.49</td>
<td>9.17 ± 1.02</td>
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<td><strong>IRM (kg)</strong></td>
<td>125.17 ± 25.07</td>
<td>144.29 ± 36.90</td>
<td>113.24 ± 20.18</td>
<td>121.67 ± 29.23</td>
</tr>
</tbody>
</table>

**p < 0.01, * p < 0.05** Significant age group effect; HEPA-Health enhancing physical activity

**2423 Board #259 June 1 9:30 AM - 11:00 AM**

**Acute Resistance Exercise on Bioactive and Immunoactive Growth Hormone in Women.**

Emily M. Post1, Matthew K. Beeler1, William H. Dupont1, Lydia K. Caldwell1, John P. Anders1, Vincent H. Hardesty1, Emily C. Barnhart1, Emily C. Borden1, Jeff S. Volek1, Wesley C. Hymer2, William J. Kraemer, FACSM, 1The Ohio State University, Columbus, OH. 2The Pennsylvania State University, University Park, PA. (Sponsor: Dr. William J. Kraemer, FACSM) (No relevant relationships reported)

**PURPOSE:** The purpose was to determine the differences between trained and untrained women for concentrations of BGH and IGH in response to acute resistance exercise.

**METHODS:** Untrained recreationally active women (UT) (N= 12), mean ± SD: 24 ± 2.4 yr, 167 ± 6.3 cm, 68.8 ± 7.3 kg, 27.3 ± 4.0% body fat, and trained women (TW) (N= 12), 25 ± 3.4 yr, 168 ± 7.3 cm, 69.8 ± 6.3 kg, 19.3 ± 2.7% body fat gave informed consent. Trained status was determined by participation in aerobic/resistance training programs for at least 1 year. The women were tested for 1 repetition maximum strength (1 RM) in the squat and were familiarized with the squat test protocol that consisted of 6 sets of 10 repetitions at 75% of their 1 RM with 2 minutes rest between sets. Testing was performed during the early follicular phase between 0630 and 1100 after an 8- to 12-h fast. Pre-exercise blood samples were obtained via standard venipuncture 15 min before the test and post-exercise samples were obtained immediately after the resistance training test protocol. Plasma was collected and assayed for IGH using polyclonal and monoclonal assays. Total BGH was assayed using the rat thyalin line in vivo bioassy. A two-way analysis of variance (2 X 2) for group and time were used to analyze the data, with p ≤ 0.05 defined as significance.

**RESULTS:** The TW were significantly stronger than the UT in the squat. Both groups significantly increased their IGH concentrations post-exercise, with the monoclonal assay showing significantly higher values than polyclonal assays and TW showing greater post-exercise values than UT [Monoclonal: (TW: 5 ± 2 to 19 ± 3 µg/L-1, UT: 4.9 ± 2 to 10.2 ± 3.0 µg/L-1)]. BGH did not increase pre to post exercise in either group, yet TW had significantly higher pre-exercise and post-exercise BGH (3900 ± 4.9 ± 2 to 10.2 ± 3.0 µg/L-1). BGH did not increase pre to post exercise in either group, yet TW had significantly higher pre-exercise and post-exercise BGH (3900 ± 4.9 ± 2 to 10.2 ± 3.0 µg/L-1). BGH did not increase pre to post exercise in either group, yet TW had significantly higher pre-exercise and post-exercise BGH (3900 ± 4.9 ± 2 to 10.2 ± 3.0 µg/L-1). BGH did not increase pre to post exercise in either group, yet TW had significantly higher pre-exercise and post-exercise BGH (3900 ± 4.9 ± 2 to 10.2 ± 3.0 µg/L-1).

**Conclusions:** This novel ankle dorsiflexion (DF) is associated with abnormal biomechanics as well as lower extremity injuries. Identifying and correcting restricted ankle DF may be a viable preventative strategy to normalize motor control and reduce injury. A reliable ankle screen may help clinicians to identify decreased ankle range of motion (ROM). The purpose of this study was to determine the reliability and criterion validity of a novel standing ankle dorsiflexion screen (SADS). It is proposed that the SADS will demonstrate strong inter-rater reliability and criterion validity. Methods: 37 healthy subjects (74 ankles) participated in the study. Ankle DF ROM was measured using an electronic inclinometer by 2 raters. Four raters measured ankle DF using the criteria of the SADS. The SADS is performed in a heel-to-toe position. Subjects performed DF by dropping their back knee forward as far as possible without lifting their back heel. The back-ankle DF is scored by identifying the position of the anterior knee in relation to the medial malleolus of the front limb. It scores as either beyond the front of the malleolus (pass), or behind the front of the malleolus (fail). Measurements were obtained by four raters, two times per ankle, with 5 minutes of rest between measurements to prevent a treatment effect. Reliability was calculated using an ICC between the 2 raters using the electronic inclinometer and using a Kappa coefficient between the 4 pairs of raters for the SADS. Results: The ICC values from the electronic inclinometer were reported as mean values for the 3 trials at 0.95 (0.92-0.97). The Kappa values were calculated for a single trial for SADS and ranged from 0.61-0.81 with percent agreement ranging from 86%-94%. There was a statistically significant difference (p<0.001) in ankle DF ROM between the between category (mean DF = 41.3° SD 4.7°) and the beyond category (mean value was 51.8° SD 6.1°). Conclusions: This novel ankle screen can be considered reliable for screening ankle DF ROM. Criterion validity, as compared to a standard goniometric measure, can also be considered meaningful. The screen may provide clinicians an effective tool to screen for ankle DF ROM defects.

**2425 Board #261 June 1 9:30 AM - 11:00 AM**

**Validation of a Modified Functional Movement Screen Test for Division III Female Soccer Players.**

Tiffany R. Widseth, Ana B. Freire Ribeiro. Augsburg University, Minneapolis, MN. (Sponsor: Dr. Mark Blegen, FACSM) (No relevant relationships reported)

**Abstract**

**Background:** The Functional Movement Screen (FMS) is comprised of seven tests to identify compensatory movement patterns that may increase injury risk and reduce performance. A modified FMS (MFMS) was created by Augsburg Athletic Trainers to improve screening efficiency and includes three original FMS tests: shoulder mobility, active straight leg raise, trunk stability pushup, and a newly added test; the vertical drop jump (VDJ), all scored on a simplified 0-2 scale. **Objective:** This study aimed to validate the MFMS for DIII female soccer players. **Methods:** Sixteen NCAA DIII soccer players and twenty non-athlete controls were recruited and completed two trials of FMS and MFMS. Reliability was calculated as Pearson Product Moment. Concurrent validity was calculated between FMS and MFMS scores, using R Statistical Software. Results: Mean age of soccer group was 21 (SD=1.37) and control 21.05 (SD=1.61). Mean FMS score for soccer group was 14.38 (SD=1.54) and control 13.35 (SD=2.39). Mean MFMS score for soccer was 5.62 (SD=0.96) and control 4.95 (SD=0.69). Soccer scores for the first MFMS trial were significantly larger than controls (p=0.02). FMS reliability coefficient was 0.99 and MFMS was 0.88. Discussion: There were moderate positive correlations between FMS and MFMS for the soccer group (r=0.51) and for controls (r=0.46), but they were not large enough to validate the MFMS. When the MFMS was rescored on the original 0-3 scale (excluding VDJ) it was valid for both groups (soccer r = 0.79; controls r=0.83). **Conclusion:** The MFMS is not valid, suggesting potential issues with the new scoring system.
Compensating unstable situations is an important functional capability to maintain joint stability, to compensate perturbations and to prevent (re-)injury. Therefore, a reduced maximum strength and altered neuromuscular activity is expected by inducing instability to high loading test situations. Possible effects are not clear for induced instability during maximum legpress tests in healthy and furthermore in subjects with functional ankle instability (FAI).

**PURPOSE:** First, to compare maximum strength and lower leg muscle activity between stable (S) and unstable (UN) maximum legpress tests. Second, to evaluate the association between FAI and effect of instability during testing. **Methods:** 18 male subjects (12 healthy/6 subjective FAI; age: 28±2yrs, height: 180±5cm, weight: 80±9kg, physical activity: 6±5h/wk) were included and their ankle function was quantified by the Foot and Ankle measure (FAAM) questionnaire. Five maximum strength test with leg press isokinetic device in concentric (CON) and eccentric (ECO) mode were measured. Muscle activity were recorded by EMG of m. tibialis anterior (TA), m. peroneus longus (PL) and m. soleus (SOL). Peak force ($F_{peak}$, Nm) for maximum strength and root mean square (RMS, Hz) for EMG amplitude of TA, PL and SOL were calculated. Comparisons of conditions (S vs UN) were analyzed descriptively and with paired T-tests. For association, Pearson correlation was applied using FAAM score and RMS differences (condition UN – S). **Results:** UN lead to a significant peak force reduction of 10.1% (CON) and 13.7% (ECO) significantly (p<0.001). RMS of PL in CON and TA in CON and ECO mode were 26.2%, 59.7% and 35.8% respectively significant higher in UN footplate in comparison with S (p<0.01). In addition, no correlations between FAI and loss of strength or changes in muscle activity have been found. **Conclusion:** Reduction in peak force and increased muscle activity confirmed the expected increased effort to compensate instability. The missing association between FAI and amount of altered strength or muscle activity might be attributed to a low level of FAI in the included subjects.

Decreased ankle dorsiflexion can be a factor that limits participation in activities and predisposes individuals to chronic issues. Traditionally, stretching protocols, strengthening of muscles, balance training, and traditional joint mobilizations have been used to increase ankle dorsiflexion. Although current methods have been successful at mitigating ankle dorsiflexion restrictions, alternative treatments should be researched. **Purpose:** Determine the possible effect of two Mulligan Mobilization with Movement (MWM) Techniques on ankle dorsiflexion. **Methods:** Individuals were recruited at three college athletic training clinics around the United States. Participants were randomly allocated into two groups, the Mulligan Ankle Dorsiflexion MWM in weight bearing and the Mulligan Fibula MWM for Dorsiflexion in non-weight-bearing. Once allocated, clinicians applied a single treatment of three sets of ten. Distance from wall and Tibial angle for the weight-bearing dorsiflexion lunge test was collected. Once allocated, clinicians applied a single treatment of three sets of ten. Distance from wall and Tibial angle for the weight-bearing dorsiflexion lunge test was collected. Distance was measured with an inclinometer. Posterior capsule thickness, humeral retrotension, and ulnar collateral ligament (UCL) thickness were collected via ultrasound. For each measurement, non-dominant arm values were subtracted from dominant arm. Data were analyzed with hierarchical multiple regression, which determined group differences while controlling for sport played. **Results:** Sport specialization criteria were met by 21 athletes before age 11 (Early). 28 athletes between the ages of 11-14 (Middle), and 25 athletes age 15 or older (Late). Shoulder internal (Early = −9.7 ± 5.6°; Middle = −8.8 ± 7.0°; Late = −8.2 ± 6.2°) and external (Early = −9.6 ± 11.1; Middle = 10.4 ± 11.8; Late = −9.9 ± 8.1) rotation produced clinically significant variations bilaterally but no statistically significant group differences (Internal: $R^2 = .08$, p = .23; External: $R^2 = .07$, p = .26). No group differences were noted for posterior capsule thickness ($R^2 = .07$, p = .28), humeral retrotension ($R^2 = .16$, p = .07), or UCL thickness ($R^2 = .11$, p = .09). Mean humeral retrotension (10.2 ± 6.1°) and UCL thickness (0.42 ± 0.61 mm) were greater on the dominant arm. **Conclusions:** Early sport specialization does not appear to exacerbate the bilateral tissue differences naturally present in collegiate overhead athletes. Therefore, sport specialization may be less concerning at the tissue level than the stress of overhead sport for the average athlete. Since the magnitude of tissue maladaptation associated with injury remains unknown, more data should be collected to determine connections among specialization, tissue characteristics, and injury rates in this population.
Musculoskeletal ultrasound imaging (MSKUI) has become an increasing studied assessment tool in orthopedic sports medicine. Several studies have investigated ulnar collateral ligament (UCL) integrity and morphology in the throwing arm of baseball players with MSKUI. Research data has indicated that UCL thickening and medial joint space (MJS) widening occurs in athletes during sustained competition.

**PURPOSE:** To examine acute UCL thickness and MJS adaptations in the throwing arm of Division I collegiate baseball pitchers with MSKUI following one in-game performance.

**METHODS:** Ten NCAA Division I collegiate baseball pitchers (mean age 20.4 ± 1.4 yrs) with no history of significant upper extremity injuries participated. Musculoskeletal ultrasound images were obtained with a GE LOGIQ e ultrasound unit before and immediately after (~15 minutes) pitching performance during each subject’s first game of the season. A 3 kg valgus force was applied with a handheld dynamometer (Hoggan Scientific microFET 2) 20 cm distal to the medial epicondyle of the throwing arm during imaging. Post-imaging ligament thickness measurements were performed at the mid-substance of UCL and at the apex of the trochlea. Moreover, post-imaging measurements were performed from the apex of the trochlea to the apex of the ulna to evaluate MJS. Changes to UCL thickness (mid-substance and apex of the trochlea) and MJS were analyzed using paired samples t-tests.

**RESULTS:** There was no significant difference in mid-substance UCL thickness width before (5.72 ± 0.77 mm) and after performance (5.70 ± 0.77 mm; t(9) = 36.3, p = .73). With respect to apex of trochlea UCL width, no significant differences were found before (2.67 ± 0.77 mm) and after (2.61 ± 0.66 mm; t(9) = 1.30, p = .23) performance. When assessing MJS, a significant change of ~4% was observed before (6.30 ± 1.5 mm) and after (6.60 ± 1.5 mm; p<0.05). Controlling for the innings pitched (F (1,7) = .11, p = .75) and pitch count (F (1,7) = 21, p = .66) did not affect the change in MJS.

**CONCLUSIONS:** A significant MJS widening did occur after one pitching outing at the start of the season; whereas, no changes were observed in UCL thickness measured at two different locations. Further research is needed to understand the etiology of increased medial elbow joint widening in pitchers at the start of the collegiate baseball season.

**ACKNOWLEDGMENT:** The authors would like to thank the Division I baseball players who volunteered for this study.

**REFERENCES:**


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**Table 1: Association of Biomarkers and Tendinopathy**

<table>
<thead>
<tr>
<th>Biomarkers</th>
<th>With The Diagnosis of Tendinopathy</th>
<th>Without The Diagnosis of Tendinopathy</th>
<th>P-Value</th>
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<tr>
<td>25-hydroxy-Vitamin D</td>
<td>26.2 ± 9.2 mg/L (n = 138)</td>
<td>26.5 ± 12.4 mg/L (n = 138)</td>
<td>0.7966</td>
</tr>
<tr>
<td>Hemoglobin A1c</td>
<td>6.5 ± 1.1% (n = 138)</td>
<td>7.5 ± 1.7% (n = 138)</td>
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<tr>
<td>ESR</td>
<td>63 (40%) (n = 138)</td>
<td>684 (53%) (n = 138)</td>
<td>0.0021</td>
</tr>
<tr>
<td>CRP</td>
<td>26 mg/L (n = 138)</td>
<td>61 (36%) (n = 138)</td>
<td>0.006</td>
</tr>
<tr>
<td>Hbg (Abnormal)</td>
<td>men: &lt;13.5 mg/dL or &gt; 17.5 mg/dL</td>
<td>women: &lt;11.5 mg/dL or &gt; 15.5 mg/dL</td>
<td>&gt;0.01</td>
</tr>
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</table>

**CONCLUSIONS:** Measures of shoulder joint ROM do not predict MJS or UCL thickness in asymptomatic baseball pitchers at the start of the season. Further research is recommended to perform multiple imaging sessions throughout the competitive season to further evaluate relationships between shoulder ROM and medial elbow structures.
completed a 46-item online questionnaire about their interest in a digital biomarker for monitoring stress-related injury risk, and their willingness to share data from specific smartphone sensors to develop that digital biomarker. RESULTS: Most athletes (82%) expressed an interest in a digital biomarker for monitoring their stress-related injury risk; however interest was significantly lower if medical staff (73%), coaches (64%), or administrators (60%) would have access to the biomarker (all p < .01). Most were willing to share data from sensors capturing motion (88%), environment (93%), location (73%), connections (77%), and usage (65%). Keyboard input was the least accepted source of data with almost 40% reporting they would never share that data to create a digital biomarker. CONCLUSION: Athletes generally find it acceptable to share their smartphone sensor data if the data will be used to identify digital biomarkers of stress-related injury risk and to recommend just-in-time stress management interventions for injury prevention.

CONCLUSION: The 30 second lateral hop endurance test had excellent reliability between raters and between days as well as a strong correlation between days. Having established the reliability of this test between days and rater, subsequent studies will evaluate differences within injured athletes.

PURPOSE: About 35% of athletes with anterior cruciate ligament (ACL) reconstruction fail to return to their preinjury level of sports participation. Psychological factors, such as fear of reinjury, often prevent athletes who wish to return to their sport from achieving their goal. Limited evidence is available to direct patient care to target these psychological impairments. Most ACL injuries are non-contact in nature and typically occur during a deceleration task such as jump landing. We propose that training focused on improving jump landing performance will improve psychological factors and facilitate increased sports participation.

METHODS: Forty-eight athletes completed screening tests an average of 2 years after unilateral ACLR (Wk0). Testing included the ACL-Ret in Sport to Injury (ACL-RSI) scale as measure of psychological readiness for sports participation. Athletes (n = 25, 9 men, age = 23 ± 5 yr) who scored below normative ACL-RSI recovery standards (<65%) completed 8 weeks of twice-weekly jump landing training. Retesting occurred at midtraining (Wk4), posttraining (Wk8), and 2 months after training (Wk16). Athletes answered a survey measuring perceived changes in sports participation at the end of training. Changes observed during training were determined via repeated measures ANOVA.

RESULTS: ACL-RSI scores improved substantially throughout treatment (mean ± SD; Wk0: 53 ± 18%, Wk4: 67 ± 15%, Wk8: 76 ± 16%; p<0.001). Treatment benefits were transferred after the retuning period (Wk16: 81 ± 15%; p=0.052). Four out of 5 athletes trained report that they were more likely to participate in their sports activities after training and two thirds of the cohort described at least a moderate increase in their sports participation.

CONCLUSIONS: Progressively dosed jump training that focuses on correcting aberrant landing movements is effective at addressing psychological factors in athletes who self-identify as having limited readiness for sport. The training was also effective at facilitating increased sports participation. Clinicians should consider implementing similar jump training interventions to help athletes who are struggling to return to their desired sport participation because of limited confidence or high fear of reinjury. Funded in part by the Foundation for Physical Therapy.

The 30 second lateral hop endurance test had excellent reliability between raters and between days as well as a strong correlation between days. Having established the reliability of this test between days and rater, subsequent studies will evaluate differences within injured athletes.

CONCLUSION: The 30 second lateral hop endurance test had excellent reliability between raters and between days as well as a strong correlation between days. Having established the reliability of this test between days and rater, subsequent studies will evaluate differences within injured athletes.

Functional tests for patients attempting to return to sports, typically focus on sagittal plane movement such as a hop test. Additionally, most functional tests do not have an endurance component to them. Many injuries involve aberrant frontal plane control and occur later in a game situation. The development of a lateral endurance hop may prove useful to identify at risk athletes. As a first step, we sought to determine the reliability of a newly developed lateral hop test.

PURPOSE: The purpose of this study was to evaluate the reliability of a new lateral hop endurance test.

METHOD: 19 healthy subjects (11 M, ages 22.4 ± 3.1, BMI 22.9 ± 3.0) with no prior lower extremity injuries completed 30 second intervals of single legged lateral hopping with the targets separated by 15.24 centimeters. Performance was measured by counting the number of times the subject was able to hop completely over and back. An error was classified as putting a foot down or landing on the target and not counted. Reliability between raters as well as within and between days was assessed using an Intraclass Correlation Coefficient (ICC) and Pearson Product Moment Correlation.

RESULTS: The average number of successful hops was (29.20 ±6.35 hops). Between rater reliability (ICC=0.99), between day reliability (ICC=0.94), and correlation between days (r=0.89, p<0.001) were all excellent.

CONCLUSION: The objective of this study was to assess the between and within session reliability of a new single leg hurdle test.

METHODS: 20 healthy subjects (11 M, ages 22.4 ± 3.1, BMI 22.9 ± 3.0) with no prior lower extremity injuries completed a single leg hop over a series of four consecutive 30.5 cm high hurdles. The distance between the hurdles was equal to the subject’s leg length with 2 trials performed on each leg. Performance was measured as the time it took to complete the hurdle series and how many attempts it took them to complete successfully. An error occurred if the subject knocked over a hurdle, hopped to the side of the hurdle or did not stick the landing on the final hop. Reliability between raters as well as within and between days was assessed using an Intraclass Correlation Coefficient (ICC).

RESULTS: The average time to complete the hurdle test was (3.63 ±1.59 seconds), and the average difference between days was (0.66 ±0.95 seconds). Between rater reliability (ICC=0.99), between day reliability (ICC=0.90), and within rater same day reliability (ICC=0.98) were all excellent.

CONCLUSION: The single leg hurdle test shows excellent within and between day reliability to complete the task. These results indicate that the test is a reliable assessment and establishes its face validity. The greater vertical component associated with this test may bias the hop towards greater quadriceps activation and help screen individuals for asymmetries. Having established the tests reliability, subsequent studies should assess its use for determining return to sport for patients following an injury.

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CONCLUSION: The use of the Star Excursion Balance Test (SEBT) is to screen deficits in dynamic postural control due to musculoskeletal injuries and to identify athletes at greater risk for lower extremity injury. However, the use of the SEBT has not proved reliable in female soccer populations in identifying potential lower extremity injury when assessed during pre-participation physical examinations.

METHODS: 23 healthy NCAA Division I female soccer athletes; 20.3 (1.2) years, 165.1 (7.62) cm, 59.8 (8.6) kg, participated in this study. Prior to the start of the season, the anterior, posteromedial, and postero lateral SEBT reach distances were measured bilaterally. Each reach distances were normalized for lower limb length. Throughout the season, injury record was maintained by the certified athletic trainer. The athletes were grouped into injured (INJ) and non-injured (N-INJ) athletes. Composite scores for all three reach distances were also calculated.

RESULTS: Independent t-test was conducted to compare reach distances for the SEBT between INJ and N-INJ athletes. There were no significant differences between the INJ and N-INJ group for normalized reach distances, nor composite scores of the SEBT.

However, there was a significant difference in anterior reach asymmetries for those that sustained an injury (M= 6.06, SD=4.5); (t(21)=2.78, p=0.011) and those that did not sustain a lower extremity injury (M=2.5, SD=1.3). CONCLUSIONS: In this study, the SEBT showed differences for lower extremity injury in the female soccer population when assessing the anterior asymmetries. Our results suggest that portions of the SEBT can be incorporated into pre-participation physical examinations to identify soccer athletes who may have a significant difference between limbs and potentially be at an increased risk for lower extremity injury.
The reinjury rate of young athletes post anterior cruciate ligament reconstruction (ACL) is 23%. Return to sport (RTS) testing, assessing limb asymmetries between the affected limb (AL) and unaffected limb (UAL), is utilized with hopes of preventing injury. **Purpose**: To compare performances of the AL and UAL ≥ 12 months post ACLR to the dominant limb (DL) and non dominant limb (NDL) of healthy controls during common RTS tests. **Methods**: 11 ACLR (9 females, 2 males, 22±4.3 years old, 5.4±4.2 years post op) and 11 healthy BMI matched controls (9 females, 2 males, 21.7±2.1 years old) were recruited. Tests included: Y excursion (anterior, posterior, lateral, posterior-medial), hop tests (single hop, triple hop, and triple cross over hop, timed hop), weight bearing lunge and isokinetic concentric peak flexion and extension torque at 60, 120, 300, 450 degrees/sec (Biodex System 4 Dynamometer MVP). **Acceptable trials for each test and limb were recorded.** The limb symmetry index (LSI) (equaled 100(AL)/UAL and 100(DL)/NDL) for ACLR and control groups respectively and was compared between groups using MANOVA (p=0.05). LSI ≥ 85% and LSI ≥ 115% were deemed clinically important differences. Pearson correlation coefficients were calculated between peak isokinetic torques and functional tests. **Results**: No statistically important differences between ACLR and control LSIs were observed. There were no clinically significant differences for the ACLR group (r=4.8±8.6% - 113.4±35.9%). Primarily small correlations were shown between the test and RTS tests. A strong correlation was observed between NDL triple hop and 60deg/s peak extension torque for controls (r=0.74). **Conclusion**: For athletes ≥ 12 months post ACLR, no statistically or clinically important asymmetries were found for RTS tests compared to controls. These findings question the sensitivity and validity of the current RTS assessment. 3D motion analysis has shown kinematic asymmetries that affect function 2 years post ACLR. Future studies should investigate the role of 3D biomechanical analyses in RTS testing, with hopes to improve injury prevention.

**Purpose**: Decreased ankle dorsiflexion has a relationship to lower extremity injury. Utilizing screens to effectively identify decreased dorsiflexion can help improve clinicians’ efficiency. The purpose of this study was to compare ankle dorsiflexion range of motion (ROM) using an ordinal scored modified weight bearing lunge test (MWLT) and the evaluation hemi kneeling lunge test (HDT). It is presumed that there will be a relationship between MWLT dorsiflexion ordinal scoring and the HDT ROM measurements. **Methods**: 30 healthy subjects (60 ankles) participated in this study. Ankle dorsiflexion ROM was measured using the MWLT and HDT. The MWLT was completed in a standing heel to toe position. The dorsiflexion of the back ankle was scored in relation to how the back knee aligns relative to the medial malleolus of the front ankle. The MWLT is scored on an ordinal scale: behind, within, or beyond the malleolus. The HDT was performed with the patient in a half kneeling position, placing a digital inclinometer just inferior to the tibial tuberosity on the forward leg. Subjects were instructed in both the HDT and MWLT to bring their knee as forward into the foot without lifting off the ground. All measurements were obtained two times per side, with 5 minutes of rest between measurements to prevent a treatment effect. Statistical analysis was completed using a series of ANOVAs. Tukey post-hoc were used to identify specific group-to-group differences (p<0.05). **Results**: Significance was found between HDT and MWLT (p=0.001). The mean HDT measurement for the MWLT score of behind was 33.5±2.0 degrees, within was 38±6.1±2.2 degrees, and beyond was 43±0.78 degrees. Tukey post hoc analysis showed that there was a significant difference comparing MWLT score of beyond and behind (p<0.001) and beyond and within (p<0.0097). No differences were found comparing MWLT score of within and behind to HDT (p=0.0760). **Conclusions**: There was a distinct difference in ankle dorsiflexion ROM between the MWLT scores of beyond and behind and within and beyond, when comparing to HDT. There was no difference in the MWLT scores of behind and within when compared to HDT. Future studies should compare goniometric measure of the MWLT to the ordinal scale and further elucidate the differences and underlying causes in the MWLT ordinal scores.

**Purpose**: The return to sport following anterior cruciate ligament reconstruction (ACL) may be impeded by psychological factors such as high fear of re-injury (kinesiophobia) or low confidence (self-efficacy). Screening psychological readiness for sport can identify individuals in need of additional intervention. The Anterior Cruciate Ligament Return to Sport after Injury (ACLR-RSI) is a 12-item questionnaire to assess psychological readiness for sport in domains of Emotions, Confidence, and Risk Appraisal. The ACL-RSI contains 2 fear of re-injury items (Emotions domain) and 5 confidence items (Confidence domain). Fear of re-injury has lower representation in the ACL-RSI total score and may not be identified to the same extent as confidence level. The purpose of this study was to examine during return to sport after ACLR 1) the relative ranking of ACL-RSI fear of re-injury item scores compared to other item scores and association with ACL-RSI total score, and 2) the association of ACL-RSI domain and total scores with kinesiophobia and self-efficacy questionnaire scores. **Methods**: Participants were 21 patients with ACLR (mean 17.4 years, 11 males) enrolled in a 5 week (10 visit) group-based return to sport training program. ACL-RSI, Tampa Scale for Kinesiophobia-11 (TSK-11) and Knee Activity Self Efficacy (KASE) questionnaires were administered before and after training. **Results**: All questionnaire scores improved from pre- to post-training (ACL-RSI: 63.2 to 73.8, TSK-11: 21.4 to 17.3, KASE: 78.5 to 92.5; p < .01). Both ACL-RSI fear of re-injury items ranked in the lowest 3 item scores at pre- and post-training, but had moderate to high correlation with ACL-RSI total score (r = .56 to .83, p<.01). ACL-RSI Confidence domain score and total score were positively correlated with KASE score at pre-training, post-training, and in the pre- to post-training change (r=.50 to .73, p<.05). ACL-RSI Emotions domain score and total score were not significantly correlated with TSK-11 score at any time point (p>0.05). **Conclusions**: Athletes with high fear of re-injury should be appropriately identified by their ACL-RSI score. It appears necessary to administer the TSK-11 separately to identify kinesiophobia, whereas a separate questionnaire for knee self-efficacy does not appear warranted.
Unilateral assessments are used to monitor the restoration of strength and strength symmetry following unilateral injury, such as an anterior cruciate ligament (ACL) tear.

**PURPOSE:** To assess the relationship between unilateral isokinetic knee extension (KE) strength and triple hop distance in post-operative ACL reconstruction patients at the time of return to sport (RTS). Methods: Thirty-two (15 male; 17 female) adult patients (age: 24.40 ± 5.78 years; height: 67.0 ± 4.0 inches; mass: 72.30 ± 17.25 kg) participated in the study. The participants randomly completed isometric strength tests of knee flexion and extension with the handheld dynamometer (HD), handheld dynamometer with patient stabilization strap (SHD), and HUMAC NORM Dynamometer (HN; CSMi, Stoughton, MA). The average of three trials was normalized by body weight and the ratio between knee flexion and extension strength was recorded for analysis.

**RESULTS:** A repeated measures ANOVA was performed to determine significant differences (P < 0.05 a priori) between variables; F(2) = 19.352, p < .01. Post hoc comparison showed SHD (mean = 2.70 ± 0.245) was significantly greater than HD (1.38 ± 0.05), HDS (mean = 2.70 ± 0.245) was significantly greater than HD (1.38 ± 0.05) and HD (1.38 ± 0.05). No significant difference was observed between HD and HDS (mean = 2.70 ± 0.245), HD and HN (mean = 2.64 ± 0.05), HD and SHD (mean = 2.70 ± 0.245), HDS and HN (mean = 2.64 ± 0.05), and HN and SHD (mean = 2.70 ± 0.245). The ES from studies involving patients with concomitant injuries (e.g., meniscus tears) was smaller than that from those without concomitant injuries (P = 0.012). Regressions also indicated a greater study ES as the isokinetic testing speed increased (P = 0.040).

**CONCLUSIONS:** Time post-ACLR, graft type, concomitant injuries, and isokinetic testing speed may explain some of the between-study variability in the KE strength of ACLR patients' uninjured legs when compared to healthy controls. Future studies are needed to examine the causal effects of these identified variables on the uninjured leg's KE strength post-ACLR. Current practice using the uninjured leg as the reference for recovery post-ACLR may need to be implemented with caution, particularly in patients in the early stages of rehabilitation, with hamstring tendon autografts, and/or with concomitant injuries.

**Abstracts were prepared by the authors and printed as submitted.**
Femoroacetabular impingement (FAI) is a growing orthopedic condition among athletes and general population. It has been reported as being a precursor of hip pain and osteo-arthritis development. Many orthopedic manual (OM) tests are currently used to assess FAI. The cause of their low reliability is related to the variability between practitioners in their approach. 

PURPOSE: To quantify three tests commonly used to diagnose FAI (FABER, FADIR and the impingement sign).

METHODS: A sample of twenty healthy participants (10 men, 10 women) without hip, knee, or back pain will be recruited. Presently, measurements were performed on the thirteen first participants during two sessions (one day apart) by three raters. We quantified the FABER height (Distance of the tibial tuberosity to the table) and ROM (in millimeter and degree) using four conditions for each test: (C1) classic, (C2) using an algometer to document pressure variability between tests and raters, (C3) under a hip positioning personalized according to a specific functional task and (C4) including the two last one. Reliabilities of measurements were determined using mean intraclass correlation coefficient (min-max) and the confidence intervals.

RESULTS: Regarding intra-rater reliability (Table 1), impingement sign and FADIR tests had higher ICC values than all the conditions when compared to FABER. Concerning the use of an algometer, intra-rater reliability increased for the three tests in comparison to C1 and C2 (mean values). Concerning inter-rater reliability, the analysis showed best mean value for C1. The use of an algometer did not increase ICC between C1 and C2. 

CONCLUSION: Impingement sign, with a simpler hip positioning, had the highest intra and inter reliability values. Using an algometer while performing OM tests seems to be helpful to improve reliability of test measurements. However, FABER test still needs improvement.

TABLE 1. Mean Intra-class Correlation Coefficients (ICC 2.1)

| Baseline | Impingement | FADIR | Mean (C1 95%)
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>0.53 (0.40-0.66)</td>
<td>0.52 (0.34-0.68)</td>
<td>0.70 (0.60-0.86)</td>
</tr>
<tr>
<td>C2</td>
<td>0.56 (0.43-0.68)</td>
<td>0.67 (0.56-0.78)</td>
<td>0.80 (0.73-0.87)</td>
</tr>
<tr>
<td>C3</td>
<td>0.62 (0.54-0.71)</td>
<td>0.55 (0.47-0.68)</td>
<td>0.66 (0.52-0.79)</td>
</tr>
<tr>
<td>C4</td>
<td>0.57 (0.49-0.66)</td>
<td>0.59 (0.49-0.70)</td>
<td>0.75 (0.58-0.87)</td>
</tr>
</tbody>
</table>

E-42 Free Communication/Poster - Obesity and Exercise

Friday, June 1, 2018, 7:30 AM - 12:30 PM
Room: CC-Hall B

Interindividual Variability For Change In Waist Circumference And Body Weight In Response To Standardized Exercise
Matthew W. Nelms1, Brittany P. Hammond2, Andrea M. Brennan1, Andrew Day1, Paula J. Stotz1, Benoit Lamarche2, Robert Ross, FACSM1, 1Queen’s University, Kingston, ON, Canada. 2Laval University, Quebec City, QC, Canada.

Substantial interindividual variability in response to a standard dose of exercise exists independent of the trait under investigation. Whether interindividual variability attributed to exercise exists after accounting for random variability is unknown. 

PURPOSE: To determine the magnitude of the interindividual variability in response to exercise for waist circumference (WC) and body weight (BW) after accounting for random variability and of an alterative of the by which variability is explained by a lifestyle behaviors. METHODS: Participants were 181 (61% female) sedentary, abdominally obese adults (mean, SD); 53, (7.5 years) who completed a 24-week intervention. Participants were randomly assigned to: control (n=44) or 5 weekly sessions of low amount, low intensity (LALI) (180 and 300kcal/session for women and men respectively at 50%; high amount, low intensity (HALI) (360 and 600kcal/session for women and men respectively at 50% V02peak, n=53); or high amount, high intensity (HAHI) (360 and 600kcal/session for women and men respectively at 75% V02peak, n=38). Adherence was ≥ 80% in all exercise groups. Physical activity (PA) performed outside of the prescribed exercise was measured by accelerometer. Daily self-report diet records were used to derive energy intake (kcal) and diet quality (Canadian-Healthy Eating Index-2010, Mediterranean Score).

The variability in response to exercise (SDR) was determined by separating the random variability from the intervention variability using the standard deviations (SD) from both the control and intervention groups. RESULTS: WC and BW were substantially reduced at 24 weeks in all exercise groups compared to control (P<0.01). The variability due to exercise (SDR) for change in WC was 3.1, 0.3 and 3.1 cm for LALI, HALI and HAHI groups respectively. Corresponding values for BW were 3.8, 2.0 and 3.5 kg for LALI, HALI and HAHI respectively. No dietary or PA variable was identified as a determinant of the individual variability in response to exercise for WC or BW (p<0.05). CONCLUSIONS: A substantial individual variability in response to exercise was observed for change in WC and BW after accounting for the random variability. The determinants of the heterogeneity in response to exercise remain to be determined. Supported by CIHR Grant OHN-63277.
person demonstrating the sequence. Participants were instructed to follow the verbal cues, but were permitted to take modifications of the poses to match their skill level. A trained instructor of Vinyasa yoga monitored whether each pose was performed in a manner consistent with the video or whether the individual modified the pose. Heart rate was assessed with a chest-worn monitor and energy expenditure was assessed with a portable metabolic indirect calorimetry device. RESULTS: The number of modifications to the asanas did not differ between overweight (4.5±3.7) vs. normal weight (4.6±3.3) at any time point. Total energy expenditure during the yoga session was greater in overweight (315.3±68.11) vs. normal weight (190.1±51.3) (p<0.80). However, energy expenditure relative to body weight (kcal per kg) did not differ between overweight (3.8±0.5) vs. normal weight (3.7±0.7) (p=0.80), and mean METs per minute did not differ between overweight (3.6±0.6) vs. normal weight (3.6±0.5) (p=0.85). CONCLUSIONS: In a 60-minute yoga session, the number of modifications to the asanas and the relative energy expenditure did not differ between overweight and normal weight participants. These findings may suggest that yoga is a viable form of exercise for both normal weight and overweight adults, which may have implications for enhancing energy expenditure and for body weight regulation.

INTRODUCTION: Obesity is associated with cardiac autonomic dysfunction at rest and may also influence the ability to recover from acute aerobic exercise (AE), but this still remains unclear. This is important, because acute AE induces a shift in autonomic balance towards sympathetic dominance, especially at moderate to vigorous intensities, which places greater stress on the cardiovascular system. The inability to return this balance to homeostatic levels quickly and efficiently after AE is an important indicator of risk. PURPOSE: To evaluate cardiac autonomic function at rest and during exercise recovery using heart rate variability (HRV) analyses in young, otherwise healthy obese vs. lean adults. METHODS: Seventeen lean (female=6; 26±5 yrs; 22.7±1.7 kg/m²) and 17 obese adults (female=7; 27±4 yrs; 32.3±2.2 kg/m²) performed moderate-intensity cycling exercise for 60 min. HRV was assessed at baseline, and at 30, 60, and 90-min post-exercise, whereas heart rate and LnLF/LnHF ratio increased from baseline, whereas all other HRV parameters decreased from baseline similarly in both groups (p<0.05). In both groups, LnHF, LnLF, and RMSSD returned to baseline at 90-min post-exercise, whereas heart rate and LnLF/LnHF remained above and LnTP remained below baseline at 90-min post-exercise (p<0.05). CONCLUSION: Our findings suggest that compared with lean counterparts, young otherwise healthy obese adults did not exhibit altered cardiac autonomic modulation following acute AE. Furthermore, our findings highlight that it may take longer than 90 min for both groups to recover using heart rate variability (HRV) analyses in young, otherwise healthy obese vs. lean adults.

RESULTS: There was a significant difference in relative (p<0.001; LOW: 21.5±3.2 vs. 22.5±3.2 mL/kg/min; PER: 17.3±2.4 mL/kg/min and absolute (p=0.002; LOW: 2.1±0.3 vs. 2.2±0.3 L/min; PER: 1.9±0.4 vs. 2.0±0.3 L/min) VO₂max across both groups, but no interaction (p>0.05). PPO also increased in response to training (p<0.01; LOW: 178.4±21.1 vs. 193.7±30.7 W; PER: 169.0±22.2 vs. 174.8±24.1 W) but there was no interaction (p>0.05). CONCLUSION: Although there were no significant differences between regimes, HIIT elicits significant changes in PPO and VO₂max in sedentary obese women, which are beneficial to health. The magnitude of change in VO₂max is lower than previously-reported values which raises the question if morbid obesity diminishes VO₂max response to training.

INTRODUCTION: Obesity and associated metabolic dysfunction has reaching epidemic levels. Physical activity is beneficial for preventing metabolic symptoms, of which myocytes secreted apelin, which not only correlated with muscle mass, and insulin resistance and secretion, creates a serious public health problem (World Health Organization 2015). In 2008, only 20% of adults in the United States met the CDC physical activity guidelines. Low levels of physical activity contribute to obesity, and a sedentary lifestyle along with obesity is related to higher risk of cardiovascular disease, type 2 diabetes, hypertension, and dyslipidemia (Abate 2000). High intensity interval training (HIIT) induces rapid increases in maximal oxygen uptake (VO₂max) in the initial weeks of exercise training, which is essential in obese populations, and is a more time efficient and enjoyable form of exercise than endurance training (Bartlett et al. 2011). Yet, few studies have investigated the effects of different HIIT regimes on change in VO₂max in obese, sedentary individuals.

RESULTS: A total 60 subjects [34 women (21 lean and 13 overweight/obese) and 26 men (8 lean and 18 overweight/obese)], age 30-59 years, with body max index (BMI) of 18-30 kg/m² were recruited based on the guidelines for overweight (BMI of 23-24.9 kg/m²) and obesity (BMI of 25 kg/m²) in Korean. Body composition, clinical parameters, and physical fitness tests were conducted. During the treadmill exercise following Bruce protocol, the blood before and 0, 15, 30 min after exercise were collected for analyses of apelin, lactate, lactate dehydrogenase (LDH), and creatine kinase (CK). Relationships among exercise-induced apelin, metabolic factors, and physical capacity were then analyzed. All measurements were conducted using independent, paired t-test between groups/time points, and Pearson correlations. RESULTS: There were significant positive correlations in post-exercise apelin level and skeletal muscle mass (r = 0.350, P = 0.006), homoeostatic model assessment of insulin resistance (HOMA-IR; r = 0.366, P = 0.004), HOMA insulin secretion (HOMA-%B; r = 0.360, P = 0.005), and isokinetic flexion and extension tests in 60° and 240°/sec (all variables, P = 0.05), but these parameters were not correlated with pre-exercise apelin levels. In men, the area under the curve of plasma apelin level was significantly higher in obese than lean individuals (P < 0.05), but this difference was not observed in women.

CONCLUSIONS: A single bout of exhaustive exercise induced apelin secretion, which not only correlated with muscle mass, and insulin resistance and secretion.
High intensity interval training (HIIT) is a suitable alternative to endurance exercise (Burgomaster et al. 2008) as it elicits similar adaptations yet is more time efficient and enjoyable (Kong et al., 2016). Results from Sawyer et al. (2016) and Higgins et al. (2016) reported that HIIT is effective in persons with obesity. However, the majority of existing data supporting efficacy of HIIT were acquired in a laboratory in which trained personnel supervise all sessions. This setting may not translate to HIIT performed in a “real world” environment. PURPOSE: The purpose of this study was to determine the feasibility of HIIT outside of a laboratory setting in sedentary, obese women. METHODS: 17 sedentary, obese women (age=37.51 ± 10.53 yr.; BMI=39.11 ± 4.34 kg/m²) participated in a 6-week exercise intervention with 3 training sessions per week, 2 in the laboratory (LAB) and 1 at home (HOME). Sessions were held at the same time of day within subjects and were performed a minimum of 24 hr apart. Heart rate (HR) was recorded via telemetry during LAB sessions, which were performed on a cycle ergometer. However, subjects were allowed to select the exercise modality for the HOME sessions, including running, cycling, or elliptical. The instructions for the HOME exercise mimicked the structure of the LAB sessions. Subjects were given downloadable HR monitors (Polar Inc., Lake Success, NY) to record HR during each HOME session. Subjects were asked to complete a HOME session 1 day/week at Rating of Perceived Exertion equal those attained during LAB on the Borg CR-10 scale. There were no consequences if the sessions were not completed. RESULTS: The average compliance rate for HOME in all 17 subjects was 73.53 ± 30.65%. Peak HR was higher during HOME for Week 1 (174.09 ± 18.63 vs 163.50 ± 14.98 b/min; p<0.01), Week 2 (175.56 ± 16.76 vs 157.50 ± 18.54 b/min; p<0.007), Week 3 (167.92 ± 20.45 vs 158.83 ± 13.89 b/min; p<0.014), and Week 4 (167.22 ± 21.38 vs 155.11 ± 15.77 b/min; p<0.026) versus LAB. There were no differences in peak HR between HOME and LAB peak HR for Week 5 (158.67 ± 26.08 vs 157.00 ± 16.30 b/min; p=0.99) or Week 6 (154.00 ± 28.82 vs 129.67 ± 31.66 b/min; p=0.31). CONCLUSION: In obese women, compliance to home-based HIIT is relatively high, and selected intensities are higher than those attained during lab sessions.

CONCLUSIONS: Our findings indicate that the Mueller and FAO/WHO/UHU programmed bioelectrical impedance analysis equations produce similar resting energy expenditure values as indirect calorimetry. These findings are important to weight management clinics without access to indirect calorimetry that currently use or are considering the use of this bioelectrical impedance analysis technology for their patients. Resting energy expenditure can be predicted in obese patients prior to individualized diet and exercise programming.

In the United States, more than one third of all adults are obese, classified by a BMI ≥ 30 kg/m². Direct medical costs for these individuals account for approximately 6% of national health expenditure. Several mechanisms have been proposed, but most consistently, obesity has been shown to complicate treatment and inflate resource utilization. Another possible explanation is obesity’s role in prolonging recovery. Currently, information regarding the relationship between obesity and the duration of care is limited.

PURPOSE: To examine the effect of obesity on hospital discharge and consequent treatment cost. METHODS: Our study involved 1,201 patients admitted to a Midwestern hospital who had complete demographic, anthropometric, and treatment data. Independent variables were age, sex, anthropometric indices, and five measurements of injury severity. Dependent variables were hospital length of stay (number of days) and total patient billing (dollars). Independent-samples t tests assessed differences between obese and non-obese patients, a negative binomial regression evaluated hospital length of stay, and a multiple linear regression tested logged cost data. RESULTS: Across the sample, average age was 55.1 ± 20.3 and 67.5% of patients were male. Average BMI was 28.46 ± 6.14% and 14.4% of patients were obese. Mean injury severity score was 16.3 ± 10.6 and average length of stay was 7.7 ± 9.0 days. Independent-samples t tests found obese patients to have 19.4% longer hospital stays (1.5 days; p=0.001) and 31.4% greater hospital bills (p=0.015) than non-obese patients. With confounding variables held constant, the negative binomial regression found obesity to predict a 17.1% longer hospital stay (1.3 days, p<0.001). While the multiple linear regression showed a non-significant increase for the effect of BMI on logged patient charges (p=0.111), classification of obesity on logged patient charges supported a trend for increase in patient cost (p=0.078).

CONCLUSIONS: Obesity in the hospitalized patient associated with a significantly longer duration of care and a trend for increased total expenditure. Exercise may function as a preventive strategy to avert the temporal and financial ramifications of obesity.

It has been shown that physician-referred hospital-based team-approach programs can be effective interventions for weight loss for adults. Programs that include strategies in behavior change may assist in successfully completing a weight loss program. PURPOSE: The purpose of this project was to evaluate the effectiveness of behavioral contracting to improve program adherence and reduce attrition in a physician-referred weight loss program for adults. METHODS: Participants included obese (BMI≥30) adults (Age 53.4±1.3yrs) enrolled in a physician-referred program. Participants were enrolled without signing an accountability contract (CONTROL, N=48) or enrolled after signing an accountability contract (CONTRACT, N=48). Starting and final weights were recorded before and after a 16-24 week intervention period that included supervised exercise sessions (EX), and scheduled consultations with a registered dietician (RD, N=4) and a behavioral health specialist (BHS, N=4). The CONTRACT group signed an accountability statement that listed program goals, standards/expectations, and an acknowledgment of commitment statement. Attendance for EX, RD, and BHS sessions was recorded. Program completion was determined if a final weight was recorded for a participant at the end of the program. Independent sample t-tests (p<0.05) were used to determine differences in participant characteristics.

RESULTS: There were no significant differences in participant characteristics for

**NOTE:** The above text contains numerical data that may require further analysis or interpretation. Please verify the accuracy of the numerical values provided.
CONTRACT as compared to CONTROL (Age 53.0±13.6 vs. 53.8±12.0; Sex 81.3% vs. 81.3% female; Starting Weight (lbs) 238.1±44.7 vs. 228.1±38.9; % Weight Loss -6.7±3.3% vs. -4.8±4.5%). Program completion was higher for CONTRACT as compared to CONTROL (87.5% vs. 58.3%). The proportion of participants who attended 75-100% of required consultation visits was higher for CONTRACT as compared to CONTROL (RD 85% vs. 29%; BHS 77% vs. 25%). However, EX attendance was slightly lower for CONTRACT as compared to CONTROL (44% vs. 52%). CONCLUSION: Behavioral contracting may be an effective tool for increasing specialized consultation adherence and reducing attrition in a physician-referred weight loss program. Additional research is required to determine how to increase exercise session adherence.