A-21 Thematic Poster - Concussion: Novel Research Findings

Wednesday, May 30, 2018, 9:30 AM - 11:30 AM
Room: CC-Mezzanine M100C

Chair: Jeffrey M. Mjaanes, FACSM. Northwestern University, Evanston, IL.
(No relevant relationships reported)

86 Board #1 May 30 9:30 AM - 11:30 AM
Risk Of Concussion By Sex And Activity In U.S. Service Academy Cadets
Kenneth L. Cameron1, Megan N. Houston1, Kathryn L. O’Connor2, Karen Y. Peck3, Steven J. Svoboda1, Tim Kelly2, C. Dain Allred4, Darren E. Campbell3, Christopher J. D’Lauro1, Jonathan C. Jackson3, Brian R. Johnson3, Gerald T. McGinty1, Patrick G. O’Donnell5, Paul Pasquina6, Thomas McCailester7, Michael McCrea8, Steven P. Broglio, FACSM2. 1United States Military Academy, West Point, NY. 2University of Michigan, Ann Arbor, MI. 3United States Air Force Academy, Colorado Springs, CO. 4United States Coast Guard Academy, New London, CT. 5Uniformed Services University of the Health Sciences, Bethesda, MD. 6Indiana University, Indianapolis, IN. 7Medical College of Wisconsin, Milwaukee, WI. (Sponsor: Steven P Broglio, FACSM)
(No relevant relationships reported)

Purpose: Examine the relative risk of concussion between males and females across three U.S. Service Academies based on level of sport competition, participation in physical education classes, military training, and free time activities.

Methods: We conducted a prospective cohort study using data from the Concussion Assessment, Research and Education (CARE) Consortium at three U.S. Service Academy sites (U.S. Military, U.S. Air Force, U.S. Coast Guard). Between August 2014 and June 2017, 10,603 participants were enrolled across the three sites. Participants were actively followed for incident concussions following enrollment. Incidence proportions, risk ratios (RR), and 95% confidence intervals (CI) were calculated by sex for concussions sustained by level of sport participation, physical education, military training, and free time activities.

Results: Of the 10,603 participants enrolled, 10,599 (n=2521 female) had complete data for the current analysis and 639 sustained a concussion during the follow-up period. The overall incidence of concussion across all sites was 6.03 (95% CI: 5.58-6.50) per 100 subjects. Females were nearly twice as likely (RR=1.93, 95% CI: 1.65-2.25, p<0.001) to sustain a concussion across all three academies regardless of activity. Females participating in club sports (RR=1.52, 95% CI: 1.06-2.19, p=0.022), physical education classes (RR=2.06, 95% CI: 1.49-2.86, p<0.001), military training (RR=2.32, 95% CI: 1.49-3.60, p<0.001) and free time activities (RR=2.83, 95% CI: 1.91-4.20, p<0.001) were also at significantly higher risk for injury. There were no differences in concussion risk among males and females participating in NCAA varsity (RR=1.11, 95% CI: 0.81-1.55, p=0.499) or intramural athletics (RR=1.04, 95% CI: 0.48-2.28, p=0.902). This held true even when football athletes and injuries were removed from the analysis for NCAA varsity athletics (RR=1.38, 95% CI: 0.96-1.98, p=0.077).

Conclusions: These preliminary findings suggest that the risk of concussion among females is nearly twice as high when compared to males at U.S. Service Academies. This increased risk ranges from 1.5 to nearly 3 times higher when compared to males across a number of activities. Further analysis is needed to better understand the factors associated with this sex discrepancy.

87 Board #2 May 30 9:30 AM - 11:30 AM
Trends In Concussion Incidence In High School Sports, 2008-09 To 2015-16
John D. Reynolds1, Andrew E. Lincoln2, Shane V. Caswell2, Reginald E. Dunn2, Lisa H. Hepburn3. 1Fairfax County Public Schools, Fairfax, VA. 2MedStar Health, Baltimore, MD. 3George Mason University, Manassas, VA. (No relevant relationships reported)

Although many studies have documented the effects of concussions in high school athletes, few recent studies have analyzed incidence rates of concussions in high school contact sports.

Purpose: To explore recent trends in sports concussion at the high school level for the period 2008-09 to 2015-16 in light of changes in concussion-related legislation, educational requirements, and public awareness.

METHODS: Sport-related concussion data were prospectively reported in an electronic medical record-keeping program by certified athletic trainers for 25 high schools in a large public school system over a consecutive eight-year period (academic years 2008-09 to 2015-16). The population included 115,439 student athletes over the study period in six boys’ sports (football, soccer, lacrosse, wrestling, baseball, and basketball) and six girls’ sports (soccer, lacrosse, basketball, cheerleading, softball, and field hockey). Incidence rates and rate ratios were calculated.

RESULTS: Over the eight years, there were 7,439 concussion injuries in 7,789,818 Athlete-Exposures (AEs), for an overall incidence rate of 0.95 concussions per 1000 AEs. Football (n=3118, 1.85 per 1000 AEs) accounted for 42% of all concussions and had a concussion rate nearly 9 times greater than baseball (n=108, 0.21 per 1000 AEs). Among girls’ sports, cheerleading experienced the highest number of concussions (n=587, 0.89 per 1000 AEs), while girls’ soccer had the highest incidence rate (n=525, 0.97 per 1000 AEs). The overall (12-sport) concussion rate increased 39% from 0.24/1000 AEs in 2008-09 to 0.76 per 1000 AEs in 2015-16. During this time, there was a 149% rise in overall concussion rate from 2008-09 to its peak in 2011-12 (1.35 per 1000 AEs), followed by a 44% decline to 2015-16.

CONCLUSION: This study presents the first evidence of a significant decline in high school sport-related concussion rates, which occurred from 2011-12 to 2015-16. The decline may reflect the combined effects of local school district policy changes and education programs, passage of a state concussion education law, nationwide rule changes within individual sports, more effective protective equipment, and changes in player behavior and technique.

88 Board #3 May 30 9:30 AM - 11:30 AM
Concussion Incidence in United States High School Boys’ Ice Hockey, 2008/09-2015/16 School Years
Juleah M. Heath1, Lauren A. Pierpoint2, John M. Roseen3, Zachary Y. Kerst3. 1University of New England, Biddeford, ME. 2Colorado School of Public Health, Aurora, CO. 3University of North Carolina at Chapel Hill, Chapel Hill, NC. (No relevant relationships reported)

In recent years, the sport of ice hockey has grown in participation and popularity. Subsequently, there is a greater interest in the risk of injuries associated with participation, particularly concussions at the high school level. PURPOSE: To examine the concussion rates and mechanisms in high school boys’ ice hockey in the 2008/09-2015/16 school years. METHODS: Data were obtained from the National High School Sports-Related Injury Surveillance System (HS RIO) during the 2008/09-2015/16 school years. HS RIO used a convenience sample of high school boys’ ice hockey programs. Athletic trainers provided detailed reports on injuries and athlete-exposures (AE). Injury rates per 1,000 AE, injury rate ratios (IRR), and injury proportion ratios (IPR) with 95% confidence intervals (CI) were calculated.

RESULTS: Overall, 323 concussions were reported during the 2008/09-2015/16 school years, of which most occurred during competition (85.4%) and in-season (92.9%). These concussions were reported across 467.278 AEs, for a concussion rate of 0.69/1,000 AEs. The concussion rate was higher in competition than practice (1.75 vs. 0.15/1000 AEs; IRR=11.15; 95% CI: 8.45, 15.68). Most concussions were due to contact with another player (47.1%), followed by contact with the boards/glass (31.6%). Concussions occurred while being checked (36.5%), skating (28.2%), and chasing a loose puck (10.5%). Most concussions occurred in wings (47.1%), followed by defensemen (28.5%) and centers (11.5%). When comparing injury mechanism distributions between being checked and checking, the proportion of concussions due to contact with another player was higher in checking than being checked (68.8% vs. 41.5%; IPR=1.66; 95% CI: 1.2, 2.43). Of the seven concussions sustained by goalies, 42.9% were due to contact with the puck; in comparison, no concussions among all other competition positions had concussions reported to be due to contact with the puck. CONCLUSION: Concussions in high school boys’ ice hockey occur mainly in competition and result from player contact. These concussions appear to be position dependent with the highest incidence occurring to wings. Examination of adaptations to the checking rule or teaching the checking technique may lead to a reduction in concussive events.

90 Board #4 May 30 9:30 AM - 11:30 AM
The Effect of Concussion on Subsequent Musculoskeletal Risk in High School Athletes
Alex Nussbickel, Ashley Zapf, Brady Tripp, Terrie Vasiliopoulos, Daniel Herman, FACSM. University of Florida College of Medicine, Gainesville, FL. (No relevant relationships reported)

PURPOSE: Prior studies in collegiate and professional athletes have noted an increased risk of musculoskeletal (MSK) injury after concussion; however, the effect in younger athletes at lower levels of competition is unknown. This study compared the risk of MSK injury in concussed high school athletes after return to play to that of non-concussed athletes.
METHODS: High school athletic training room electronic medical records from the 2010-2011 to the 2014-2015 seasons were queried for time-loss concussion and MSK injury in football, volleyball, basketball, soccer, lacrosse, baseball, and softball athletes from twelve local high schools. Concussed athletes were assessed for presence of MSK injury within 365 days prior to and subsequent to the concussion. Non-concussed athletes who experienced MSK injury were assessed for the presence of a second MSK injury within 365 days. Non-injured athletes were recorded for every year without injury. Chi-square analyses were conducted to compare the frequency of subsequent musculoskeletal injury in the athlete-years with prior concussion, prior concussion with prior musculoskeletal injury, and neither prior musculoskeletal injury or concussion. Odds ratios with 95% confidence intervals were calculated, and significance was set a-priori at $P = 0.05$.

RESULTS: Of the total number of athlete-years in this study ($n=14461$), 1.8% sustained a concussion and 8.3% experienced a MSK injury within a year of concussion. MSK injury was significantly associated with previous concussion ($P < 0.001$), and athletes with a concussion displayed nearly three times the likelihood of subsequent MSK injury in the following year when compared to those without previous concussion (OR=2.9, 95%CI: 1.9-3.7). This relationship proved similar in both male (OR=2.9, 95%CI: 2.1-4.0) and female (OR=2.8, 95%CI: 1.3-6.3) athletes. However, no difference in rates of later MSK injury was observed in the athletes with prior MSK injury or a combination of prior MSK injury and concussion ($P = 0.34$).

CONCLUSIONS: High school athletes who sustain a concussion display an elevated risk of subsequent MSK injury at rates comparable to higher-level concussed athletes and to athletes who have sustained a prior MSK injury. Neuromechanical rehabilitation during concussion recovery may be needed to moderate this effect.

Estimates of the incidence of sport-related concussions range from 1.6 to 3.8 million cases per year. Short- and long-term consequences of concussion are continued topics of intensive research. In addition to an increased risk of suffering a second concussion or musculoskeletal (MSK) injury upon return to sport (RTS), long-term term sequelae include increased risk of mild cognitive impairment to severe neurodegenerative disease. This and recent studies have investigated the effect of concussion on lower extremity MSK injury.

PURPOSE: To perform a systematic review and meta-analysis to determine the risk of lower extremity MSK injury after concussion.

METHODS: A comprehensive search of electronic databases through to September 2017 was performed by two independent reviewers and supplemented by manual searches of the reference lists of included studies. Two search concepts were used: the first terms were ‘cognition’, ‘brain’, and ‘brain injuries’; the second were ‘athletic injuries’ and ‘lower extremity.’ Studies were included if they reported the number of lower extremity injuries in athletes after RTS from a concussion diagnosis. Nine studies were included for data extraction and analysis. Data regarding number of injuries after concussion were combined via odds ratio (OR) and incidence rate ratio (IRR) meta-analysis using a random effects model. 95% confidence intervals (CI) were also calculated.

RESULTS: Seven of the nine included studies individually reported higher rates of lower extremity MSK injury after concussion, while two reported no significant difference in injury risk between concussed athletes and non-concussed control athletes. Results of the meta-analysis show that athletes who suffered a concussion had 2.06 times the odds of sustaining a lower extremity injury after RTS compared to a control group (OR = 2.06, 95% CI 1.48-2.88). Athletes who suffered a concussion had a 1.67 times higher incidence rate of lower extremity injury per athletic exposure after RTS (IRR = 1.67, 95% CI 1.42-1.96).

CONCLUSION: Based on the evidence of higher risk of lower extremity MSK injuries after concussion, concussed athletes should be examined not only for their cognitive function prior to RTS, but also screened for neuromuscular risk factors associated with lower extremity MSK injuries.

PURPOSE: Examine the relationship between Concussion Symptom Clusters (CSCs) and return-to-play time using a representative sample of college athletes with sports-related concussions. METHODS: Data from the 2009-2010 and 2013-2014 academic years ($n=1670$) were obtained from the Datalys Center for Sports Injury and Prevention Inc. database. Exploratory factor analytic methods were applied, and the resulting factors were used in multimomial regression modeling to identify associations between CSCs and return-to-play time. RESULTS: A 4-factor solution accounted for 48.8% of the variance and included an audio-vestibular, somatic, amnesic, and affective factor structure. Audio-vestibular symptoms were associated with increased odds of prevented participation at 7-13 days, 14-29 days, greater than 30 days, and out for remainder of season, respectively ($P < 0.05$). Somatic symptoms were associated with decreased odds of prevented participation at 7-13 days and greater than 30 days, respectively ($P < 0.05$). Amnesic symptoms were associated with decreased odds of prevented participation at 1-7 days, 7-13 days, 14-29 days, and greater than 30 days, respectively ($P < 0.05$). Affective symptoms were associated with decreased odds of prevented participation at 7-13 days, 14-29 days, greater than 30 days, and out for remainder of season, respectively ($P < 0.05$). CONCLUSIONS: Specific CSCs were significantly associated with return-to-play time in college athletes, ($P < 0.05$).

Football is a popular sport, but is not without risk. Concern has been raised about concussion in youth football. However, there is little data regarding concussion risk or natural history of concussion for youth younger than high school. PURPOSE: To collect prospective data regarding: 1) incidence of concussion, 2) risk factors for concussion, and 3) natural history of concussion in 6-14 year old football athletes. METHODS: We conducted a prospective cohort study with youth football athletes and their parents during a 10-week season. Youth who sustained a concussion were contacted weekly to determine mechanism of injury and time to return to: 1) school 2) sport and 3) baseline concussion symptoms. Logistic regression was used to estimate odds of sustaining a concussion based on baseline demographic factors. Baseline measures of mental health and concussion symptoms were compared between concussed and non-concussed youth using Student’s t-tests. Time to return to school, sport and baseline symptoms were examined using survival curves.

RESULTS: 610 youth were followed and 38 sustained a concussion, for a one season athlete-level concussion incidence of 5.9%. Two-thirds occurred during games and approximately half from head to head collisions. Youth with a history of concussion had a 3-fold increased risk for sustaining an incident concussion, and those with a history of depression had a 5-fold increased risk. No other demographic factors were associated with increased risk for concussion. Following a concussion, 50% of athletes returned to school by 3 days, 50% returned to sport by 10 days, and 50% returned to a baseline level of symptoms by 2.5 weeks. Two youth returned to sport before their symptoms had returned to baseline levels, but no complications were noted with these youth.

CONCLUSIONS: Concussion rates in this study were higher than previously reported, affecting 6 out of every 100 youth playing for one season. History of prior concussion and history of depression were both associated with greater risk. Further research is needed to explore ways to continue to improve safety in youth football. Funding for this project was provided by Seattle Pediatric Concussion Research Collaborative and the University of Washington Sports Health and Safety Institute.
METHODS: A sample of 204 former collegiate football players that played at least one season of football in 1999-2001 and did not play professional football completed an online questionnaire. Data included: lifetime concussion history; Physical Composite Score (PCS) and Mental Composite Score (MCS) from the Veterans RAND 36 Item Health Survey; the depression module of the Patient Health Questionnaire (PHQ-9); and the CAGE alcohol dependence questionnaire. Multivariable binomial regression models estimated prevalence ratios (PR) with 95% confidence intervals (CI) while controlling for demographics/playing history covariates through forward selection model building.

RESULTS: Overall, 84.3% reported a concussion history; 22.1% and 39.2% of participants reported PCS and MCS scores <50, respectively (i.e., worse health than US national averages); 19.1% reported PHQ-9 scores ≥10 (i.e., moderate/severe depression) and 24.8% reported CAGE scores ≥2 (i.e., alcohol dependence). The prevalence of having MCS <50 was higher in those reporting ≥2 versus 0 concussions (PR=2.5, 95% CI: 1.3, 4.9), Controlling for body mass index (BMI), the prevalence of moderate/severe depression was higher in those reporting ≥3 versus 0 concussions (PR=4.2, 95% CI: 1.0, 16.3). Controlling for BMI, the prevalence of having PCS <50 was higher in those reporting ≥3 versus 1-2 concussions (PR=2.6, 95% CI: 1.3, 5.8), but not 0 concussions (PR=1.5, 95% CI: 0.6, 3.6). No associations were found for alcohol dependence.

CONCLUSION: Associations between multiple concussions and adverse health outcomes were found in former collegiate football players without professional football exposure, but were limited to those reporting ≥3 concussions. Continued examination within non-professional football populations is needed, but findings highlight a need for concussion prevention efforts.

A-22 Thematic Poster - Exercise Biomarkers

Wednesday, May 30, 2018, 9:30 AM - 11:30 AM
Room: CC-Lower level L100C

Chair: Joseph Weir, FACSM. University of Kansas, Lawrence, KS.

No relevant relationships reported

95 Board #1 May 30 9:30 AM - 11:30 AM

Cell-free, Circulating Dna As A Novel Marker For Player Load In Soccer


No relevant relationships reported

PURPOSE: The relevance of biomarkers reflecting internal player load in intermittent sports such as football is questionable, so far. Increased levels of circulating DNA (cfDNA) have been demonstrated in a variety of exercise settings. Recently, it has been shown that cfDNA increased depending on intensity and duration during aerobic running. In this context, cfDNA was suggested to be applied in intermittent exercise, however the effects of short repeated sprinting as an essential feature of intermittent sports on cfDNA values are unknown. For the first time, we assessed both alterations in memory T cells following a bout of exercise is not well known. PURPOSE: To quantify exercise induced changes in surface markers of early, middle, and late stage activation during and after exercise. METHODS: First, nine participants were subjected to a standardized sprint training session in a cross-over design of five maximal sprints of 40 meters with either “short” (1 minute) or “long” (5 minutes) duration. Capillary cfDNA and lactate were measured after every sprint and venous cfDNA before and after each series of sprints. In addition, capillary cfDNA and lactate values were monitored in 23 professional football players during the course of a training week at rest (baseline) and in all 17 enrolled players following a regular season game. Game data in terms of total distance, sprints and contact runs was recorded for each player using the OPTA system.

RESULTS: Venous cfDNA and lactate increased in “short” (2.8-fold, p<0.0001 and 5.6-fold, p<0.0001) and less pronounced during “long” (1.9-fold, p<0.0051 and 3.6-fold, p<0.0001). The season game increased cfDNA 22.7-fold (p<0.0001) and lactate 2.0-fold (p=0.09) compared to baseline. CIDNA increases correlated with distance covered during game (spearmen's r=0.87, p<0.0012), while no correlation between lactate and the tracking data could be found.

CONCLUSIONS: Here we show for the first time that cfDNA could be an objective marker for player load in intermittent sports reflecting total distance covered during professional soccer.
and late (HLA-DR) markers of activation within the CD45RO\(^+\)CD45RA\(^-\) subset were quantified at days 0, 1, and 3. Data were analyzed using two-way RMANOVAs.

**RESULTS:** There were no significant differences in any markers of activation at the pre-measure (p > .05). Preliminary data suggests exercise does not alter functional activation in non-stimulated CD45RO\(^+\)CD45RA\(^-\) cells. There does appear to be a functional impact related to the T\(_N\) cells ability to respond to stimuli post-exercise with two-fold increases observed in HLA-DR expression for cells co-stimulated through CD3\(^+\)CD28. CONCLUSIONS: Exercise-induced alterations in functional activation of T\(_N\) cells will need to be better quantified to determine not only the magnitude of change, but also to identify a kinetic profile of marker expression. Quantification of changes in this subset of cells will aid in our understanding how immune responses following vaccination are affected by exercise stress. Supported by an award through the Dr. George F. Haddix President’s Faculty Research Fund at Creighton University.

**101 Board #6 May 30 9:30 AM - 11:30 AM**

**CD4\(^+\) T Cell Activation Markers Altered Following Resistance Training In Untrained Subjects: A Pilot Study**

Brad W. Macdonald, Alexander K. Holbrook, Allysson Ihlenfeldt, Hunter D. Peterson, Samantha A. Bianchi, Eric C. Bredahl, Michael A. Belsham, Jacob A. Siedlik. *Creighton University, Omaha, NE.* (Sponsor: Joseph P. Weir, FACSM)

No relevant relationships reported.

Assessment of immune function in response to exercise is commonly done via proliferative assays. These assays are often performed on mixed cell populations and fail to quantify discrete activation elements upstream of the proliferative response. Together these factors limit our ability to understand how subsets of immune cells respond to exercise and hinder our ability to target interventions towards a specific cellular response. **PURPOSE:** To quantify exercise-induced changes in surface marker changes of early, middle, and late stage activation in CD4\(^+\) cells. **METHODS:** Using a cross over design, untrained subjects completed a control and exercise visit. The control visit consisted of 30 min seated rest while the exercise session entailed 3 sets x 10 reps squat at 70\% 1RM, 3x10 leg press at 70\% 1RM, and 3x10 leg extensions at 70\% 1RM with 2 min rest between sets. Venous blood samples were obtained pre and post each visit. CD4\(^+\) T cell isolation from peripheral blood was conducted through negative selection using a Human CD4\(^+\) T cell enrichment kit. CD4\(^+\) T cells were plated at 1.5 x 10\(^6\) cells/ml in 200 μl of Immunocult T-cell expansion media directly after isolation and costimulated through CD3\(^+\)CD28 or no stimulation. Cells were incubated for 1 and 3 day at 37\°C in a humidified incubator with 5\% CO\(_2\) and then analyzed by flow cytometry. Purity of cell samples was assessed following T cell isolation (day 0) by staining with anti-CD4. Data analyses utilized two-way RMANOVAs. **RESULTS:** There were no significant differences in any markers of activation at the pre-measure (p > .05). Preliminary data suggests there exists two separate effects: 1) An exercise alone effect with alterations in CD25 expression observed in the non-stimulated cells, and 2) An exercise effect on the ability of cells to respond to stimuli with changes in CD25 and HLA-DR expression observed in cells co-stimulated through CD3\(^+\)CD28. **CONCLUSION:** Exercise induced alterations in T cell activation likely need to be quantified on a subset basis. Using mixed cell populations limits the development of exercise strategies targeting improvement in specific factors of immune function, and possibly leading to misinterpretation of exercise-derived immunological data. Supported by an award through the Dr. George F. Haddix President’s Faculty Research Fund at Creighton University.

**100 Board #5 May 30 9:30 AM - 11:30 AM**

**Development Of A Consumer-Oriented Microbiome Tracker**

Shawn M. Talbott, FACSM\(^1\), Marc P. Oddou\(^2\), Bret J. Stephens\(^2\), *EQQIL, Draper, UT.* \(^{1}\)Wasatch Scientific Services, Murray, UT.

**Reported Relationships:** S.M. Talbott: Ownership Interest (Stocks, Bonds), Owner in development of BiomeTracker.

**Background:** Interest in and knowledge of the gut microbiome has increased exponentially in the past decade. This once overlooked component of the gastrointestinal tract is now implicated in multiple aspects of human health, including mental wellness (e.g. depression, anxiety, stress), metabolic (e.g. diabetes, obesity), neurologic (e.g. Alzheimer’s, autism), gastrointestinal (e.g. irritable bowel syndrome, Crohn’s), and immunologic (e.g. inflammation, cancer), among others. **Objective:** To develop a consumer-facing microbiome test and scoring system (BiomeTracker) that provides an attractive alternative to 16S RNA-based testing services. This system allows samples to be processed quickly at low cost, and provides an easy to understand score for bacterial composition and health. **Results:** BiomeTracker analysis was performed in parallel with 16S sequencing for human fecal samples, with similar abundance quantification for major phyla through families of bacteria. As a proof-of-concept, patient baseline and final samples following microbiome intervention (diet and supplementation) were tested, and BiomeTracker was able to accurately assess changes of low abundant species known to function in a healthy gut. **Conclusions:** We envision that this system can be used by scientists and consumers alike to more quickly and easily evaluate the efficacy of dietary interventions on microbial composition and function.
The physical benefits of resistance exercise training (RET) are well documented. Less is known regarding the effects of RET on mental health outcomes. Recent meta-analytic evidence supported the anxiolytic effects of RET, but no quantitative synthesis of the effects of RET on depressive symptoms has been conducted.

**Methods:** Fifty-four effects were derived from 33 articles published before August 2017, located using Google Scholar, MEDLINE, PsyCINFO, PubMed, and Web of Science. Trials included 1,877 participants (mean age = 52.18 years) and included both randomization to RET (n = 947) or a non-active control condition (n = 930) and a validated measure of depressive symptoms assessed at baseline, mid-, and/or post intervention. Hedges' d effect sizes were computed and random effects models were used for all analyses. Meta-regression was used to examine participant and trial characteristics as moderators of the overall mean effect.

**Results:** RET significantly reduced depressive symptoms by a moderate-sized mean effect (Hedges' d = 0.66 (95% CI: 0.48-0.83; z = 7.35; P < 0.001)). Significant heterogeneity was indicated (Q(residual) = 216.92, P < 0.001; I² = 76.03%), 95% (CI: 72.67%-78.97%), and sampling error accounted for 32.9% of observed variance. Total volume of prescribed RET, participant health status, and strength improvements were not significantly associated with the overall effect of RET on depressive symptoms. However, smaller reductions in depressive symptoms were found in trials with blinded allocation and/or assessment (Hedges' d = 0.56; 95% CI: 0.40-0.71; z = 7.03; P < 0.001).

**Conclusions:** The available empirical evidence supports the antidepressant effects of RET. RET significantly reduced depressive symptoms in otherwise healthy participants and those with a physical or mental illness. Improvements were not moderated by total prescribed volume of RET or significant improvements in strength. Higher quality randomized controlled trials that blind both allocation and assessment compared to other empirical-supported treatments for depressive symptoms are needed.
bone mineral content ($p = 0.42$, $P = 0.04$), bone mineral density ($p = 0.47$, $P = 0.02$), bone density T-score ($p = 0.49$, $P = 0.02$), and bone density Z-score ($p = 0.46$, $P = 0.02$).

CONCLUSIONS: Exercise intensity tolerance was negatively associated with resting heart rate and blood pressure, total cholesterol, triglycerides, LDL, and WHR, and positively associated with bone density variables. These findings suggest that as exercise intensity tolerance increases, so does the favorability of CMBI health and bone density in young adult females.

### RESULTS

Participants felt lower emotional arousal and physical exertion when instructed to utilize cognitive reappraisal than when given no emotion regulation instruction, but not when instructed to utilize distraction. Utilization of these regulation strategies did not influence emotional valence or prefrontal cortex oxygenation.

CONCLUSION: Emotion regulation strategies benefit psychological state during endurance exercise, independent of reductions in prefrontal cortex oxygenation.

### Funding

Research reported in this abstract was supported through a contract with the US Army Natick Soldier Research, Development, and Engineering Center (NSRDEC, Natick, Massachusetts, USA) under award number W911Q113C0012.
Physical activity promotes an osteogenic response leading to greater bone mineral density (BMD). Previous studies suggest women who use oral contraceptives (OC) may not experience the same magnitude of skeletal benefits from exercise compared to women not using OC. These findings are important for athletes competing in sports with a high prevalence of low BMD and fracture, such as rowing. PURPOSE: To examine skeletal health, OC usage, and injury rates in collegiate competitive female rowers.

METHODS: Data from two cross-sectional studies were used to investigate body composition and skeletal attributes in 49 NCAA Division I female rowers. DXA was used to measure body composition and areal BMD (aBMD) of the total body, lumbar spine, and dual femur. pQCT was used to measure bone geometry of the 4%, 38%, and 66% tibia sites. RESULTS: There were no significant differences between OC users (n=14) and non-users (n=35) for age, height, weight, fat mass, bone free lean body mass, age at menarche, calcium intake, training volume, or years of rowing experience (p>0.340). OC users had significantly greater total body aBMD, dual femoral neck (FN) aBMD, and dual total hip (TH) Z-Scores (p=0.05). Bone strength index was greater in the non-dominant tibia of OC users at the 4% site (p=0.017). For tibiae 38% and 66% sites, OC users had greater cortical area and thickness, while non-users had greater endosteal circumference (p=0.047). Rowers who reported fractures had significantly lower rib aBMD, non-dominant trochanter Z-Scores, and 66% tibiae 38% and 66% sites.

Our findings suggest that in this population OC usage had significantly lower rib aBMD, non-dominant trochanter Z-Scores, and 66% tibiae sites as compared to non-users. Our findings suggest that in this population OC usage had significantly lower rib aBMD, non-dominant trochanter Z-Scores, and 66% tibiae 38% and 66% sites.

Board #1

May 30 9:30 AM - 11:30 AM
The Influence of Oral Contraceptive Use on Skeletal Characteristics of Female Collegiate Rowers

Breanne S. Baker, Ivy E. Brown, Michael G. Bemben, FACSM, Allen Knehans, Debra A. Bemben, FACSM, University of Oklahoma, Norman, OK. (Sponsor: Dr. Debra Bemben, FACSM)

Though both FRT and TRT increased affect and decreased SA, higher levels of enjoyment following FRT may lead to increased adoption rates acutely and possibly increase the percentage of college-females meeting ACSM RT guidelines.

Table 1. Skeletal differences between OC users and non-users.

<table>
<thead>
<tr>
<th>Variable</th>
<th>OC Users (n=14)</th>
<th>Non-users (n=35)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Body aBMD (g/cm²)</td>
<td>1.305 ± 0.029*</td>
<td>1.241 ± 0.014</td>
</tr>
<tr>
<td>Dual FN aBMD (g/cm²)</td>
<td>1.206 ± 0.028*</td>
<td>1.132 ± 0.018</td>
</tr>
<tr>
<td>Dual TH Z-Score</td>
<td>1.008 ± 0.249*</td>
<td>0.358 ± 0.148</td>
</tr>
<tr>
<td>Mean 38% vBMD (mg/cm²)</td>
<td>966.63 ± 10.47*</td>
<td>914.77 ± 9.15</td>
</tr>
<tr>
<td>Mean 38% Cort Thickness (mm)</td>
<td>6.33 ± 0.10**</td>
<td>5.71 ± 0.09</td>
</tr>
<tr>
<td>Mean 38% Endo Circ (mm)</td>
<td>32.95 ± 0.91</td>
<td>36.83 ± 0.84*</td>
</tr>
<tr>
<td>Mean 66% vBMD (mg/cm²)</td>
<td>744.92 ± 18.40</td>
<td>698.90 ± 9.24</td>
</tr>
<tr>
<td>Mean 66% Cort Thickness (mm)</td>
<td>5.04 ± 0.15*</td>
<td>4.66 ± 0.07</td>
</tr>
</tbody>
</table>

* p<0.05, ** p<0.01

Skeletal differences between OC users and non-users.

112 Board #2

May 30 9:30 AM - 11:30 AM
T Cells Accumulate In Skeletal Muscle Following Contraction-induced Damage To A Greater Degree In Women

Michael R. Deyhle, Kaitlyn Evans, Chris Sutton, Seth Hampton, Jacob Parmley, Jacob R. Sorensen, 84602, Allen Parcell, FACSM, Robert Hydahl, 84602. Brigham Young University, Provo, UT.

Immune cells, such as macrophages and monocytes are active participants in muscle repair/regeneration following damage. Recent studies have identified T cells as important mediators of effective muscle regeneration following traumatic injury. A few studies have reported that T cells also accumulate in muscle following damaging contractions, suggesting that they may also be involved in muscle repair and adaptation following contraction-induced damage. However, it is not clear: 1) when T cell accumulation peaks in following contraction-induced damage and 2) whether muscle T cell accumulation is different between men and women. The PURPOSE of this study was to identify the time course of CD8+ T cell accumulation following contraction-induced damage in men and women. METHODS: Six men and three women (age 22.2 ± 2.4 years of age) did 300 (30 sets of 10 reps) maximal-effort lengthening contractions (LC) of the knee extensor muscles using an isokinetic dynamometer. Maximal isometric torque of the knee extensors was measured before LC and at 5min, 24h and 72h-post. Muscle biopsies (vastus lateralis) were taken before LC and at 3h, 24h, and 72h-post LC. Intramuscular CD8+ T-cells were counted with immunohistochemistry and fluorescence microscopy. RESULTS: Compared to baseline values (207.2 ± 37 Nm), maximal isometric torque was significantly reduced 5min after (106 ± 45.7 Nm), 24h after (107 ± 50 Nm), and at 72h after LC (112 ± 70 Nm) (p<0.05). Torque loss between men and women was not different (p>0.35), suggesting a similar degree of muscle damage. Intramuscular CD8+ T-cells were increased at 72h-post LC compared to baseline (5 fold, p=0.0008), 24h-post LC (3.2 fold, p=0.0016), and 3h-post LC (3.1 fold, p=0.018). T cell content before LC was not different between men and women, but accumulation following LC was significantly greater in women compared to men (Sex×Time, p=0.01). CONCLUSIONS: Following contraction-induced damage, muscle CD8+ T cell content peaks at or later than 72h, and the accumulation appears to be more robust in women than men.

114 Board #3

May 30 9:30 AM - 11:30 AM
Sex-Related Differences in Muscle Composition and Motor Unit Firing Rates of the First Dorsal Interosseous

Mandy E. Wray, Adam J. Sterczala, Jonathan D. Miller, Hannah L. Dimmick, Trent J. Herda. University of Kansas, Lawrence, KS.

PURPOSE: To determine sex-related differences motor unit (MU) firings during a high intensity contraction and muscle composition of the first dorsal interosseous (FDI) in recreationally trained individuals. METHODS: Nine males (mean±SD: age = 22.3±3 yr, height = 1.80±0.63 cm, weight = 73.4±10.3 kg, BMI = 22.3±3.3 kg/m²) and 11 females (mean±SD: 164.2±3.7 cm, weight = 63.6±5.3 kg, BMI = 23.6±1.1 kg/m²) were recruited. The FDI was isolated and measured during abduction of the index finger against a metal force plate. A 6-pin electrophysiological (EMG) sensor array was placed over the FDI to record muscle activity. EMG signals collected during the submaximal muscle actions were decomposed to extract action potentials and firing events of single MUs. Subjects completed isometric trapezoidal muscle action at 70% maximal voluntary contraction (MVC). Recruitment thresholds (RTs) and mean firing rates (MFR) at the targeted steady force were calculated for each MU and analyzed with a linear relationship for each subject. Normalized EMG amplitude was recorded for each subject at the targeted steady force. In addition, ultrasound scans of the FDI were completed prior to the experimental visit in order to determine the muscle cross-sectional area (CSA), echo intensity (EI), and subcutaneous fat (SF). Independent samples t-tests were analyzed to compare mean differences between males and females. RESULTS: Males had a significantly larger CSA (p<0.001) and peak torque during the MVC (p<0.001), while females had significantly higher y-intercepts from the MFR vs. RT relationship (p<0.036) with no differences in the slopes (p=0.398). No differences were found in normalized EMG (p=0.398), EI (p=0.423), and SF (p=0.400). CONCLUSION: Males had greater CSA, more contractile area, and generated more force. During the 70% MVC, females had significantly greater y-intercepts from the MFR vs. RT relationships, but slopes were similar. These relationships indicated greater MFRs of MUs with RTs from 25.1 to 39.2 in females. Greater MFRs for females may have been necessary to achieve the targeted force as a result of weaker higher-threshold MUs.

115 Board #4

May 30 9:30 AM - 11:30 AM
Effects of Estrogen Receptor Alpha and Progesterone on Skeletal Muscle Fatigue and Recovery

Christine A. Cabelka1, Brittany C. Collins2, Cory W. Baumann3, Espen E. Spangenberg3, Dawn A. Lowe, FACSM4. 1University of Minnesota, Minneapolis, MN. 2University of Utah, Salt Lake City, UT. 3East Carolina University, Greenville, NC.

Skeletal muscle function declines with aging, most notably at the time of menopause. Human and rodent research indicates that estrogen-based hormone therapy can attenuate the decline. However, the role of the major estrogen receptor in muscle (ER α) remains unclear. While estrogen appears to play a predominant role in maintenance of muscle strength the other key ovarian hormone, progesterone, has been implicated in protection against muscle fatigue. Purpose: We hypothesized...
1) voluntary wheel running would not protect mice lacking estrogen receptor α in skeletal muscles (sknErαKO) against fatigue and 2) treatment with progesterone after ovariotomy would protect against fatigue. METHODS: Study 1: 32 sknErαKO mice and WT (Flox) littermates were randomized into 4 groups: sknErαFlox-Run, sknErαKO-Run, sknErαFlox-Sed, and sknErαKO-Sed. Run groups were given free access to wheels for 20 wk. Sedentary mice remained in standard cages. In vivo and in vitro muscle contractility was measured at wk 20. Study 2: 40 female C57BL/6J mice ran on wheels for 2 wk and then randomized into 4 treatment groups: E2, P4, E2+P4, or OVX. All mice underwent OVX, ran for another 2 wk, hormone pellets were implanted, and then mice returned to running wheels for 6 wk before in vitro soleus muscle contractility testing was completed. Results: Study 1: In vivo isometric, concentric and eccentric torque was low in sknErαKO groups compared to WT (p = 0.029). Additionally, muscles of sknErαKO mice had greater fatigue (p < 0.001) and did not recover strength as well as WT (p = 0.001). Study 2: After 60 fatiguing contractions, soleus muscles of the OVX+E2+P4 group maintained greater submaximal force than those of other groups (p < 0.05). Immediately after the fatiguing contractions, OVX+E2+P4 muscles had greater maximal force production than the OVX+E2 group (p = 0.027). Conclusion: Skeletal muscle production less force regardless of physical activity. Although 20 wks of wheel running partially prevented force loss during fatigue in sknErαKO mice, force production during recovery remained low, indicating that estrogens function through ERα in skeletal muscle. A combined treatment of E2+P4 protected soleus muscles against fatigue, suggesting both hormones have roles in preventing muscle fatigue. This work was supported by NIH grant R01-AG031743.

Board #5 May 30 9:30 AM - 11:30 AM
Increased Quadriceps Muscle Attenuation Correlates With Reduced Cellular And Whole Muscle Function In Older Women
Chad R. Straight¹, John D. Chase¹, Philip A. Ades¹, Michael J. Toth², Mark S. Miller¹.¹University of Massachusetts Amherst, Amherst, MA. ²University of Vermont, Burlington, VT.

PURPOSE: Adiposity adversely affects physical function in older adults, but the mechanism underlying this relationship remains unclear. The aim of this study was to examine ectopic fat located in or around muscle fibers, as reflected in the measurement of muscle tissue attenuation derived from computed tomography, and its relationship with skeletal muscle function in older adults from the molecular to the whole muscle level.

METHODS: Healthy older men and women had their body and thigh composition characterized by dual-energy X-ray absorptiometry and computed tomography, and their knee extensor function by dynamometry. Isometric tension (force per cross-sectional area) and myofilament stiffness properties were measured on single muscle fibers obtained from biopsies of the vastus lateralis.

RESULTS: Older women had greater absolute and relative body and thigh fat (all p < 0.05). However, quadriceps muscle attenuation was similar between sexes (51.4 ± 50.3 HU for men and women, respectively, p = 0.33). In women, lower quadriceps attenuation, representing greater fat deposition, was related to decreased whole muscle isometric torque (r² = 0.21; p < 0.05) and isokinetic power (r² = 0.18; p < 0.05), but no association was evident in men. In older women, lower quadriceps attenuation was associated with decreased isometric tension in myosin heavy chain (MHC) I (r² = 0.17) and IIA (r² = 0.36) muscle fibers (both p < 0.05). At the molecular level, lower quadriceps attenuation was associated with reduced myofilament lattice stiffness of MHC IIA fibers in older women (r² = 0.26; p < 0.05), but not men. Greater myofilament lattice stiffness at turn, was strongly associated with higher isometric tension in MHC I (women r² = 0.30; men r² = 0.17) and IIA (women r² = 0.53; men r² = 0.40) fibers in both sexes (all p < 0.05); however, relationships were stronger in women.

CONCLUSIONS: Despite similar quadriceps muscle attenuation between sexes, impairments in force generation at the cellular and whole muscle levels were present only in older women. Our results suggest that greater quantities of fat in the muscle microenvironment after skeletal muscle ultrastructure in ways that decrease myofilament stiffness, leading to reduced myosin-actin cross-bridge force transmission, and ultimately impaired cellular and whole muscle function.

Board #6 May 30 9:30 AM - 11:30 AM
Myosin Super-relaxed state is Affected by Aging in Female But Not Male Skeletal Muscle
Sira M. Karvinen¹, Lien A. Phung², Brett A. Colson¹, David D. Thomas³, Dawn A. Lowe, FACSM.¹ University of Jyväskylä, Jyväskyla, Finland. ²University of Minnesota, Minneapolis, MN. ³University of Arizona, Tucson, AZ. (Sponsor: Dawn A. Lowe, FACSM)

Purpose: We evaluated for the role of ovarian hormones in SRX regulation during aging, by measuring the SRX population and ATP turnover rate in skeletal muscle fibers from female and male mice during natural aging process. METHODS: The population of myosin heads in the SRX state and ATP turnover rate were measured in chemically skinned skeletal muscle (psoas) fibers from young (3–4 months old) and aged (28 months old) C57BL/6 female and male mice. Quantitative confocal microscopy of fluorescent MANT-ATP turnover was used to detect and quantify myosin SRX in the fibers. RESULTS: In female mice, fibers from aged animals had faster SRX and RX myosin ATP turnover rates compared to those from young mice (SRX: 94 ± 4 vs 117 ± 9 s⁻¹, p = 0.033 and RX: 18 ± 1 vs 22 ± 2 s⁻¹, p < 0.001). There was no difference in turnover rates between fibers from young and aged male mice (SRX: p = 0.804 and RX: p = 0.202). We found no differences in the population of myosin heads in RX and SRX states between young and aged fibers in either sex (p ≥ 0.100). CONCLUSION: Our results indicate that ovarian hormones rather than aging process per se influence the myosin SRX state. This work was supported by R01-AR032961, R37-AG26160, T32-AR007612, and R01-AG031743.

Board #7 May 30 9:30 AM - 11:30 AM
The Effects Of Whole-body Vibration On Posture, Balance, And Mobility In Women With Multiple Sclerosis
Eduardo Freitas, Christine Frederiksen, Ryan M. Miller, Aaron D. Heishman, Janpeet Kaur, Karolina J. Kozioł, Bianca A. R. Galletti, Debra A. Bemben, FACSM, Michael G. Bemben, FACSM. University of Oklahoma, Norman, OK. (Sponsor: Michael G. Bemben, FACSM)

PURPOSE: To investigate the effects of acute and chronic WBV on postural control, balance, and mobility in women with relapsing remitting multiple sclerosis (RRMS). METHODS: Twenty-one women were divided into a whole-body vibration (WBV: n=12) and a control (CON: n=10) group. WBV was submitted to 5 sets of vibration (30 Hz of magnitude and 3 mm of amplitude) for 30 s each with 1 min between trials maintaining a squat position with slight flexion of knees, hips, and ankle. CON group was not submitted to any vibration, but mimicked the vibration exposure by standing on the platform in a squat position. For the acute response, all measures were performed immediately pre and post for both testing conditions at week 1 and week 5. For the chronic adaptation, measurements were performed at baseline and after 5 weeks of WBV once a week. Participant’s postural sway and balance were measured using a NeuroCom Balance Master. Field tests were used to measure mobility, fatigue, and flexibility and included timed-up and go test, 500 m walk, and seat reach flexibility. Two-way repeated measures ANOVA were used to test for group and time main effects. RESULTS: Acutely, no significant differences were observed for the field tests at week 1 or 5 (p>0.05); but, significant group*time interactions (p<0.05) revealed that WBV induced more stability as results from the sensory organization test improved from pre to post for the WBV group while it decreased for CON, at week 1 and 5. However, there was also a significant group*time interaction for the unilateral stance test, in which the CON group was significantly more stable (p<0.05) than the WBV group, at week 5. Chronically, WBV group presented greater stability as a significant group*time interaction (p<0.05) showed that participants in the WBV group improved their scores in the modified clinical test for sensory integration of balance, while CON decreased. Additionally, a significant group*time interaction (p<0.05) revealed that WBV group increased in walking speed and steps; whereas, CON group, in a significant group*time interaction (p<0.05) revealed that CON improved flexibility, when pre to post percent changes were calculated from week 1 to 2. CONCLUSION: Acute WBV did not improve postural balance, stability or mobility any in women with RRMS. However, chronic exposure improved stability and mobility.
Limited knee motion and increased movement variability during gait occurs following anterior cruciate ligament reconstruction (ACL-R). Previous study findings have limited clinical application since they only included male participants and did not describe impairments in context to patient function.

**PURPOSE:** To quantify differences in nonlinear measures of sagittal plane movement variability during running in individuals within 2 years of ACL-R compared to a healthy group. A secondary purpose was to determine the relationship between movement variability and patient-reported outcome measures.

**METHODS:** Nineteen individuals with a history of ACL-R (13 female, 6 male; mean±SD age= 20.1±5.6 y; height= 172.9±8.0 cm; mass= 70.3±13.6 kg; time since surgery= 12.2±5.2 months; International Knee Documentation Committee subjective knee scale [IKDC]= 87.7±13.4) and twenty healthy participants (11 female, 9 male; age= 20.2±4.2 y; height= 175.6±9.6 cm; mass= 69.4±12.1 kg; IKDC= 97.2±4.3) performed 2 minutes of running. The primary outcome measures were sagittal plane movement variability (sample entropy) and IKDC subjective scores. A mixed model ANOVA was used to determine differences between sides (involved/uninvolved; nondominant/dominant) and groups. The relationship between movement variability and IKDC scores was quantified using a Pearson product moment correlation.

**RESULTS:** There was a significant group x side interaction (F= 7.95, p< .01). The ACL group had significantly lower (F= 10.82, p= .002) sagittal plane movement variability compared to healthy individuals (nondominant= .36±.05; dominant= .36±.05) with greater (t= 2.81, p< .01) deficits in the involved limb (3.40±.06) relative to the uninjured limb (3.35±.06; p= .019). There was a moderate relationship (r= .59, p=.007) between IKDC scores and sagittal plane movement variability during running.

**CONCLUSIONS:** Individuals with a history of ACL-R demonstrate decreased sagittal plane movement variability during running compared to healthy individuals. Decreased movement variability manifests as more predictable movement in the involved relative to the uninjured limb and negatively impacts patient function. Future studies should determine interventions to address movement variability impairments.
relative to body weight and gait velocity, were also compared. Independent t-tests assessed group differences with an alpha level of p<0.05. RESULTS: Gait velocity did not differ between the groups (CAI 1.27±0.11m/s, Control 1.23±0.08m/s, p=0.18). However, time to peak vGRF (CAI: 148.47±17.9s, Control:162.48±15.86s, p=0.018) and the normalized loading rate (CAI 5.69±0.62N/kg×s, Control: 5.29±0.44N/kg×s, p=0.034) were significantly different between the groups. No other group differences were noted (p>0.05). CONCLUSION: Those with CAI have less time to peak vGRF relative to uninjured controls while walking. Increased loading rates, when normalized to body weight and gait velocity, were also higher in CAI participants relative to controls. These altered loading patterns may play a role in the degeneration of talar articular cartilage following acute and recurrent lateral ankle sprains. This project was supported by a grant from the Southeastern Athletic Trainers’ Association.

U.S. Army Soldiers have carried average loads of 45 kg in past conflicts. With the recent decision permitting women to enter Combat Arms roles, knowledge of whether other aspects of dynamic M1 mobility instead of simple ROM may be related to increased loading of M2 and M3. Future studies should examine whether these relationships vary with load carriage.

### Table 1: Spatiotemporal Parameters for Different Loads and Gender

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Gender</th>
<th>Load</th>
<th>15 kg</th>
<th>30 kg</th>
<th>45 kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gait cycle</td>
<td>F</td>
<td>1.04±.04</td>
<td>1.04±.03</td>
<td>1.04±.05</td>
<td>1.03±.04</td>
</tr>
<tr>
<td>(sec)</td>
<td>M</td>
<td>1.07±.04</td>
<td>1.07±.06</td>
<td>1.07±.06</td>
<td>1.05±.05</td>
</tr>
<tr>
<td>Stride length</td>
<td>F</td>
<td>0.63±.03</td>
<td>0.61±.02</td>
<td>0.63±.05</td>
<td>0.61±.03</td>
</tr>
<tr>
<td>(m)</td>
<td>M</td>
<td>0.75±.03</td>
<td>0.75±.01</td>
<td>0.75±.04</td>
<td>0.74±.03</td>
</tr>
</tbody>
</table>

### Conclusion

Our results do not support the hypothesis that M1 hypermobility increases loading of M2 and M3. Aberrant gait biomechanics following anterior cruciate ligament reconstruction (ACLR) are hypothesized to contribute to the increased risk of developing knee osteoarthritis (OA). It remains unclear how time since ACLR influences gait biomechanics.

#### Purpose

To determine how time since ACLR influences loading characteristics during walking gait following ACLR. Methods: Ninety-five (64 F; 31 M; 73.4±11.5 kg) individuals at least 6 months removed from unilateral ACLR and 25 (20 females, 5 males; 62.8±11.9 kg) uninjured controls volunteered for the study. The ACLR cohort was categorized into four groups based on time since ACLR: 6 months (n=24); 7-12 months (n=24); 13-36 months (n=21); >36 months (n=26). Kinetics and kinematics were sampled during walking gait at a self-selected speed with peak vertical ground reaction force magnitude (vGRF), peak instantaneous loading rate (ILR; first time derivative), and linear loading rate (LLR; slope), and peak internal knee extension, valgus, and varus moments identified during the first 50% of the stance phase. vGRF, ILR, and LLR were normalized to body weight (xBW) and moments were normalized to the product of BW and height (xBW*ht). Outcomes were compared between groups via one-way ANOVA with Bonferroni corrections.

Results: vGRF was significantly lower in the 6 month (1.04±0.07 xBW) group compared to the uninjured (1.12±0.09 xBW; p=0.03) and 13-36 month (1.13±0.10 xBW; p=0.005) groups. LLR was significantly less in the 6 month (6.88±1.5 xBW/s) group compared to the 13-36 (9.02±2.0 xBW/s; p=0.003) and >36 month (8.57±2.2 xBW/s; p=0.038) groups. The internal knee extension moment was significantly larger in the 7-12 (-0.059±0.02 xBW*ht; p=0.006) and >36 month (-0.057±0.02 xBW*ht; p=0.01) groups compared to the uninjured group (-0.038±0.015 xBW*ht).

Conclusion: Based on these results, walking gait biomechanics fluctuate following ACLR as representative of lower loading early and increasing over time. Continued research should be conducted to determine the necessary ranges for joint loading during walking gait to preserve joint health following injury and take into consideration the changes in walking gait over time to establish how these alterations influence risk of OA.
A-26  Clinical Case Slide - Hip and Pelvis I
Wednesday, May 30, 2018, 9:30 AM - 11:10 AM
Room: CC-200E

127 Chair: Angela Smith, FACSM. Nemours Children's Health System, Bryn Mawr, PA.

128 Discussant: Kelly Lynne Roberts Lane, FACSM. Fix It physical therapy, Mahomet, MN.

129 Discussant: Robert Baker, FACSM. Western Michigan University School of Medicine Clinics, Kalamazoo, MI.

130 May 30 9:30 AM - 9:50 AM
Recurrent Hip Pain in a Preadolescent Soccer Athlete
Megan Fraker, Greg Catty. Childrens Mercy, Kansas City, MO.

HISTORY: 11yo male soccer player has worsening right hip pain vaguely localized to his groin. He has had right hip pain for 3-4 months which did not resolve with physical therapy following his initial visit. Recently progressed and unable to play with friends. Any activity, even walking, makes it worse. He also has a rash on his right knee and scrotal area that has not improved with antifungal or topical steroid treatment. PHYSICAL EXAMINATION: Afebrile. Well appearing thin male. Erythematous plaque over his right patella and follicular papules on his scrotum. Full, passive range of motion of both hips but pain with flexion and external rotation. His hip girdle strength was decreased: 4/5 flexion and abduction; 4+/5 hip adduction and extension. Antalgic gait and refuses single leg hop or squat attempts secondary to pain. Spine exam was normal. No other MSK swelling, tenderness, or limitations with active ROM.


TEST AND RESULTS: -AP and frog view pelvic xray: no bony abnormality -MRI right hip with and without IV contrast: increased T2 signal right pubic ramus. Patchy edema in ilium near acetabulum as well as in the intrarhecanteric femoral neck -Lab(CBC, CMP, CK, ESR, CRP): all normal except with exception of Hbg 12.5, Hct 36.7, ESR 31

FINAL WORKING DIAGNOSIS: Chronic relapsing multifocal osteomyelitis (CRMO)

TREATMENT AND OUTCOMES: 1. Ibuprofen 400mg TID initially-mild improvement 2. Rheumatology consult - whole body MRI with repeat labs plus vitamin D, immunoglobulin, UA with urine creatinine and urine calcium, TSH, ANA, DEXA - No gross abnormalities. No acute joint dysfunction

131 May 30 9:50 AM - 10:10 AM
Hip Pain Post Pregnancy
Sarah T. Yang. Schwab Rehabilitation Hospital/University of Chicago, Chicago, IL.

HISTORY: 28 year old woman with PMH Type 1 Diabetes Mellitus and hypothyroidism presented to clinic with severe right-sided groin pain 1 week after prolonged delivery resulting in C-section of a healthy infant. She received 2 weeks of PT per her OB with only temporary relief. She was then referred to PM&R. In clinic, she reported localized pain in her right groin and difficulty walking. Symptoms were exacerbated by sitting or lifting her R leg. She denied numbness, radiation, or bowel/bladder symptoms. Tynlon and tramadol provided minimal relief.

PHYSICAL EXAMINATION: She has considerable difficulty getting out of the chair to the bed. She ambulates with an antalgic gait. No specific tightness or tenderness surrounds the right pelvis or upper leg. Overall painful active ROM of the right hip, particularly with internal rotation. Supine PROM: flexion 115, ER 40, IR 15. Strength 4+/5 hip flexion and adduction, 4/5 abduction glut max, 4+/5 abduction glut medius. Leg lengths are equal. Neurovascular examination of the bilateral lower extremities is normal.


TEST AND RESULTS: Xray of Hips and Pelvis - No gross abnormalities. No acute fracture or subluxation. MRI Hip wo est - Transient osteoporosis of the femoral head and neck with subchondral insufficiency fracture. Non-displaced anterior superior labral tear DEXA - lowest Z-score with a bone mineral density of 0.999 g/cm2 and Z score of -1.8 (within age-expecte range) MRI Hip wo est, 1 month later - overall decrease in T2 bone marrow signal in the right femoral head and neck with persistent focus of subchondral fracture. Grade 2-3 right hip chondral thinning with small spur formation. Labral tear similar to prior exam

FINAL WORKING DIAGNOSIS: Subchondral fracture secondary to Transient osteoporosis of the hip TREATMENT AND OUTCOMES: 1. Conservative treatment - protected weight-bearing with crutches, analgesia, and supportive PT. 2. Calcium and vitamin D supplementation. 3. On 4 week follow-up, she was upgraded to WBAT. 4. On 2 month follow-up, strength 5/5. Negative FABER and FADIR. Went for a walk for the first time. 5. On 3 month follow-up, no pain with passive ROM of hip. Strength normal. No TTP. Able to ascend/descend stairs without pain.

132 May 30 10:10 AM - 10:30 AM
Public Pestilence-Cross Country
Keirsten E. Smith, James B. Robinson, Earl R. Stewart, Brett C. Bentley. University of Alabama Sports Medicine, Tuscaloosa, AL.

HISTORY: An 18-year-old female collegiate cross-country runner presented with complaints of acute abdominal pressure for 3 days. Initially evaluated by ED treated for an UTI but her pain has persisted. The athlete did extra core work for 30 minutes prior to the onset of symptoms and does not usually do core-work. Her pain was periumbilical and LLQ, radiating to the left flank. The pain was relieved by ibuprofen and aggravated by movement and bending. Associated symptoms include bloating, decreased appetite, nausea. She denies back pain, fever, chills, dysuria, vaginal bleeding or discharge. She has no significant PMH.

PHYSICAL EXAMINATION: Examination revealed a thin female in pain. Abdomen soft, normal bowel sounds, severe tenderness to palpation over her rectus abdominis insertion LLQ with inability to leg-lift or sit-up. No CVA tenderness. Normal neurological exam.


TEST AND RESULTS: LABS: Leukocytosis, elevated ESR/CRP, normal CMP, CK, UA XR Pelvis revealed no acute osseous abnormality. MRI pelvis showed moderate edema within the distal left rectus abdominis musclecutural, adductor group, and subcutaneous tissue. Signal changes of the left pubic ramus with some cortical discontinuity. CT pelvis without contrast showed symptoms appearance most suggestive of osteitis pubis rather than fracture with cortical erosions on the left. NM-RAE scan three-phase revealed mild increased activity in the pubis and symphysis.

FINAL WORKING DIAGNOSIS: Pubic Osteomyelitis

TREATMENT AND OUTCOMES: 1. Operative left pubis debridement with deep bone debridement, cultures and pubic symphysis lave performed. 2. Prolonged antibiotic course was initiated initially with Vancomycin IV which was later changed to Cidamycin IV after surgical cultures grew back Propionibacterium Acnes and Meticillin Resistant Staphylococcal Epidermidis. 3. Returned to sports as tolerated after suture removal from surgical debridement with Groshong catheter in place. Her pelvis continued to hurt after long-distance exercises but she had no severe resting pain; therefore, inflammatory markers (ESR and CRP) were monitored as surrogate markers of the progress toward cure.

133 May 30 10:30 AM - 10:50 AM
Novel Treatment of Anterolateral Thigh Pain-Triathlon
Ciara Johnson, McCaskey Smith, Neil Segal. University of Kansas Medical Center, Kansas City, KS.

HISTORY: A 49-year-old male, active duty Army, presented with a 4-month history of right anterolateral thigh pain and paresthesias. Pain was described as numb-like, stabbing, burning, and sharp. Symptoms began while cycling during a triathlon. After the race, there was increasing numbness and pain in left anterolateral thigh. Symptoms worsened with sitting, yoga, and flexion of the hip past 90°. He noted
increased weakness with running. Pregabalin, naropin, tramadol, physical therapy, and inversion table were ineffective. He underwent 6 lateral femoral cutaneous nerve blocks under ultrasound guidance that provided positive diagnostic benefit, but temporary therapeutic benefit. At presentation, Visual Analog Scale pain score was 6-8/10.

**Physical Examination:**

Patient demonstrated allodynia of the right thigh 4-6cm lateral to the midpoint of the inguinal ligament from Pubic symphysis to ASIS that increased with resisted hip flexion. There was also diminished sensation over the right anterolateral thigh. Neurological and musculoskeletal examination was otherwise unremarkable.

**Differential Diagnosis:**

1. Meralgia Paresthetica
2. Lumbar Plexopathy
3. L1, L2 Lumbar Radiculopathy
4. L5-S1 disc protrusion resulting in mild lateral recess stenosis.

**Final Working Diagnosis:** Meralgia Paresthetica

**TREATMENT AND OUTCOMES:**

1. Cryoablation of Lateral Femoral Cutaneous Nerve under US guidance
2. Immediate, complete resolution of anterolateral thigh pain
3. Post-procedural pain score was 0/10, decreased from Pre-procedure pain score of 6/10
4. Complete resolution of pain for 1.5 months post-procedure with return to activity. Continues to have 60-70% relief.

**Patient was able to return to running, cycling, and swimming.**

**S12 Vol. 49 No. 5 Supplement**

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

**A-27 Clinical Case Slide - Medical Issues I**

**Wednesday, May 30, 2018, 9:30 AM - 11:10 AM**

**Room: CC-200F**

**Chair:** Kenneth P. Barnes, FACSM. Elon University / Kemodle Clinic Orthopedics & Sports Medicine, Elon, NC.

**Discussant:** Hallie Labrador. NorthShore University HealthSystem, Gurnee, IL.

**Discussant:** Suzanne S. Hecht, FACSM. University of Minnesota, Minneapolis, MN.

**HISTORY:**

A 20yo male college football player presented to the athletic training room with 15 pounds of unexplained weight loss over a two-week period. He reported decreased appetite, increased general fatigue and muscle fatigue over the past two weeks. His review of systems was otherwise negative. He had no chronic medical problems or current medications. His family history was significant for asthma, hypertension, and diabetes mellitus type 2.

**Physical Examination:**

- Tenderness to palpation over left anterolateral thigh and adductor muscles bilaterally, worse on right due to baseline sensory deficits on left.
- Strength 5/5 bilaterally for ankle dorsiflexion, plantar flexion, inversion, eversion, and EHL.
- Right hip flexion, hip abduction, and TFL strength 3/5, all with significant pain. Passive right hip adduction caused severe pain. Left hip flexion 2/5; hip adduction 1/5; and light touch sensation over left lateral thigh diminished, her baseline due to known nerve palsy. Reflexes 1+ on right and absent on left. Stinchfield’s and scour tests positive on the right. FABER and log roll negative bilaterally.

**Differential Diagnosis:**

1. Pelvic floor and lower extremity strengthening, stretching, gait stability, and balance upon return to full weight bearing
2. Thyrotropin Receptor Ab - 11
3. Thyroid Stimulating Ig - 5.8
4. Hepatitis Panel - Negative
5. Vitamin B12 or D Deficiency
6. Diabetes mellitus

**Tests and Results:**

- Vitamin D (25HD) - 25
- Vitamin B12 - 782
- Vitamin D (25HD) - 25
- CRP - <0.01
- Uric acid - Normal
- CMP - Na 139, K 3.9, Cl 105, CO2 29, UN 23, Cr 0.93, Glu 101, Ca 10, Pro 6.7, Alb 4, AST 48, ALT 83, Alk Phtos 81, Bil 0.6
- CBC - Wbc 8.1, Hgb 13.3, Hct 39, Plt 39, Pb 238
- CK - 675
- ESR - 30
- CRP - 0.2
- Monospot - Negative
- Vitmain B12 - 782
- Vitamin D (25HD) - 25
- Thyrotropin Receptor Ab - 11
- Thyroid Stimulating Ig - 5.8
- Hepatitis Panel - Negative

**Final/Working Diagnosis:**

1. Hypothyroidism due to Grave’s Disease
2. Hyperthyroidism
3. Hyperthyroidism
4. HIV
5. Vitamin B12 or D Deficiency
6. Diabetes mellitus

**TREATMENT AND OUTCOMES:**

1. Hyperthyroidism due to Grave’s Disease
2. Thyrotropin Receptor Ab - 11
3. Thyroid Stimulating Ig - 5.8
4. Hepatitis Panel - Negative
5. Vitamin B12 or D Deficiency
6. Diabetes mellitus

**Follow-Up Labs:**

- Free T4 - 4.65
- Free T3 - 2.0
- Thyroid stimulating hormone - 5.8
- TSH - <0.01

**Neurological and musculoskeletal examination was otherwise unremarkable.**

**History:**

A 41 year old G3P1 woman 3 months postpartum presented with 2 days of groin pain that started after riding a stationary cycle. She also reported night sweats and fever.

**Tests and Results:**

- Blood drawn 1.5 months post-procedure with return to activity. Continues to have 60-70% relief.

**Final diagnosis was normal.**

**TREATMENT:**

1. Tylenol PRN for pain. Stop NSAID’s
2. NWB left leg for 2 weeks

**OUTCOMES:**

- Patient was able to return to running, cycling, and swimming.

**136**

**137**

**138**

**Avoiding Grave Cardiac Outcomes in an Athlete with Grave’s Disease**

Sander Rubin, Robert Kiningham, FACSM. University of Michigan, Ann Arbor, MI.

**(No relevant relationships reported)**
in atrial fibrillation. Given the increased risk of atrial fibrillation in his hyperthyroid state, he will be instructed to keep his heart rate target below 120bpm. Once his thyroid levels return to normal, he plans to undergo radioactive iodine ablation, likely after the football season.

139 May 30 9:50 AM - 10:10 AM

Exercise Intolerance in an Endurance Athlete with Depression
Ankit B. Shah, Aaron L. Baggish, FACSM, Meagan M. Wasfy. Massachusetts General Hospital, Boston, MA. (No relevant relationships reported)

HISTORY: A 46-year-old male competitive cyclist with a history of depression presented with concerns of decreased exercise tolerance. Over the past year, he has had difficulty maintaining as high a level of effort for a sustained period of time as he was accustomed. A year ago, his heart rate using a chest strap monitor during maximal perceived exertion was 170 beats per minute (bpm). This year, with similar effort, his heart rate does not rise above 150 bpm. Upon further questioning, he was started on two new medications in the last year, buproprion 200mg twice daily and desipramine, a tricyclic antidepressant (TCA) 150mg daily. PHYSICAL EXAMINATION: Resting heart rate was 65 bpm, he was normotensive and oxygen saturation was 100% on room air. Cardiopulmonary examination was normal. DIFFERENTIAL DIAGNOSIS: 1. Sinus node dysfunction 2. Myocardial Ischemia 3. Heart Failure 4. Medication side effect 5. Hypothyroidism.

TEST AND RESULTS: Thyroid panel, basic metabolic panel and complete blood count were within normal limits. Electrocardiogram showed normal sinus rhythm, left axis deviation with normal PR and corrected QT intervals. Exercise testing confirmed his subjective limitations and revealed chronotropic incompetence. We hypothesized that TCAs’ previously described impact on central nervous system (CNS) B1 adrenergic receptors was the cause of his limitations.

Desipramine was safely weaned off and repeat exercise testing revealed improved VO2 and normalization of peak heart rate. TCAs are known to reduce the sensitivity and/or density of B1 receptors in the CNS, and we propose that this side effect is likely due to similar impact on cardiac B1 receptors. FINAL WORKING DIAGNOSIS: Depression is well controlled on a different antidepressant regimen prescribed by his psychiatrist. He has not had recurrence of his exerional intolerance.

141 May 30 10:30 AM - 10:50 AM

Left Lower Quadrant Abdominal Pain in a Division 1 Discus Thrower
Alyssa M. Neph1, Tracy Bras2, Kentaro Onishi3. 1University of Pittsburgh Medical Center, Pittsburgh, PA. 2Maine General Orthopedics/Evergreen Sports Medicine Fellowship, Augusta, ME. (Sponsor: Brian A. Davis, FACSM) (No relevant relationships reported)

HISTORY: A 19-year old female Division 1 discus thrower with a history of ruptured left ovarian cyst presents with intermittent left lower quadrant abdominal pain that started 8 months ago. Focal pain is located superior and medial to the left anterior superior iliac spine and there is an associated bulge, reportedly brought by heavy activity, although not clinically reproducible. Physical therapy for core and lumbo pelvic strengthening did not provide improvement. As CT and MRI were unremarkable, she was referred to our sports ultrasound clinic for a diagnostic ultrasound of the left lower abdominal region.

PHYSICAL EXAM: Non-antalgic gait with full lumbar and left hip range of motion. Mild tenderness to palpation medial to the iliac crest in the left lower quadrant without guarding or rebound. No palpable muscle defect is appreciated at rest or with valsalva maneuver. Transition from FABER to hip extension does not reproduce pain or snapping. Resisted sit up, Stinchfield, FAIR, and hip hyper flexion impingement tests were negative.

DIFFERENTIAL DIAGNOSIS:
1. Sports hernia/athletic pubalgia
2. Ovarian cyst
3. Endometriosis
4. Inguinal hernia
5. Intra-articular hip pathology
6. Spigelian hernia

TEST AND RESULTS:
- Pelvic ultrasound and CT abdomen/pelvis: normal
- X-ray lumbar spine and pelvis: dextroscoliosis of lumbar spine, normal left hip and pelvis
- MRI pelvis: Right adnexal cyst measuring 4.9 x 4.2 cm. No inguinal hernia, edema, or fascial defect over the lower abdominal wall
- Left lower quadrant musculoskeletal ultrasound: 11 mm gap within transversalis fascia on the lateral edge of the left rectus abdominis muscle, just deep to the inferior epigastric vessels. Herniation was seen deep to the intermediate investing fascia and was exacerbated with coughing, laughing, and half sit-ups

FINAL WORKING DIAGNOSIS
Type 1 Spigelian hernia

TREATMENT AND OUTCOMES:
1. Diagnostic laparoscopy identified a 12-15 mm area of defect in the left Spigelian fascia with pre-peritoneal fat herniation as seen on the diagnostic ultrasound. The defect was repaired in an open fashion with four sutures.
2. Gradual return to activity 12 weeks post repair with decreased pain during heavy weight lifting and participation in discus throwing.
3. Repeat ultrasound 4 months after surgical repair was normal with no visible abdominal wall defect.
**A-38 Free Communication/Poster - Blood Flow Restriction**

**Wednesday, May 30, 2018, 7:30 AM - 12:30 PM**

**Room: CC-Hall B**

160 Board #1

**May 30 9:30 AM - 11:00 AM**

**The Retaining Effects of Running Training Combined with Blood Flow Restriction on VO_{2max} and Muscular Strength after Detraining**

Yun-Tsang Chen,1 Mong-Da Hsu,1 Yao-Yi Hsieh1, Jung-Chuang Lin2, National Taiwan Normal University, Taipei, Taiwan.

Chinese Culture University, Taipei, Taiwan.

(No relevant relationships reported)

**Purpose:** Concurrent improvements in maximal oxygen uptake (VO_{2max}) and muscle strength in aerobic (e.g., walking and running) training combined with blood flow restriction (BFR) has been reported. However, the retain effects of aerobic training combined with BFR on VO_{2max} and muscular strength is still unknown. Therefore, this study investigated the effects of 2 weeks detraining on VO_{2max} and muscle strength performance following running training combined with BFR.

**Methods:** Twenty male athletes were recruited and paired matched into (1) running training with thigh BFR group (RT-BFR, n=10), or (2) running training only group (RT, n=10). Before detraining, all subjects were included in both groups performed eight weeks of running training (24 sessions). RT-BFR group performed running sessions with pressure cuff belts. The occlusion pressure was 1.3 x resting systolic blood pressure. VO_{2max}, all out time (AOT), muscular strength and hamstrings/quadiceps (HIQ) ratio were assessed before and after the detraining.

**Results:** There were no differences (p > .05) between groups in VO_{2max} (-3.5 ± 3.6 vs. -0.8 ± 6.3 %), AOT (-3.4 ± 3.6 vs. -1.6 ± 4.0 %), isokinetic knee extensor (60°/s, -3.5 ± 8.5 vs. -1.2 ± 9.7 %; 180°/s, -0.2 ± 7.1 vs. 4.0 ± 10.8 %), flexor strength (60°/s, 29.9 ± 8.4 vs. 0.9 ± 8.9 %; 180°/s, 27.8 ± 11.4 vs. 1.6 ± 12.9 %) and HIQ ratio (60°/s, 0.9 ± 9.4 vs. 2.9 ± 11.1 %; 180°/s, 0.7 ± 11.6 vs. -2.7 ± 7.8 %) after 2 weeks detraining. However, the RT-BFR group decreased HIQ ratio from 0.75 ± 0.69, which may alleviate the training-induced injury protective effects in hamstring.

**Conclusions:** There were similar retaining effects on aerobic capacity and muscular strength between groups after 2 weeks detraining. However, only RT-BFR group was shown to have higher VO_{2max} (65.1 ± 5.2 vs. 64.3 ± 4.7 ml/kg/min), AOT (15.9 ± 1.7 vs. 15.4 ± 1.4 min), knee extensor (60°/s, 2.5 ± 0.5 vs. 2.3 ± 0.4 Nm/kg; 180°/s, 1.9 ± 0.2 vs. 1.6 ± 0.2 Nm/kg) and flexor strength (60°/s, 1.5 ± 0.2 vs. 1.4 ± 0.3 Nm/kg; 180°/s, 1.3 ± 0.2 vs. 1.2 ± 0.2 Nm/kg) performance when compared with pre-training. Thus, the findings suggest that RT-BFR may be considered as a practical training strategy for concurrent increase in VO_{2max} and muscular strength performance. In addition, the training effects are maintained within 2 weeks of detraining in athletes.

**161 Board #2**

**May 30 9:30 AM - 11:00 AM**

**Exercise with Blood Flow Restriction and Power Development of the Lower Body**

Justin Faller1, Susan Sotir2, Kristen Ouettel3, Vincent J. Paalone, FACSIM, Brian Thompson1, Skidmore College, Saratoga Springs, NY. Springfield College, Springfield, MA. (Sponsor: Vincent J. Paalone, FACSIM)

(No relevant relationships reported)

Sixty to eighty percent of one repetition maximum (1 RM) is generally recommended to elicit improvements in muscular fitness, however these intensities may not be appropriate for all populations and situations. A new training technique has been reported to elicit increases in muscle strength and size uses low intensity resistance training (≤ 20% 1RM) in combination with blood flow restriction (BFR) to the working muscle. BFR training has also been reported to reduce atrophy experienced during immobilization. Muscle power can improve due to increases in muscular strength and size, which can be beneficial to athletic performance. Acute changes in power output have been observed following near maximal resistance exercise efforts, however this has not been examined extensively in BFR training.

**PURPOSE:** To determine the acute effects low intensity resistance exercise with BFR has on power output of the lower body.

**METHODS:** Resistance trained males (n = 14) completed three experimental sessions in which lower body power output and vertical jump height were measured pre and post exercise protocol. Exercise protocols consisted of the barbell back squat with either 20% 1 RM and blood flow restriction (BFR) for 15 repetitions, or a high load (90% 1 RM) without restriction for 3 repetitions, and no exercise control. Vertical jump height and lower body power output were assessed using a portable force plate before and following the back bar back squat. A two-way repeated measures ANOVA was utilized to examine exercise protocol and vertical jump height as well as exercise protocol and power output.

**RESULTS:** Vertical jump height following BFR exercise was reduced when compared to vertical jump height before BFR exercise (46.4±5.6 cm vs. 43.6±4.6 cm, p < 0.05). No differences in vertical jump height were observed with 90% 1 RM (45.4±4.7 cm vs. 46.2±4.9 cm, p>0.05) or in the control group (47.6±5.9 cm vs. 45.6±5.7 cm, p>0.05).

Power output was unaffected by condition but decreased from pre to post exercise (62.2±3.7 w/kg vs. 60.9±7.7 w/kg, p<0.05).

**CONCLUSION:** A decrement in vertical jump height was experienced after an acute bout of BFR with low load resistance exercise. Low load resistance exercise with BFR or high intensity exercise may not be beneficial as part of a warm up to acutely enhance vertical jump or power output.
CONCLUSION: In a limited sample, BFR training was shown to be a comparable training method when compared to traditional hypertrophy training. The findings were specific to increases in bench press performance.

**Board #4**
May 30 9:30 AM - 11:00 AM
**Early Adaptations In Strength As A Result Of Blood Flow Restriction Training Is Not Mode-specific**

**PURPOSE:** Low-intensity blood flow restriction training has been demonstrated to elicit increases in muscle strength comparable to training at high intensities of exercise without blood flow restriction. Eccentric muscle actions are a key component to induce favorable adaptations in muscle, but there is limited information regarding the effects of eccentric (Ecc-BFR) versus concentric (Con-BFR) blood flow restriction training. The purpose of this investigation was to examine Ecc-BFR versus Con-BFR training on muscle strength. METHODS: Twenty-four untrained women (mean age ± SD = 21.9 ± 1.4 years) were randomly assigned to (1) 2-wk of Ecc-BFR (n = 12) at 30% of their eccentric peak torque (PT) or (2) 2-wk of Con-BFR (n = 12) at 30% of their concentric PT. Training was performed 3 times per week for 2-wk and consisted of 75 repetitions each training session performed over 4 sets (1 × 30, 3 × 15) and each set was separated by 30-s of rest. All training and testing procedures were performed on an isokinetic dynamometer at a velocity of 120°/s. At baseline and after 2-wk of training, indices of muscle strength (eccentric PT, concentric PT, and maximal voluntary isometric contraction [MVIC]) were assessed. Training-induced changes in muscle strength were examined using a 2 × (Time: baseline, 2-wk) × 2 × (Group [Ecc-BFR, Con-BFR]) × 3 (Mode [eccentric PT, concentric PT, MVIC]) mixed factorial ANOVA. RESULTS: There were no significant (p > 0.05) interactions, but there were significant (p < 0.05) main effects for Time and Mode, but not for Group. Muscle strength increased 12.0% (collapsed across Group and Mode) from baseline (24.2 Nm) to 2-wk (27.1 Nm), and eccentric PT (34.6 Nm) was greater than concentric PT (20.4 Nm) and MVIC (22.0 Nm), but concentric PT and MVIC were not different (collapsed across Time and Group). CONCLUSION: These findings indicated that low-intensity Ecc-BFR and Con-BFR training elicited comparable increases in muscle strength following 2-wk of resistance training. In addition, the increases in muscle strength were not mode-specific and increased for all modes of testing (eccentric PT, concentric PT, and MVIC) regardless of the training modality (Ecc-BFR or Con-BFR). Collectively, these results suggested that Con-BFR training resulted in comparable increases in muscle strength when compared to Ecc-BFR training.

**Board #5**
May 30 9:30 AM - 11:00 AM
**Acute Effects Of Resistance Training With And Without Blood Flow Restriction On Muscle Thickness**

Iván Chulvi-Medrano1, Moisés Picón1, Juan M. Cortell-Tormo1, Diego A. Alonso-Aubín1, Tamara Rial1, José Fernández-Sáez1, Daniel Alonso1, Yasser Alakhdar2, University of Alicante, Alicante, Spain. *International Hyporessorive and Physical Therapy Institute, Vigo, Spain. University of Valencia, Valencia, Spain.*

**RESULTS:** Twenty-four untrained women (mean age ± SD = 21.9 ± 1.4 years) were randomly assigned to 2-wk of Ecc-BFR (n = 12) at 30% of their eccentric peak torque (PT) or 2-wk of Con-BFR (n = 12) at 30% of their concentric PT. Training was performed 3 times per week for 2-wk and consisted of 75 repetitions each training session performed over 4 sets (1 × 30, 3 × 15) and each set was separated by 30-s of rest. All training and testing procedures were performed on an isokinetic dynamometer at a velocity of 120°/s. At baseline and after 2-wk of training, indices of muscle strength (eccentric PT, concentric PT, and maximal voluntary isometric contraction [MVIC]) were assessed. Training-induced changes in muscle thickness were examined using a 2 × (Time: baseline, 2-wk) × 2 × (Group [Ecc-BFR, Con-BFR]) × 3 (Mode [eccentric PT, concentric PT, MVIC]) mixed factorial ANOVA. RESULTS: There were no significant (p > 0.05) interactions, but there were significant (p < 0.05) main effects for Time and Mode, but not for Group. Muscle strength increased 12.0% (collapsed across Group and Mode) from baseline (24.2 Nm) to 2-wk (27.1 Nm), and eccentric PT (34.6 Nm) was greater than concentric PT (20.4 Nm) and MVIC (22.0 Nm), but concentric PT and MVIC were not different (collapsed across Time and Group). CONCLUSION: These findings indicated that low-intensity Ecc-BFR and Con-BFR training elicited comparable increases in muscle thickness following 2-wk of resistance training. In addition, the increases in muscle thickness were not mode-specific and increased for all modes of testing (eccentric PT, concentric PT, and MVIC) regardless of the training modality (Ecc-BFR or Con-BFR). Collectively, these results suggested that Con-BFR training resulted in comparable increases in muscle thickness when compared to Ecc-BFR training.

**Board #6**
May 30 9:30 AM - 11:00 AM
**Acute Cardiovascular Responses To Resistance Training With And Without Blood Flow Restriction**

Moisés Picón1, Iván Chulvi-Medrano1, Juan M. Cortell-Tormo1, Diego A. Alonso-Aubín1, Tamara Rial1, José Fernández-Sáez1, Daniel Alonso1, University of Alicante, Alicante, Spain. *International Hyporessorive and Physical Therapy Institute, Vigo, Spain. University of Valencia, Valencia, Spain.*

**RESULTS:** Twenty-four untrained women (mean age ± SD = 21.9 ± 1.4 years) were randomly assigned to 2-wk of Ecc-BFR (n = 12) at 30% of their eccentric peak torque (PT) or 2-wk of Con-BFR (n = 12) at 30% of their concentric PT. Training was performed 3 times per week for 2-wk and consisted of 75 repetitions each training session performed over 4 sets (1 × 30, 3 × 15) and each set was separated by 30-s of rest. All training and testing procedures were performed on an isokinetic dynamometer at a velocity of 120°/s. At baseline and after 2-wk of training, indices of muscle strength (eccentric PT, concentric PT, and maximal voluntary isometric contraction [MVIC]) were assessed. Training-induced changes in muscle strength were examined using a 2 × (Time: baseline, 2-wk) × 2 × (Group [Ecc-BFR, Con-BFR]) × 3 (Mode [eccentric PT, concentric PT, MVIC]) mixed factorial ANOVA. RESULTS: There were no significant (p > 0.05) interactions, but there were significant (p < 0.05) main effects for Time and Mode, but not for Group. Muscle strength increased 12.0% (collapsed across Group and Mode) from baseline (24.2 Nm) to 2-wk (27.1 Nm), and eccentric PT (34.6 Nm) was greater than concentric PT (20.4 Nm) and MVIC (22.0 Nm), but concentric PT and MVIC were not different (collapsed across Time and Group). CONCLUSION: These findings indicated that low-intensity Ecc-BFR and Con-BFR training elicited comparable increases in muscle thickness following 2-wk of resistance training. In addition, the increases in muscle thickness were not mode-specific and increased for all modes of testing (eccentric PT, concentric PT, and MVIC) regardless of the training modality (Ecc-BFR or Con-BFR). Collectively, these results suggested that Con-BFR training resulted in comparable increases in muscle thickness when compared to Ecc-BFR training.

**Board #7**
May 30 9:30 AM - 11:00 AM
**Blood Flow Restriction During Barbell Squats does not Alter Performance or Muscular Damage**

Teresa Wiczynski, Joseph Badinger, Cody E. Morris, Ray VanWye, Scott Arnett, Lee J. Winchester, Western Kentucky University, Bowling Green, KY. (Sponsor: Scott Lyons, FACSM)

**RESULTS:** Twenty-four untrained women (mean age ± SD = 21.9 ± 1.4 years) were randomly assigned to 2-wk of Ecc-BFR (n = 12) at 30% of their eccentric peak torque (PT) or 2-wk of Con-BFR (n = 12) at 30% of their concentric PT. Training was performed 3 times per week for 2-wk and consisted of 75 repetitions each training session performed over 4 sets (1 × 30, 3 × 15) and each set was separated by 30-s of rest. All training and testing procedures were performed on an isokinetic dynamometer at a velocity of 120°/s. At baseline and after 2-wk of training, indices of muscle strength (eccentric PT, concentric PT, and maximal voluntary isometric contraction [MVIC]) were assessed. Training-induced changes in muscle thickness were examined using a 2 × (Time: baseline, 2-wk) × 2 × (Group [Ecc-BFR, Con-BFR]) × 3 (Mode [eccentric PT, concentric PT, MVIC]) mixed factorial ANOVA. RESULTS: There were no significant (p > 0.05) interactions, but there were significant (p < 0.05) main effects for Time and Mode, but not for Group. Muscle strength increased 12.0% (collapsed across Group and Mode) from baseline (24.2 Nm) to 2-wk (27.1 Nm), and eccentric PT (34.6 Nm) was greater than concentric PT (20.4 Nm) and MVIC (22.0 Nm), but concentric PT and MVIC were not different (collapsed across Time and Group). CONCLUSION: These findings indicated that low-intensity Ecc-BFR and Con-BFR training elicited comparable increases in muscle thickness following 2-wk of resistance training. In addition, the increases in muscle thickness were not mode-specific and increased for all modes of testing (eccentric PT, concentric PT, and MVIC) regardless of the training modality (Ecc-BFR or Con-BFR). Collectively, these results suggested that Con-BFR training resulted in comparable increases in muscle thickness when compared to Ecc-BFR training.
BFR (4.99 ± 3.5) training when compared to baseline (2.73 ± 2.4; p for both < .05), but there was no significant difference in myoglobin between the two conditions (p = .39). IL-6 currently being assessed.

CONCLUSIONS: Our current results indicate that blood flow restriction training results in an increase in perceived pain rating during acute bouts of resistance training. However, it does not impair muscular performance or enhance muscular damage when compared to traditional resistance training. Future studies are needed to address the mechanism behind the ability of BFR training to enhance muscular performance.

A-39 Free Communication/Poster - Cardiovascular
Wednesday, May 30, 2018, 7:30 AM - 12:30 PM
Room: CC-Hall B

167 Board #8 May 30 9:30 AM - 11:00 AM
The Effect Of Different Exercises On Qt Dispersion In Sedentary Women.
Guner Cicek1, Oguzhan Celik1, Hittit university, Corum, Turkey. 2Mugla Sittikocman University, Mugla, Turkey. (Sponsor: Mark D. Peterson, FACSM) (No relevant relationships reported)

The effect of different exercises on QT dispersion in sedentary women. Background: QT dispersion (QTd) is a marker of myocardial electrical instability, and is a clinical metric known to predict ventricular arrhythmias and sudden cardiac death. Regular exercise has been shown to decrease both QTd and risk for cardiovascular mortality in various populations; however, the extent to which exercise modalities differ with respect to QTd adaptive response is less well-understood.

METHODS: A total of 26 volunteers were randomized and monitored in an aerobic exercise group (n=16; 35±2.2 years) and a resistance exercise group (n=10; 36±2.8 years). In both groups, exercise took place 4 days per week, for 16 weeks, and with 60 minute session. Heart rate (HR) was monitored continuously during all sessions, with the goal of maintaining an intensity of 60-70% max HR. Before and after the interventions, a standardized 12-lead surface ECGs and blood pressure, were recorded. Pre and post intervention changes were assessed within subjects and between groups.RESULTS: Following the exercise interventions, there was a decrease in the body mass, body mass index (BMI), and systolic and diastolic blood pressure in both intervention groups. There were also increases in the values of RR intervals, T wave, and P wave, and decreased resting HR for the aerobic exercise group (p<0.05), but not significantly in CSG. In addition, for the aerobic exercise group, QTd decreased in from 50±15.0 to 26.2±11.4 ms, and QTc decreased in from 17±3.5 to 8.3±3.7 ms (p=0.01). For the resistance exercise group, QTc decreased from 16±3.5 to 11.3±3.9 ms (p<0.05). CONCLUSION: The results of this study indicate that aerobic exercise significantly reduces the indices of ventricular repolarization dispersion among sedentary women. While there were improvements in QTc for the resistance exercise group, QTd parameters improved to a greater extent.

Key Words: Sedentary woman, exercise, ventricular repolarization

168 Board #9 May 30 9:30 AM - 11:00 AM
Heat Rate Variability: Meaningful Change and Reliability using a Heart Rate Sensor Chest Strap and an Android Phone Application
Nathan J. Hellyer, Sonya Blyakher, Sarah Costello, Kaitlin Wohnoutka. Mayo Clinic College of Medicine, Rochester, MN. (No relevant relationships reported)

PURPOSE: Heart rate variability (HRV), or the beat-to-beat variance in heart rate, is an adjunct measure of stress and physiological fatigue. Physically active individuals and athletes may use HRV as a measure of recovery from physical exhaustion, but change in HRV naturally fluctuates and meaningful change has not been well described. Therefore, the purpose of our investigation is to investigate reliability and minimal detectable difference in HRV measurement.

METHODS: We employed a test-retest reliability design with five minute resting heart rate measurements taken one week apart in eleven male and eleven female subjects (23±1 years old; BMI 22.7±2.3 kg/m²) positioned in a supine posture. HRV was collected by a Polar H7 heart rate sensor strap with data collected by a commercially available HRV android application, HRV Elite. Artifact detection and HRV analysis was performed using ARTiFACT software to generate the root mean square of the successive differences (RMSSD) values for each HRV measurement. Intraclass correlation coefficients (ICC) were calculated to examine reliability and a minimal detectable difference was calculated to examine change detectable beyond the limitations of error.

RESULTS: RMSSD means on trial one and two were 75.0
CONCLUSION: Preliminary data indicate that training with the ETM does not enhance either aerobic or anaerobic endurance beyond standard training and may produce adaptations that are less favorable in comparison. However, under conditions of restricted breathing (i.e. GXT performed wearing the ETM), the TM group showed greater improvement. While the ETM may not provide benefits to those whose breathing is not typically restricted, further study is required to determine if there may be adaptive benefits for those who typically perform under restricted breathing conditions. *Data collection is ongoing with final data (n=24) to be presented at the time of conference.

The validity of photoplethysmography-measured heart rate (PPG-HR) during exercise with varying degrees of upper extremity movement is unknown. PURPOSE: To assess the concurrent validity of three popular, commercially available PPG-HR monitors during exercises requiring varying amounts of upper extremity movement. METHODS: Twenty-one subjects (11 women and 10 men; mean±SD: age=24±4 yrs, height=1.71±0.06m, body fat=19.4±6.5%) donned PPG-HR devices at the forearm, wrist, and ear canal and researchers applied the 12-lead electrocardiogram (ECG; criterion standard). HR data were collected during 4 minutes each of treadmill exercise, cycling, rowing, and calisthenics. Exercise intensity progressively increased each minute from 1, 2, 3, 4, to 8 on Borg's 6-20 ratings of perceived exertion scale with pre-exercise (P<0.05). Five minutes after exercise, the SBP(109.1±7.9 vs 116.8±6.1mmHg) and DBP(61.2±6.2 vs 63.4±5.7mmHg) of CW group were significantly lower than those of IW group.

CONCLUSIONS: Both intermittent walking and continuous walking do good to lower blood pressure and heart rate, ameliorate arterial stiffness and improve vascular elasticity of female university students. Continuous walking has better effect on improvement of blood pressure and ankle brachial index compared with intermittent walking, which contribute to reduce risk of lower extremity arterial stenosis. All those improvement are beneficial to prevent cardiovascular disease in early life.

Blood pressure (BP) is an important ACSM risk factor when assessing cardiovascular health. Yoga practice addresses both movement related benefits for BP and also benefits related to an activation of the parasympathetic nervous system through the use of breath and meditation. Meditative relaxation emphasizes parasympathetic nervous system activation but does not include the movement component. PURPOSE: The purpose of this study was to compare the effects of yoga and meditative relaxation on BP among college students. METHODS: Sixty-seven men and women with an average age of 19.88 (±1.75) years participated. Participants were enrolled in a 13-week yoga (n=35), meditative relaxation (n=42), or a control group course (n=10). BP was measured at the beginning and the end of the 13-week semester. Participants were grouped based on hypertension classification. The ACSM hypertension guidelines were used to place participants in either a high or low hypertension group. A two-way ANOVA (p < 0.05) was used to determine group differences by hypertension class on change in systolic and diastolic BP. RESULTS: Forty-four participants were placed in the low hypertension group (systolic below 140mmHg and diastolic below 90mmHg) and 23 participants were placed in the high hypertension group (systolic at or above 140 mmHg and/or diastolic at or above 90mmHg). Among the participants in the high hypertension group, independent sample t-test showed a significant drop in both systolic, t(65) = 4.62, p = 0.00, and diastolic, t(65) = 2.78, p = 0.00, BP across both
exercise groups and the control group. Furthermore, a significant interaction between hypertension class and group was found for diastolic BP, F(2, 2577) = 3.59, p = 0.034 but not for systolic BP. When the data was divided separately by hypertension class, a one-way ANOVA no longer showed significant group differences among either hypertension class. **CONCLUSION:** Among this sample, high hypertensive participants significantly decreased both systolic and diastolic BP by the end of a 13-week academic semester. However, there was no significant difference in BP change between groups, suggesting no effect of resistance training on BP. Continued research is needed to uncover potential benefits for students engaging in movement and meditation courses over the course of an academic semester.

**RESULTS**

**Conclusion:** Leading up to and following a dance performance. Along with HR, analysis of HRV frequency of stress of dancers.

**METHODS:** Nineteen subjects (20±1 yr.) from a Division I University volunteered for the study. All subjects voluntarily signed an informed consent and completed anthropometric measures including height, weight and BMI. Subjects were then fitted with a BodyMedia SenseWear Armband to assess PA and sleep efficiency for the duration of one week (7 days). Upon returning the device, each subject had HRV assessed utilizing CardioSoft software by assessing standard deviation of the mean R-R intervals (SDANN). Subjects were classified as “Normal” or “Overweight” according to their BMI and t-tests were utilized to compare the two groups. **Results:** Our results show that the “Overweight” category (mean BMI = 26.6 kg/m²) had fewer steps (79, 060) when compared to the “Normal” BMI category (mean BMI = 21.6 kg/m²), steps (81, 212). Our results also show that the “Overweight” category had a lower HRV score when compared to the “Normal” category. However, the results of the t-tests showed no statistical difference (p < 0.05) between the two groups. **Conclusion:** While there was no statistically significant relationship between BMI and HRV, based on the results of the current study and by previous results (Wolfe & Dennis, 2016; Dennis & Wolfe, 2016) PA and PA intensity appear to have a larger impact on HRV rather than weight status. In terms of improving health, increasing PA should be the focus of college aged adults rather than reducing weight status.

Heart rate (HR) variability (HRV) is a useful tool for assessing cardiac autonomic function and identifying potential training maladaptation in athletic populations, but has yet to be investigated in ballet or modern dance populations. As such, HRV may be able to provide valuable insight into the preparedness of dancers and the demands of performance in a collegiate dance population.

**PURPOSE:** The purpose of the study was to examine acute fluctuations in cardiac autonomic function in a cohort of collegiate dancers over an intensive modern and ballet concert weekend.

**METHODS:** Female collegiate dancers (n=29, age=20.0±1.1 years) were monitored leading up to and following a dance performance. Along with HR, analysis of HRV was performed on the square root of the mean squared differences of the successive RR intervals (RMSSD). Magnitude based inferences (MBI) with effect sizes (ES) were used to identify the practical significance of changes during the Winter Dance Concert. The Recovery-Stress Questionnaire for Athletes (RESTQ-Sport) measured the frequency of stress of dancers.

**RESULTS:** Mean heart rate was higher at the first (76.5±1.8 bpm, 92/6/0, ES=0.35) and second (75.6±1.8 bpm, 94/6/0, ES=0.33) pre-show recordings compared to baseline (69.8±1.7 bpm). In contrast, RMSSD was most likely lower at the first (0.0/100, ES≈0.61) and second (0.0/100, ES=0.58) pre-show recordings compared to baseline. Both HR and RMSSD returned to baseline values at the post-show recording. Additionally, as per the RESTQ-Sport dancers reported feeling increasingly stressed and lacking energy going into the performances, as well as significantly higher feelings of fatigue after the weekend of performances when compared to baseline values.

**CONCLUSIONS:** Dancers responded to concert performances in a comparable manner to other athletic populations approaching intense competition, exhibiting decreased parasympathetic activity, while returning to baseline values within 24 hours of their performance. This is indicative of ideal preparation and recovery from the weekend dance performances.
Heart Rate (HR) is widely used for exercise intensity prescriptions and/or studies of exercise training. It is often assumed that exercising at a given HR results in similar metabolic stress, regardless of the mode of exercise. PURPOSE: To gauge the leukocyte and lactate responses following a submaximal exercise at an equivalent target HR on cycle ergometer (CE) and treadmill (TM).

METHODS: Six healthy male adults (25.4 ± 3.2 y.o) completed 4 laboratory visits. Participants performed a progressive exercise test to exhaustion on CE and TM. On subsequent separate days, in a randomized order, participants performed a 30-min constant exercise challenge at 70% HR reserve (HRR) on CE or TM. Borg’s Rating of Perceived Exertion (RPE) was recorded every 5 min. Blood was drawn before and immediately after the 30-min exercise. Paired t-test was used to evaluate within-person differences (before/after exercise) & between modes. Due to the small sample size, effect sizes were also calculated.

RESULTS: We successfully “clamped” HR during the exercise in CE and TM (154.8 ± 0.7 T; 156.8 ± 0.8 bpm). During the first 10 minutes, all participants perceived the CE challenge as more strenuous compared to the TM (RPE: 1.39 ± 0.1 vs 1.13 ± 0.4), with no difference between exercise modes (monocytes; CE 53.3 ± 62.5%, TM 42.7%, lymphocytes; CE 118.7%, TM 76.9%). However, a moderate effect size (d = 4.86) was seen for lymphocytes, with a greater increase in CE. CONCLUSION: Lactate response was lower on TM while leukocyte response was generally similar. The smaller lactate increase on TM may reflect lower reliance on anaerobic metabolism when using a larger muscle mass and/or greater lactate clearance by upper body muscles. The similar leukocyte response may reflect the fact that in both modes metabolic stress was moderate. HR is not sufficient in and of itself to fully assess the metabolic stress associated with a given mode of exercise. Supported by NIH PO1HD-048721 & PERC Systems Biology Fund

Maximizing training in and out of season is essential for player development in college soccer. Maintaining and improving aerobic performance has been shown to be successful using high-intensity interval training (HIIT) and vigorous endurance exercise (END). Utilizing HIIT can be as much as half the time commitment, which may improve their FGA score by 33%. The other individual increased their 6-minute walk distance 10% while improving their FGA score by 33%. The other individual progressed from 33 N to 85 N of continuous force. A 37% increase in exercise occurred upon completion of the training with marginal changes in comfortable walking speed and a 34% improvement in 6-minute walk distance along with an 11% increase in FGA.

CONCLUSION: This preliminary data suggests that using horizontal resistive forces to generate an aerobic level of training during walking is a feasible approach to exercise training of individuals poststroke and may result in improved gait economy, balance, ability to sustain higher work at their comfortable speed, and endurance.
A-40

Free Communication/Poster - Cycling

Wednesday, May 30, 2018, 7:30 AM - 12:30 PM
Room: CC-Hall B

181
Board #22
May 30 9:30 AM - 11:00 AM
Training Impulses And The Relationship With Performance Improvement: Not That Straightforward
Kobe M. Vermeire, Gilles Vandewiele, Jan Bourgois, Jan Boone.
Ghent University, Ghent, Belgium.
(No relevant relationships reported)

Purpose: To assess the relation between training load and performance improvement in a homogeneous group with a differentiated training program.

Methods: Training data from 11 recreational cyclists (aged 38.5 ± 5.9 yr) were collected during a 12-week training period. Before and after the training period, subjects underwent a laboratory incremental exercise test with lactate measurements. Baseline metrics were the anaerobic lactate threshold (ALT), the anaerobic lactate threshold (ALT), and the maximum power output (MPO). Internal training load was calculated using individualized TRIMP (tTRIMP), Lucia TRIMP (tLuciaTRIMP), Banister TRIMP (bTRIMP) and Edwards TRIMP (eTRIMP). The distribution of training load was calculated as the time in zone 1 (Z1), zone 2 (Z2) and zone 3 (Z3), being the zone below the ALT, between ALT and ANLT and the zone above ANLT respectively.

Results: 353 training sessions were analysed. All metrics improved (p < 0.01) from baseline to posttest (ALT from 161.4 ± 20.8 to 179.4 ± 25.6; ANLT from 221.6 ± 25.8 to 240.4 W ± 25.0 and MPO from 273.5 W ± 23.7 to 290.9 W ± 26.0) All TRIMP calculations correlated very highly with one another (r = 0.88 – 0.99; p < 0.01). No significant correlations (p < 0.05) were found between the mean weekly TRIMP, for every calculated method, and the improvement in fitness variables. When looking at the distribution of training time, total minutes in Z2 correlated largely with the progression in the ANLT (r = -0.63, p = 0.02). The percentage of time trained in Z1 correlated with progress in MPO (r = 0.58, p = 0.03), percentage in Z2 correlated negatively with MPO (r = -0.74; p = 0.01) and percentage in Z3 shows a relation with the progression in ANLT (r = -0.56, p = 0.04). When combining the percentage and total time in each of the training zones in a regression analysis, there is a stronger relation with the improvement in ALT (r = 0.29), in ANLT (r = 0.74) and MPO (r = 0.81).

Conclusion: Directly relating training impulses with training progression should be done with caution. Distribution of training time over the intensity zones should always be accounted for. It is improbable that one metric could directly relate to the overall progression of an athlete.

While lactate threshold (LT) is a common laboratory test and is often used to design training plans and monitor fitness changes, there is no consensus as to which determination method should be used. Three of the most common are the break point (BREAK), 1 mmol/L over baseline (+1 mmol), and reaching 4 mmol/L onset of blood lactate accumulation (OBLA). Currently, it is not clear if different determination methods could yield varying results in different populations.

PURPOSE: We compared 3 most commonly used LT methods in trained cyclists and in athletes (soccer players) who were not accustomed to cycling exercise. We hypothesized that the BREAK and +1 mmol methods would yield similar results in both populations.

METHODS: LT data were analyzed from 41 athletes [18 trained cyclists (15 males [m], 3 females [f]) and 23 female soccer players]. Tests were performed on a cycle ergometer using 5 min stages starting at 70 W (m)/50 W (f). Work rates were increased by 25 W (m)/15 W (f) for the first 3-4 stages, and by 15 W (m)/10 W (f) for the last 2-3 stages. Blood samples were obtained in the last min of each stage, and blood lactate was analyzed using a Lactate Plus device. For determinations of LT, 3 trained investigators independently analyzed the plots.

RESULTS: In cyclists, LTs using BREAK and +1 mmol (247±48 W vs. 250±50 W; p=0.52) were not different but were significantly lower than that obtained with OBLA (270±54 W). Correlational analyses indicate that LT using BREAK and +1 mmol were strongly related (R=0.99). Associations were strong between +1 mmol and OBLA (R=0.96) and between BREAK and OBLA (R=0.96). In non-cyclists, LTs obtained with all 3 methods were significantly different (BREAK: 125±13 W; +1 mmol: 130±11 W; OBLA, 134±13 W; all p<0.04), although BREAK and +1 mmol were strongly associated (R=0.98).

The associations between different LT methods were much weaker in non-cyclists (1 mmol and OBLA: R=0.90; BREAK and OBLA: R=0.85) compared with cyclists.

CONCLUSIONS: Break point and +1 mmol LT methods yield comparable results in trained cyclists but not in non-cyclists. Caution should be used when interpreting LT results obtained from different determination methods.

The Wattbike is an electromagnetically and air-braked cycle ergometer that has been used for talent identification and elite development by British Cycling. It is paired with advanced software that includes a 3-min aerobic test meant to provide maximum minute power (MMP) and predict maximal oxygen consumption (VO₂ peak).

PURPOSE: To assess the accuracy of the prediction by the Wattbike, and to determine the accuracy of the 3-min test to elicit a true VO₂ peak.

METHODS: This study included 13 cyclists (3 women, 10 men) with varying degrees of experience, a mean±SD age of 29.2±10.0 years, height of 178.7±8.3 cm, and mass of 75.1±12.5 kg. At the first lab visit, a 10-min self-paced VO₂ peak test (SPV) was performed. For the second visit, they were asked to complete a warm-up followed by the 3-min...
test. The goal of the 3-min test, as stated in the manufacturer’s instructional video, is to maintain as high of a power output as possible for three full minutes without a drop in performance. Participants were shown the video, so that they were fully aware of the protocol and requirements. They were free to alter pedal cadence and resistance throughout the test. A metabolic cart was used to collect expired gases. 15-breath moving averages were calculated and the maximal value for each variable was used for analysis (VO2, respiratory exchange ratio (RER) and ventilation (Ve)). A one-way repeated-measures ANOVA was used to compare the values provided by the metabolic cart during the minimal work (5.2±8.7 SPV, 54±0.97 W) given by the Wattbike to the values provided by the metabolic cart for the SPV and the 3-min test. Significant differences were observed between groups for power asymmetry. Cycling performance is closely related to the ability to produce higher power outputs. Further research is needed to understand this relationship as well as potential training interventions to reduce levels of asymmetry observed during cycling.

There was a paucity of research on how trunk posture affects recovery during a race or practice immediately between cycling sprints, although there is speculation that posture may influence recovery. This study included 13 competitive male cyclists, with an average of 10.9 years of cycling experience. Participants completed two 30-s maximal effort sprints on a cycle ergometer followed by two 4-min active recovery intervals at 75 W and the same cadence for each session. Participants assumed one of two trunk posture conditions during the recovery intervals on two separate days. They were randomly assigned to either a flexed thoracic spine position greater than 14° (FC) or a neutral thoracic spine position (NC) on the first testing day and completed the other no less than 48 hours later. Recorded variables included heart rate recovery (HRR), tidal volume (Vt), carbon dioxide output (VCO2), change in sprint mean power (AMP), and change in sprint fatigue index (AFI). There were no significant differences between conditions in any of the variables (p>0.05). Results of FC versus NC for each variable were: HRR 22.5±1.0 vs. 21.3±0.8; Vt 235.0±51.3 vs. 319.5±54.5; L·VCO2 3.28±0.25 vs. 3.67±3.60 L/min; AMP 29.7±10 vs. 28.6±19 W; AFI 0.59±0.25 vs. 0.43±1.90 W/s. Using the Cohen’s d statistic, there was a small effect of thoracic spine position during recovery on HRR (d=0.33), Vt (d=0.34), and AFI (d=0.45) from one sprint to another. However, there was no effect of thoracic position on VCO2 (d=0.062) or the AMP (d=0.051) from sprint to sprint and recovery intervals. There may be little to no benefit to recovery in assuming a more flexed thoracic position between cycling sprints.

The rate of muscular contractions during cycling can be modified by increasing or decreasing pedaling revolutions. The manipulation of cadence (revolutions per minute, rpm) may lead to alterations in the physiological response at a given work rate and cadence selection may affect overall cycling performance. PURPOSE: Therefore, the purpose of this study was to assess the relationships between cadence selection and accumulated energy (AE), time to exhaustion (TTE), and VO2 peak. METHODS: 20 individuals (18.45±2.8 years old) participated in the current study. Participants were grouped into two groups, cycling experience (CE=8) and no cycling experience (NCE=12). Subjects in both groups each completed 3 graded exercise tests (GXT) at 3 different cadences over the course of 3 visits. The initial GXT (visit 1) was at a self-selected (SS) cadence and the subsequent 2 visits consisted of a GXT at either a Low (55-70 rpm) or High (100-115 rpm) cadence. The cadence for visits 2 and 3 were randomly selected. A two-way repeated measures ANOVA was used to determine if significant differences existed between groups as well as between cadences. RESULTS: A significant group by condition interaction was present. Significant group differences existed for AE (CE 196.17±37.95 vs. NCE 100.67±37.38), TTE (CE 1368.67±207.37 vs. NCE 990.11±174.64) and VO2 peak (CE 47.71±8.21 vs. NCE 35.78±4.72). However, significant differences were observed between the High and Low cadences for AE (135.33±16.64 vs Low 156.28±66.97) and TTE (High 1123.42±285.69 vs Low 1218.167±254.32). Significant differences were also observed between the High and SS cadences for AE (High 135.33±16.64 vs SS 154.32±66.68) and TTE (High 1123.42±285.69 vs SS 1196.58±254.28). No significant differences were observed between the Low
and SS cadences for AE and TTE (p > 0.05). No significant differences were observed at the different cadences for VO2 peak. **CONCLUSION:** Cadence selection appears to have a significant effect on AE and VE, but not VO2 peak. These findings suggest that selecting a higher cadence will lead to earlier development of fatigue and volitional exhaustion compared to that of lower cadences. This indicates that improper cadence selection could have a detrimental effect on cycling performance and should be individualized.

**Novice Cyclists Using Shorter Crank Lengths**

G. Alan Garvick, Edward K. Merritt, R. Andrew Shanely. Appalachian State University, Boone, NC.

Previous endurance exercise studies suggest that a high-intensity-low-volume-taper period improves performance over a low-intensity taper period. However, few, if any, studies have examined different exercise intensities in the two days preceding a race, a period often manipulated during training. **PURPOSE:** To compare performance in a simulated 40km cycling time trial (TT) 24hr after a high-intensity interval-low-volume cycling session (HII), commonly described as an “openers,” or a low-intensity effort session (LIE). **METHODS:** Eight subjects (6 males/2 females, 29.6±4.5 yrs, VO2̇max. 62.3±21.1 ml kg⁻¹ min⁻¹) completed two simulated 40km time trials following the familiarization-40km TT (FAM). The FAM trial was completed 5-10 days prior to the first performance trial. Performance trials, HII and LIE, were completed in a random crossover repeated measures design. Subjects rested the day before FAM, HII, and LIE to mimic normal pre-race structure. HII consisted of 1hr of cycling (15-min warm up at 63% of FAM power (FAMP)), three 1-min efforts at 150% FAMP separated by 5-min at 63% FAMP, three 30-sec efforts at maximum FAMP separated by 5-min at 63% FAMP, and 15.5-min cool down at 65% FAMP). LIE consisted of 1hr cycling at 35% FAM. Time to complete the TT, average power, VO2̇, respiratory exchange ratio (RER), and rating of perceived exertion (RPE) were measured. **RESULTS:** Neither time to completion nor average power differed between HII and LIE trials (63.2±3.51 min vs. 62.9±0.04 min, p=0.545, 219±36.3 watts vs. 222±38.6 watts, p=0.374). The trend taken to reach each 5km distance over the 40km distance did not differ between trials (p=0.362). The pattern of change in VO2̇, RER, and RPE did not differ between trials (p=0.775, p=0.281, p=0.508, respectively). **CONCLUSION:** Despite previous reports that high-intensity-low-volume taper paradigms improve performance over a low-intensity taper, exercise performance, average power, VO2̇, RER, and RPE did not differ in trained cyclists during 40km time trials completed 24hr after HII and LIE sessions.

**The Physiological and Perceptual Response to Self-, Even- and Variable Paced Cycling Time Trials**

Jos J. de Koning, FACSM,1 Tim Veneman1, Wouter Schallig1, Maaike Eken1, Carl Foster, FACSM,2 Vrije Universiteit, Amsterdam, Netherlands. 1Stellenbosch University, Tygerberg, South Africa. 2University of Wisconsin - La Crosse, La Crosse, WI.

The aim of this study was to describe the differences in physiological variables and RPE between time trials with a self-paced- and an enforced constant- and fluctuating PO. **METHODS:** Healthy male trained cyclists (N=10) completed three 10-km time trials. First, a self-paced time trial (SELF) was completed. Subsequently, in random order, time trials with an imposed constant (CON) and fluctuating (FLUC) PO were completed with both the same average PO as SELF. During FLUC, PO varied step-wise per kilometer with 10% deviations under and above the average PO. In all trials, RPE, muscle activation and metabolic variables were measured. **RESULTS:** A significant main effect on RPE was found between FLUC and CON (F=10.44, P=0.014). Analysis per kilometer showed that the RPE was significantly lower in FLUC compared to CON in kilometer 4, 5, 8, 9 and 10 (P<0.05). No main effect on RPE was present between SELF and FLUC or SELF and CON. No overall differences in muscle activation and metabolic variables were present between the trials, despite differences per kilometer. **CONCLUSION:** The differences in RPE with absence of overall differences in metabolic variables and muscle fatigue, suggest that the fluctuations in PO provide a psychological rather than a physiological advantage. The fluctuations might cause a shortening of in-race goal setting, since it divides the time trial into several segments. Shorter goal setting is known to be perceived as more feasible and increase motivation.
Determined maximal oxygen consumption (VO$_{2\max}$) in cyclists typically involves measuring expired respiratory gases during an incremental trial to exhaustion. These methods can be expensive and inaccessible to many recreational cyclists. Therefore, being able to estimate VO$_{2\max}$ from the peak power ($W_{\text{peak}}$) attained during an incremental cycling trial (ICT), may provide an easier and less expensive way for these cyclists to estimate their cardiorespiratory fitness. **Purpose:** The study had two aims: 1) to validate the regression equation of Hawley and Noakes (1992) (HNEQ) to predict VO$_{2\max}$ from $W_{\text{peak}}$ attained during an ICT with a HIPO to an ICT using a lower initial power output (LIPO); and 2) to compare VO$_{2\max}$ measured during the ICT with a HIPO to an ICT using a lower initial power output (LIPO). **Methods:** Twelve recreationally trained cyclists (9 males and 3 females; cycling at least 4 d/wk or 6 hr/wk) completed both the HIPO and LIPO trials to measure VO$_{2\max}$ and $W_{\text{peak}}$. For the HIPO trial, initial power output (PO) was 2.5 or 3.3 W/kg body mass for females and males, respectively. PO increased by 50 W after 150 s, and 25 W every 150 s thereafter until volitional fatigue. For the LIPO trial, initial PO was 1.5 or 2.0 W/kg body mass for females and males, respectively, and PO increased by 25 W every 120 s until volitional fatigue. During each ICT, expired respiratory gases were measured with a calibrated metabolic measurement system and time to exhaustion was recorded to the nearest second to extrapolate $W_{\text{peak}}$, which was used to estimate VO$_{2\max}$ with the HNEQ. **Results:** There was a significant difference (p<0.001) between the mean VO$_{2\max}$ value measured during the HIPO trial (50.56 ± 7.28 mL/kg/min) and the predicted mean VO$_{2\max}$ value estimated from the HNEQ (57.46 ± 6.15 mL/kg/min). However, there was no significant difference (p=0.165) between the mean VO$_{2\max}$ values measured during the HIPO and LIPO trials (50.56 ± 7.28 mL/kg/min and 51.48 ± 6.94 mL/kg/min, respectively). **Conclusions:** This study found that the HNEQ overestimated VO$_{2\max}$ in recreationally trained participants. However, because the HIPO and LIPO protocols resulted in VO$_{2\max}$ values that were not statistically different, either protocol can be used to determine VO$_{2\max}$ in recreationally trained cyclists.

**Fitness tracking devices commonly use accelerometry (ACC) and heart rate (HR) data to quantify physical activity (PA). Inaccurate tracking of PA may occur using ACC during multimodal training (e.g. circuit training), and both HR and ACC may overestimate work performed during upper body exercise or in special populations.**

**Purpose:** Evaluate the effectiveness of using upper body muscle activity (EMG) to track PA during a bout circuit resistance training (CRT) performed by able bodied (AB) and those who have sustained a spinal cord injury (SCI). **Methods:** N= 5 (3 AB and 2 SCI). First visit, participants performed a graded exercise test to volitional failure on an arm ergometer and analyzed via indirect calorimetry (IC). Second visit, participants performed a circuit resistance training (CRT) bout adapted from a previous protocol developed for persons with SCI. The protocol was three rounds of six exercises: (1) seated bench press, (2) seated row, (3) seated leg press, (4) seated calf raise, (5) seated abdominal crunch, and (6) seated lateral raise. All exercises were performed using free weights on a seated exercise machine. Emg activity was measured using surface electrodes with 128 recording channels. EMG signals were amplified, bandpass filtered (10-450 Hz) and sampled at 1000 Hz. EMG activity was calculated via the root mean square (RMS) method. **Results:** Results showed that there was considerable variability in EMG activity across different exercises and muscle groups. For the CRT, the EMG activity was higher for SCI compared to AB for the seated bench press, seated row, and seated leg press. However, there were no significant differences in EMG activity between groups for the remaining exercises. **Conclusions:** The EMG activity was lower in SCI compared to AB for the seated bench press, seated row, and seated leg press. However, the differences were not statistically significant. Further research is needed to determine the effectiveness of using EMG to track PA during upper body exercise in SCI.
Board #37 May 30 9:30 AM - 11:00 AM

A Comparison of Muscle Unit Activation during Biceps Curl Exercise at 40, 60, 80 and 100% of 1 Repetition Maximum

Alex Zykoff, Mike Aquino, Jacqueline Pellechia, John Petrizzo, John Wygand, FACSM, Robert M. Otto, FACSM. Adelphi University, Garden City, NY. (No relevant relationships reported)

The optimal intensity of resistance training exercise is subject to ongoing debate. There is universal agreement that electromyography (EMG) is an excellent index of motor unit (MU) activation or recruitment. The amount of EMG activity can infer the relative intensity of the exercise as compared to a maximal voluntary contraction (MVC) of a specific muscle, performing a specific exercise within one specific individual.

Purpose: To determine the magnitude of muscle fiber recruitment (activation) of the Bicip Brachii during various loading of the muscle (40, 60, 80, and 100% of 1 RM) during bicep curl (BC) exercise performed to momentary muscular fatigue (MMF), 12 subjects (age 22.5±1.0 yr, ht. 169.4 cm;11.1 cm, body mass 75.3 kg;17.5 kg, 70) with resistance training experience, volunteered. Methods: A familiarization trial on the conventional BC exercise was performed to MMF while subjects exerted a maximal force against an immovable load at approximately 35% DL ROM. After safe lifting form was confirmed, a 1RM was titrated and randomized trials of B and NB were performed to MMF at 80% of subject’s 1RM with a minimum of 30 minutes between trials. MU recruitment was estimated by EMG. All subjects adhered to a 3-1-3-1 sec repetition duration and terminated the lift at MMF on the concentric phase.

RESULTS: Analysis by dependent t test was applied to these data and revealed no significant difference between trials with motor unit activation for BF of 98.0% and 93.7%, for G of 92.2% and 80.7%, and for T of 72.3% and 71.0%, for B and NB trials, respectively. Conclusion: The use of a properly aligned and fitted weightlifting belt did not yield a significant difference in muscle activation between the (B) and (NB) trials for the tested muscle groups while performing the conventional DL. Thus, a weight lifting belt may augment the lifter’s perception, but it does not enhance or detract from motor unit activation.

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

A Comparison of EMG Muscle Activity and Turn Times Using Orthosis and Stock Insoles During Skiing

Heidi Nunnikhoven. Montana State University, Bozeman, MT. (No relevant relationships reported)

New alpine ski boots are generally sold with generic, foam rubber stock insoles which may lead to over-pronation of the foot due to a lack of subtalar support. The use of stock insoles may result in inefficient movements of the foot and reduced transfer of force throughout the turn cycle. A flexible orthosis insole is designed to provide support of the foot and while still allowing for the rotation of subtalar joints which may lead to over-pronation of the foot due to a lack of subtalar support. The use of weightlifting belts for free weight training and competition is commonplace. Theoretically, the use of the belt in conjunction with a simultaneous valsala maneuver provides additional support to the spine by facilitating increased stabilizing pressure inside the abdominal cavity. This is accomplished by isometric contraction of the core muscles in the abdominal wall and lower back with support from the belt. Generally lifts with 5-15% greater loading are reported when wearing a belt. Purpose: The purpose of this study was to determine the magnitude of motor unit activation in the biceps femoris (BF), gastrocnemius (G), and trapezius (T) during a conventional deadlift (DL) wearing a weightlifting belt (B) or without a belt (NB).

Methods: 10 subjects with resistance training experience (age 22.2 ± 0.78, ht. 170.4 ± 11.9 cm, and body mass 81.7± 21.6 kg, 60) volunteered to perform a familiarization trial of the conventional DL technique of three repetitions at 70% of their self-reported one repetition maximum (IRM). A maximal voluntary contraction (MVC) was obtained while subjects exerted a maximal force against an immovable load at approximately 35% DL ROM. After safe lifting form was confirmed, a 1RM was titrated and randomized trials of B and NB were performed to momentary muscular fatigue (MMF) at 80% of subject’s 1RM with a minimum of 30 minutes between trials. MU recruitment was estimated by EMG. All subjects adhered to a 3-1-3-1 sec repetition duration and terminated the lift at MMF on the concentric phase.

RESULTS: Statistical analysis by dependent t test was applied to these data and revealed no significant difference between trials with motor unit activation for BF of 98.0% and 93.7%, for G of 92.2% and 80.7%, and for T of 72.3% and 71.0%, for B and NB trials, respectively. Conclusion: The use of a properly aligned and fitted weightlifting belt did not yield a significant difference in muscle activation between the (B) and (NB) trials for the tested muscle groups while performing the conventional DL. Thus, a weight lifting belt may augment the lifter’s perception, but it does not enhance or detract from motor unit activation.

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

The Effect Of Using A Weightlifting Belt On Muscle Activation During A Conventional Deadlift

Jacqueline Pellechia, John Petrizzo, Robert M. Otto, FACSM, John Wygand, FACSM. Adelphi University, Garden City, NY. (Sponsor: John Wygand, FACSM) (No relevant relationships reported)

The use of weightlifting belts for free weight training and competition is commonplace. Theoretically, the use of the belt in conjunction with a simultaneous valsala maneuver provides additional support to the spine by facilitating increased stabilizing pressure inside the abdominal cavity. This is accomplished by isometric contraction of the core muscles in the abdominal wall and lower back with support from the belt. Generally lifts with 5-15% greater loading are reported when wearing a belt. Purpose: The purpose of this study was to determine the magnitude of motor unit activation in the biceps femoris (BF), gastrocnemius (G), and trapezius (T) during a conventional deadlift (DL) wearing a weightlifting belt (B) or without a belt (NB).

Methods: 10 subjects with resistance training experience (age 22.2 ± 0.78, ht. 170.4 ± 11.9 cm, and body mass 81.7± 21.6 kg, 60) volunteered to perform a familiarization trial of the conventional DL technique of three repetitions at 70% of their self-reported one repetition maximum (IRM). A maximal voluntary contraction (MVC) was obtained while subjects exerted a maximal force against an immovable load at approximately 35% DL ROM. After safe lifting form was confirmed, a 1RM was titrated and randomized trials of B and NB were performed to momentary muscular fatigue (MMF) at 80% of subject’s 1RM with a minimum of 30 minutes between trials. MU recruitment was estimated by EMG. All subjects adhered to a 3-1-3-1 sec repetition duration and terminated the lift at MMF on the concentric phase.

RESULTS: Statistical analysis by dependent t test was applied to these data and revealed no significant difference between trials with motor unit activation for BF of 98.0% and 93.7%, for G of 92.2% and 80.7%, and for T of 72.3% and 71.0%, for B and NB trials, respectively. Conclusion: The use of a properly aligned and fitted weightlifting belt did not yield a significant difference in muscle activation between the (B) and (NB) trials for the tested muscle groups while performing the conventional DL. Thus, a weight lifting belt may augment the lifter’s perception, but it does not enhance or detract from motor unit activation.
The Eccentric Utilization Ratio (EUR) is an indicator of lower-extremity stretch-shortening cycle function in power athletes. Joint-specific EUR’s have not been established, and their contributions to whole-body EUR are currently not known. Determining joint-specific EUR’s and their contribution to whole-body EUR would help expand the understanding of the neuromuscular function and biomechanics of jumping exercises and provide insights for the program design process. PURPOSE: To determine joint-specific EURs and their associations with whole-body EUR. METHODS: Nine college track and field and soccer athletes (Height: 175 ± 15 cm, Weight: 71 ± 20 kg) participated in this study. All athletes performed three squat (SJ) and countermovement jumps (CMJ) at different speed. All jumps were recorded kinematically and kinetically. Muscle size was measured using cross-sectional area. RESULTS: The CMJ/SJ ratio (unitless) was calculated from the three-trial average peak joint powers of the hip, knee, and ankle joint (joint-specific EUR) and from jump height (whole-body EUR) of the CMJ and SJ. Joint-specific EUR’s were computed with one-way ANOVA. Joint-specific EUR’s were then correlated to whole-body EUR with simple linear regressions. RESULTS: Joint-specific EUR’s were 1.04 ± 0.18, 1.15 ± 0.25, and 1.05 ± 0.18 for the hip, knee, and ankle joint, respectively. Joint-specific EUR’s did not differ across joints. Whole-body EUR was 1.11 ± 0.70. The Pearson correlation coefficients (r) between joint-specific EUR’s of the hip, knee, and ankle joint and whole-body EUR were 0.10 (p = 0.80), 0.70 (p = 0.01), and 0.50 (p = 0.17), respectively. CONCLUSIONS: The stretch-shortening cycle function of the knee joint appears to be the primary determinant of whole-body stretch-shortening cycle performance, while the ankle and hip joints do not appear to contribute much at all.

The relationship between the lactate and electromyographical (EMG) thresholds has previously been established via graded exercising testing during cycling. Currently, no published literature exists comparing the most appropriate and efficient filtering methods of EMG analyses to estimate the workload at which lactate threshold (LT) occurs. PURPOSE: The purpose of this investigation was to evaluate and compare EMG transformations and time windows to predict LT. METHODS: Participants (n=14) completed an incremental, maximal exercise test on a cycle ergometer until exhaustion. Blood lactate was measured every minute, while EMG was recorded continuously at the site of the vastus lateralis. EMG signal was then transformed and filtered using two time-segment windows (i.e., 10 and 60 seconds), as well as three signal conversions (i.e., root mean square, smoothing, and peak amplitude averaging). RESULTS: Results indicated no mean differences between the EMG thresholds, for any of the filtering methods or time-segment windows, when compared to the LT criterion. Significant moderate correlations were seen when comparing the lactate and EMG time-converted threshold with peak root mean square and smoothing filters accurately indicated LT in 10 out of 14 participants; whereas peak amplitude averaging indicated LT for 11 out of 14 participants. CONCLUSIONS: EMG may be a useful tool to estimate the work rate associated with LT. Averaging EMG over a minute of time and continual 10-second recordings demonstrate comparable readings and allow an easier application of EMG threshold in the field.

Push-up exercises are widely used as a recommended home-based strengthening exercise for the upper body. Very little has been published on push-ups and the activation of upper limb major muscles in different hand positions using EMG. More research is needed to explain the workload done by Triceps Brachial (TB), Pectoral Major (PM) and Anterior Deltoid (AD). PURPOSE: The aim of this study is to measure the EMG signals of TB, PM and AD while performing push-ups in two different hand positions. METHODS: 50 African American subjects were recruited and performed push-ups on two separate occasions. The 2 different hand positions were dictated by the index or pinky alignment with the spine position. Hands were spread by shoulder length. The mean of peak EMG signals to exhaustion were analyzed. A non-parametric Kruskal-Wallis H test was applied and followed by Wilcoxon Signed-Rank test as the post hoc paired difference test. A Bonferroni correction of p=0.01 was applied which was derived from p=0.05/2. RESULTS: Significant differences were found in all muscles with a greater activation using the index finger position in the TB muscle. Males experienced a significantly greater activation in all muscles compared to females. CONCLUSIONS: Higher muscle activation of TB implies that the training effect of TB may be higher in the above-mentioned hand position. Future studies should address the increase in muscle strength in in-home setting especially in minorities.
Exercise Intensity Reduces Circulating Annexin V-CD105 Microparticles in Adults With Prediabetes

Natalie ZM Eichner, Nicole M. Gilbertson, Emily M. Heistron, Julian M. Gaitan, Luca Musante, Sabrina LaSalvia, Eugene J. Barrett, Arthur L. Weltman, FACSM, Uta Erdbrügger, Steven K. Malin, FACSM. University of Virginia, Charlottesville, VA. (Sponsor: Steven Malin, FACSM) (No relevant relationships reported)

PURPOSE: Microparticles (MPs) derived from platelets, leukocytes and endothelial cells are important players in cardiovascular disease (CVD) risk. Exercise is established to reduce CVD risk, but no study has tested the effect of exercise intensity on various subtypes of MP in people with prediabetes. We tested the hypothesis that short-term interval (INT) training could reduce MP subtypes, continuous (CONT) exercise.

METHODS: Eighteen obese adults (age: 63.8±1.5yrs; BMI: 31.0±1.3 kg/m²) were screened for prediabetes using ADA criteria (75g OGTT and/or HBA1c). Subjects were randomized to INT (n=10, 3 min intervals at 90% and 50% HRpeak) or CONT (n=8, 70% HRpeak) training for 12 supervised sessions over 2 wks for 60 min/d. Fitness (VO2peak) and weight (kg) were assessed and arterial stiffness (augmentation index; AI) calculated using total AUC during a 75g OGTT. Total MPs, platelet MPs (CD13/CD41+), endothelial MPs (CD105, CD31/CD41+) and leukocyte MPs (CD45+CD105-) were analyzed from fresh plasma via imaging flow cytometry pre/post-intervention.

RESULTS: Our interventions had no effect on weight loss but INT exercise increased VO2peak (trend: P=0.08) compared with CONT training. While our intervention had no effect on platelet or leukocyte MPs, INT exercise decreased Annexin V- endothelial MP CD105 (1.6±0.2 vs. 1.4±0.2 count) compared with CONT training (1.2±0.2 vs. 1.8±0.1 count; P=0.04). Increased VO2peak correlated with decreased Annexin V+ CD105 endothelial MPs (r=−0.60, P=0.01). CONCLUSION: Exercise intensity decreases endothelial derived MPs through possibly a cardiovascular fitness related mechanism, independent of weight loss.
PURPOSE: Evidence shows humans who suffered poor nutrition during early postnatal life have altered cardiovascular development and increased likelihood for chronic disease during adulthood. Several studies have shown using an animal model that inadequate nutrient intake during early life causes changes in cardiomyocyte nucleation, maturation, and function. Protein expression differences as a result of early life undernutrition has yet to be studied and protein networks remain unidentified.

METHODS: All experiments were conducted according to IACUC at Michigan State University. FVB mouse dams were fed either a semi-purified diet (CON: 20% protein), or a low-protein (LP) isocaloric diet (PUN: 8% protein) beginning 1 week before mating. LP females produce 15-20% less milk than litters, pups were nursed by LP females experience a global nutrient deficit. Following birth, pups were reorganized to 8 pups/ female. After birth, day 1 (P1) until day 21 (P21) the PUN group survived to be weaned. Milk from females fed the LP diet, the CON group survived from females being fed the 20% protein diet. At P21 the hearts were collected from the CON and PUN mice and cardiac tissue was frozen in liquid nitrogen. Two-dimensional differential in-gel electrophoresis (2D DIGE) was a 2-step method of extracting proteins from the hearts of CON and PUN. Proteins are separated according to the electrochemical charge and weight. An ANOVA compared protein differences between diet (CON vs. PUN) and gender (male vs. female) using Decyder Protein identification software (standardized log abundance). RESULTS: 37 statistically significant proteins were identified from 2D DIGE. CON versus PUN proteins (134% greater abundance than CON) included polymeric I transcript receptor, Fetoan, and Ca2activated K. channels. CON over-expressed proteins included cyclin-dependent kinase inhibitor (114% greater abundance), and Alpha-1 type IV collagen (90% greater abundance). CONCLUSIONS: Identified proteins allow for a proposed mechanism that may explain the cellular change in the heart following undernutrition in early life and the associated increase for cardiovascular disease (CVD) in adulthood. Physical activity may serve as a positive countermeasure to contest the increased likelihood for CVD in adulthood.

Ischemia reperfusion (IR) induces increased serum MG53 level, and intravenous injection of rh-MG53 protein can ameliorate the damage from cardiac stress. However, the association between human serum MG53 level and cardiorespiratory function haven’t studied yet. PURPOSE: To investigate the association between the endogenous human serum MG53 level and cardiorespiratory function. METHODS: Sixteen healthy male volunteers (23.1±2.9 yrs, 169.5±6.0 cm in height, 53.2±5.4 ml/min/kg in VO2 peak) signed informed consent and participated in this study. Each individual performed two VO2 peak tests on cycle ergometer, and they had 7 wks of regular camp training between the two tests. Fasting blood samples were drawn before each VO2 peak test, and serum MG53 was measured by ELISA. RESULTS: Serum MG53 levels showed big difference among individuals, therefore, three levels of MG53 were divided, they are Low serum MG53 group (0.60±0.45 ng/ml) (L), Medium serum MG53 group (2.08±0.75 ng/ml) (M) and High serum MG53 group (4.23±1.80 ng/ml) (H). We found red blood cell count (RBC) (4.98±0.22 vs 4.65±0.31 *1012/L, p<0.01), hemoglobin (Hb) (155.3±7.6 vs 141.5±8.1 g/L, p<0.01), and hematocrit (HCT) (46.6±2.1% vs 43.1±2.6%, p<0.01) were higher in M than in L. Moreover, we found that ventilation threshold (VT) was higher in H than in L (47.5±6.5 vs 38.6±3.9 ml/min/kg, p<0.01) and higher than in M (47.5±6.5 vs 42.5±2.8 ml/min/kg, p<0.05). Similarly, we found that VO2 peak (46.5±3.1% vs 43.1±2.6%, p<0.01) were also higher in H than in L. Conclusion analysis demonstrated that VO2 peak (r=0.43, p<0.05), workload at VT (r=0.41, p<0.05), RBC (r=0.53, p<0.01), Hb (r=0.57, p<0.01) and HCT (r=0.47, p<0.01) are positively correlated with Serum MG53. CONCLUSIONS: It predicts that human serum MG53 level might be positively correlated with cardiorespiratory fitness. Supported by NSF Grant 31371205 and General Administration of Sport Grant 2011B006.
In the eukaryotic cells ATP synthesis is closely related to the structural and functional integrity of mitochondria. F0F1-ATP synthase participates in oxidative phosphorylation and ATP production. The effect of Prohibitin (PHB1) on mitochondrial function and F0F1-ATP synthase expression and activity is largely unclear. PURPOSE: To investigate the effect of PHB1 on the Oxygen Consumption Rate (OCR), oxidative stress (ROS) and ATP production in C2C12 cells. The influence of PHB1 on the content and activity of F0F1-ATPase was also examined. METHODS: The PHB1 overexpression and the RNA-interfered vector were inserted into the adenoviral vector by the phb1 overexpression sequence and the interfering sequence. Intracellular fluorescence distribution was detected by fluorescence inverse phase microscope. The efficiency of PHB1 transfection was determined by flow cytometry. The content of PHB1 was determined by Western blot. The expression of F0F1-ATPase activity was detected using a mitochondrial respiratory chain complex V activity kit. ATP content was detected by a kit. The changes of OCR were assessed by a XF cell mitochondrial stress detection kit. RESULTS: The complex V activity and the mRNA level of F0F1-ATPase were significantly increased in the PHB1 over-expression C2C12 cells. Compared with the control group, the activity of complex V in PHB1 overexpression group increased by 226% (p<0.01), whereas it was significantly decreased in PHB1 RNA-interfered cells. Cells with low PHB1 activity showed lower complex V activity (-95%, p<0.01), whereas ATP content, OCR were significantly increased in PHB1 over-expression cells. Compared with the control group, the ATP content of PHB1 over-expression group was increased by 80% (p<0.01), but it was decreased in the low-PHB1 RNA group (-21%, p<0.01). ROS production was lowered in PHB1 overexpression cells (-74%, p<0.01) compared with control, but it was increased in the low-PHB1 RNA cells (+104%, p<0.01). CONCLUSION: The over-expression of PHB1 can increase the content and activity of F0F1-ATP synthase, ATP production and improve energy metabolism in C2C12 cells. Over-expression of PHB1 can also reduce ROS production, suggesting that PHB1 may be involved in stabilizing mitochondrial structure. Supported by NSFC (No. 31470661).

**Table 1.** Prevalence of dynapenia in older-aged female adults with LSMM.

<table>
<thead>
<tr>
<th>LSMM criteria</th>
<th>Prevalence of LSMM</th>
<th>Prevalence of dynapenia</th>
<th>Odds ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALSTKG</td>
<td>60.75</td>
<td>84.62</td>
<td>5.5</td>
<td>2.2 to 13.6</td>
</tr>
<tr>
<td>ALST/BMI</td>
<td>38.32</td>
<td>90.24</td>
<td>6.4</td>
<td>2.0 to 20.1</td>
</tr>
<tr>
<td>ALST/HT</td>
<td>42.06</td>
<td>77.78</td>
<td>1.8</td>
<td>0.8 to 4.3</td>
</tr>
</tbody>
</table>

*p<0.05

**Purpose:** Frailty is a clinical syndrome associated with adverse health outcomes in older adults. Currently, there is a great need to identify interventions to prevent or delay the onset as well as decrease the burden of frailty symptoms. Identifying the onset of frailty is one of the first steps in developing effective interventions. Therefore, the purpose of this study was to determine the onset of frailty using the mouse frailty index.

**Methods:** Male C57BL/6J (n=52) were purchased at 12 months of age. At 14 months of age, the mice were subjected to a frailty assessment that included 5 criteria: loss of body weight, weakness (grip strength), slow walking speed (Rota-rod), low activity level (voluntary wheel running) and poor endurance (treadmill test). Mice repeated these tests every 3 months throughout their lifespan. The designated cutoff point for each frailty criterion was determined from data collected at 14 months of age and was set at 1.5 SD below the mean. If a mouse had three of the criteria scores below the cutoff points, the mouse was identified as frail, while a mouse with two criteria scores was identified as mildly frail.

**Results:** Prevalence of frailty increased across the lifespan of the mice, with 75% of the 35 month old mice identified as frail. The survival rate at 35 months of age was 25% of the original cohort. The onset of frailty occurred at 23 months of age (89.9%), strength (18.9%), endurance (51.1%), walking speed (31.4%), and activity levels (89.9%). A progression from mild frail to frail to mortality was observed; in that, mild frail mice at 17 months of age were frail by 23 months and died at 26 months.

**Conclusions:** Taken together, the onset of frailty occurs early in the lifespan and is associated with a negative outcome in mice. It provides the framework to develop interventions for preventing or delaying the frailty.

**Table 1.** Dynapenia in older-aged female adults with LSMM.

<table>
<thead>
<tr>
<th>LSMM criteria</th>
<th>Prevalence of LSMM</th>
<th>Prevalence of dynapenia</th>
<th>Odds ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALSTKG</td>
<td>60.75</td>
<td>84.62</td>
<td>5.5</td>
<td>2.2 to 13.6</td>
</tr>
<tr>
<td>ALST/BMI</td>
<td>38.32</td>
<td>90.24</td>
<td>6.4</td>
<td>2.0 to 20.1</td>
</tr>
<tr>
<td>ALST/HT</td>
<td>42.06</td>
<td>77.78</td>
<td>1.8</td>
<td>0.8 to 4.3</td>
</tr>
</tbody>
</table>

*p<0.05

**Purpose:** Synthesis Activity Of F0F1-atpase And Mitochondrial Integrity Of PHB1.

**Methods:** The oxygen consumption rate (OCR), oxidative stress (ROS) and ATP production in C2C12 cells were assessed. The changes of OCR were assessed by a XF cell mitochondrial stress detection kit. The complex V activity and the mRNA level of F0F1-ATPase were significantly increased in PHB1 overexpression cells. Compared with the control group, the ATP content of PHB1 over-expression group was increased by 80% (p<0.01), but it was decreased in the low-PHB1 RNA group (-21%, p<0.01). ROS production was lowered in PHB1 overexpression cells (-74%, p<0.01) compared with control, but it was increased in the low-PHB1 RNA cells (+104%, p<0.01). **Conclusion:** The over-expression of PHB1 can increase the content and activity of F0F1-ATP synthase, ATP production and improve energy metabolism in C2C12 cells. Over-expression of PHB1 can also reduce ROS production, suggesting that PHB1 may be involved in stabilizing mitochondrial structure. Supported by NSFC (No. 31470661).

**Table 1.** Dynapenia in older-aged female adults with LSMM.

<table>
<thead>
<tr>
<th>LSMM criteria</th>
<th>Prevalence of LSMM</th>
<th>Prevalence of dynapenia</th>
<th>Odds ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALSTKG</td>
<td>60.75</td>
<td>84.62</td>
<td>5.5</td>
<td>2.2 to 13.6</td>
</tr>
<tr>
<td>ALST/BMI</td>
<td>38.32</td>
<td>90.24</td>
<td>6.4</td>
<td>2.0 to 20.1</td>
</tr>
<tr>
<td>ALST/HT</td>
<td>42.06</td>
<td>77.78</td>
<td>1.8</td>
<td>0.8 to 4.3</td>
</tr>
</tbody>
</table>

*p<0.05

**Purpose:** Dynapenia And Low Skeletal Muscle Mass In Older-aged Women.

**Methods:** We evaluated 107 women aged 65 or more years from the western of Mexico. A whole body DXA scanning (Hologic QDR 4500) was performed to evaluate the body composition. The indicators and cut points used to diagnose LSMM were: 1) appendicular lean soft tissue absolute kilograms (ALSTKG) ≤15.02; 2) appendicular lean soft tissue corrected by body mass index (ALST/BMI) ≤0.51, both according to The Foundation for National Institutes of Health sarcopenia Project (FNHISP); and 3) appendicular lean soft tissue corrected by squared height (ALST/HT²) ≤5.45 as established by The European Working Group on Sarcopenia in Older People (EWGSOP). The criteria of dynapenia was a maximum isometric strength (MIS) of the hand and forearm muscles equal or lower the 20 kg evaluated by handheld dynamometry (Jamar Handgrip Dynamometer).

**Results:** Overall prevalence of dynapenia was 71.3%. The prevalences of LSMM and their respective prevalence of dynapenia are showed in Table 1. The probability for dynapenia was significant for women with LSMM defined by ALSTKG and ALST/BMI. No statistical probability was observed with ALST/HT². **Conclusions:** We observed a high prevalence in both loss of muscle mass and dynapenia in our sample. Prevalence of dynapenia is higher in women with LSMM defined by FNHISP criteria. Our findings suggest that several indicators should be taken in consideration in order to properly assess the impact of LSMM.
The magnitude of strength deficits during recovery from eccentric contraction-induced muscle injury is generally greater in old compared with adult mice. However, less is known about age-related differences in the progression of developed eccentric force deficits during the eccentric contraction bout. **Purpose:** To determine if there are age-related differences in the 1) peak isometric torque deficits immediately after 150 eccentric contractions and 2) developed eccentric torque during the course of 150 contractions.

**Methods:** Isometric tetanic torque output from anterior crucial muscles (tibialis anterior (TA) and extensor digitorum longus (EDL)) was measured before and immediately after a single bout of 150 eccentric contractions (from -19° ankle dorsiflexion to 19° plantarflexion at 2000°/s) in anesthetized female mice. Developed eccentric torque was measured during the 1st, 50th, 100th, and 150th contractions, and is determined by the difference in the initial eccentric peak and peak eccentric torques.

**Results:** Older female mice weighed more than adults (30.7 ± 1.4 vs 24.1 ± 0.4g), and were less at older compared with adults (6 months of age; n=10) and old (21 months of age; n=7) mice. Developed eccentric torque was measured during the 1st, 50th, 100th, and 150th contractions, and is determined by the difference in the initial eccentric peak and peak eccentric torques.

**Conclusion:** Compared with adults, older female mice experienced less isometric torque deficits during the injury than adult mice (aged 40.7 ± 1.1%; adult=46.6 ± 1.1%), but had similar developed eccentric contraction deficits after 50 (aged=25.3 ± 2.7%; adult=21.4 ± 3.0%), 100 (aged=26.6 ± 4.4%; adult=26.2 ± 2.8%) and 150 (aged=30.2 ± 4.6%; adult=30.8 ± 2.9%) contractions. The deficit in developed torque for the 150th eccentric contraction was significantly less than the isometric torque deficits after the injury for adults and old mice.

**Conclusion:** Compared with adults, older female mice experienced less isometric and similar eccentric torque deficits associated with a single bout of eccentric contractions.

**Purpose:** Aging is associated with a loss in skeletal muscle force producing capacity. However, there is evidence that old muscle is more resistant to fatiguing isometric muscle contractions than young muscle. It is unknown if age-related fatigue resistance occurs with eccentric contractions (lengthening contractions). The purpose of this study was to test the hypothesis that skeletal muscle of older adults is more resistant to fatigue induced by EC relative to muscle of young individuals. **METHODS:** 10 young (22.7 ± 2.25 yrs) and 8 physically active old (70.9 ± 7.5 yrs) subjects completed 30 sets of 10 repetitions on a Biodex dynamometer, and torque, power, and work were measured. Between sets, mice were given 10 reps, whereas human subjects were given a one minute rest period. **RESULTS:** There were no significant differences between young and old for anthropometric measures. Likewise, the total amount of functional work (young: 44.2 ± 1.31 vs old: 47.6 ± 1.06 kJ), average torque (young: 5048±13011 vs old: 5440±11507 N*m) and average power output (28105±6985 vs old: 30825±5405 watts) that was calculated during the bout of ECs was similar between groups. However, as hypothesized, the rate of functional decline (fatigue) was greater in the young relative to the old throughout the 30 sets of ECs for average work (p=0.038) and power output (p=0.024), but not average torque (p=0.63) as indicated by a group x time interaction. **CONCLUSIONS:** Consistent with other studies, we show that, contrary to isometric force production, eccentric force production is preserved in old muscle. Furthermore, older subjects demonstrated significantly greater fatigue resistance through the eccentric exercise session than did the young subjects. High-force EC may be an ideal exercise for maintaining muscle mass in older individuals given the higher force production, and preservation of functional capacity when compared to shortening contractions.

**At the cellular level, muscle provides a reservoir for body fluids to maintain fluid volume and blood pressure, so older adults may be at risk for hypocotension due to loss of muscle mass with age. ** **PURPOSE:** To evaluate lean mass, hydration, and postural blood pressure in adults ≥65 years of age. **METHODS:** Older men (n=17) and women (n=30) completed two measurements of lean mass and hydration using multi-frequency bioelectrical impedance, and postural blood pressure lying, sitting, and standing. Day 1 was mid-day in a euhydrated state. Day 2 was the next morning, within 30 minutes of waking, in a fasted state. All were grouped for analysis by lean mass relative to height, using Lean Mass Index cut points of low (women <14.9 kg/m²; men <18.7 kg/m²) and Normal (women ≥14.9 kg/m²; men ≥18.7 kg/m²). **RESULTS:** On Day 1, the Low group had lower relative lean mass (men 17.1 ± 0.4 vs. 20.2 ± 0.3 kg/m²; women 13.5 ± 0.2 vs. 16.5 ± 0.3 kg/m²; p < 0.001), absolute lean mass (men 55.7 ± 2.1 vs. 66.7 ± 1.8 kg; p < 0.001), hydration (total body water: men 44.9 ± 1.0 vs. 51.1 ± 1.0 L; women 30.3 ± 0.5 vs. 36.1 ± 0.6 L; p < 0.001), and fluid volume (extracellular water: men 19.0 ± 0.4 vs. 22.2 ± 0.5 L; women 14.4 ± 0.2 vs. 17.2 ± 0.3 L; p < 0.001) compared to the Normal group. Overnight (Day 2), both groups lost similar amounts of total body water (−0.83 ± 0.13 L; p < 0.001), extracellular water (−1.01 ± 0.42 L; p < 0.001), and the Low group preferentially lost more intravascular water (−1.0 ± 0.8 vs. −0.4 ± 0.7 L). During postural changes from lying to standing the Low group had greater drops in systolic blood pressure (Day 1: −1.8 ± 3 vs. −2.4 ± 2.7 mmHg; p < 0.001; Day 2: −1.6 ± 3.2 vs. −2.8 ± 3.3 mmHg; p < 0.001). By comparison, diastolic blood pressure was more stable and compensated for postural changes from lying to standing in the Normal group, but not in the Low group (Day 1: Low = 50 ± 2.7 vs. Normal = 67 ± 5.4 mmHg; p < 0.001; Day 2: Low = 3.5 ± 1.9 vs. Normal = 5.5 ± 1.6 mmHg; p < 0.01). **CONCLUSION:** Loss of muscle with age is accompanied by loss of hydration and fluid volume that manifests as lower and less stable blood pressure. In fact, the severe drop in systolic blood pressure observed on Day 2 in the Low group approximates the criteria for diagnosis of orthostatic hypotension. Based on these data, loss of muscle increases risk for postural hypotension in older men and women.
**TABLE 1: BMD by Sport Type**

<table>
<thead>
<tr>
<th>Sport</th>
<th>Femoral Neck (g/cm²)</th>
<th>Greater Trochanter (g/cm²)</th>
<th>Total Femur (g/cm²)</th>
<th>Lumbar Spine (g/cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hockey</td>
<td>1.0 (±0.13)</td>
<td>1.04 (±0.11)</td>
<td>1.01 (±0.13)</td>
<td>0.83 (±0.11)</td>
</tr>
<tr>
<td>Ballet</td>
<td>1.14 (±0.78)</td>
<td>1.17 (±0.15)</td>
<td>1.06 (±0.13)</td>
<td>0.80 (±0.10)</td>
</tr>
<tr>
<td>Cheerleading</td>
<td>1.17 (±0.14)</td>
<td>1.04 (±0.10)</td>
<td>1.04 (±0.10)</td>
<td>1.14 (±0.10)</td>
</tr>
<tr>
<td>Synchronized Swimming</td>
<td>1.06 (±0.13)</td>
<td>1.04 (±0.10)</td>
<td>1.04 (±0.10)</td>
<td>1.17 (±0.15)</td>
</tr>
</tbody>
</table>

**PURPOSE:** The aim of the study was to investigate the association of serum irisin concentrations with bone strength in Korean adults.

**METHODS:** We evaluated the osteoporotic and sarcopenic risk factors and circulating irisin levels of 472 adults (307 women) aged 19-89 years. Bone status was assessed using a calcaneal quantitative ultrasound method. Appendicular lean mass (ALM) was measured by bioelectrical impedance analysis and muscle function was evaluated by handgrip strength (HS) test. Serum irisin level was measured with ELISA methods. Sarcopenia and pre-sarcopenia were determined by the presence of muscle atrophy (ALM/height < 7.0 kg/m² in men, and < 5.7 kg/m² in women) and/or weakness (HS < 26 kg in men and < 18 kg in women), respectively. Subjects were classified into four groups according to sex and quartiles of irisin levels.

**RESULTS:** As expected, the prevalence of those with sarcopenia tended to increase in the lowest quartile of irisin, whereas bone stiffness index (BSI) was significantly higher in the highest quartile of circulating irisin compared to the lowest one (93.6 ± 16.9 vs 81.7 ± 13.9 in men and 79.7 ± 18.1 vs. 71.6 ± 13.3, all for p < 0.05). Moreover, serum irisin levels had positive linear correlation with BSI in both sexes (r = 0.1441 and r = 0.1438 in men and r = 0.1438 in women, all for p < 0.05).

**CONCLUSIONS:** Our results suggest that circulating irisin is associated with bone strength as well as sarcopenia in Korean subjects. Further investigations are needed to clarify the role of irisin as a mediator of bone-muscle unit.

**PURPOSE:** To assess if menstrual resumption or weight gain contributed to improved bone metabolism during a nutrition intervention in amenorrheic exercising women.

**METHODS:** Amenorrheic exercising women (n=27, 18-25 yr) were recruited for a 12mo intervention to assess the impact of increased caloric intake on menstrual and bone health. Body weight and serum markers of bone formation (PINP) and resorption (CTX) were measured at baseline (BL) and the time of menstrual resumption (MoM) or study completion if participants did not resume menses (n=12, range 5-49 wks) (post). Bone balance (BB) at BL and post was calculated as the multiple of median of formation [MoMr=[PINP]/[CTX]] and resorption [MoMf=[CTX]/[PINP]] with an ovulatory control group serving as the reference (OV). Two-way ANOVA determined if change in MoMf, MoMr, and BB were related to menstrual resumption or weight gain. Women were classified as gaining ≥1 kg (Wt+ or Wt+ and increasing in Wt+ experienced increased BB (1.03 to 1.23) whereas women in Wt- experienced decreased BB (1.16 to 0.97). There was an interaction effect of resumption and weight on MoMf (p=0.027), such that the largest decrease in MoMf (1.4 to 1.1) occurred in Wt+ women in Wt+ experienced increased BB (1.03 to 1.23) whereas women in Wt- experienced decreased BB (1.16 to 0.97). There was an interaction effect of resumption and weight on MoMr (p=0.007), indicating that women in Wt+ experienced increased BB (1.03 to 1.23) whereas women in Wt- experienced decreased BB (1.16 to 0.97). There was an interaction effect of resumption and weight on BB (p=0.007), such that the largest decrease in BB (1.03 to 1.23) occurred in Wt+ women in Wt+ experienced increased BB (1.03 to 1.23) whereas women in Wt- experienced decreased BB (1.16 to 0.97). There was a main effect of weight on BB change (p=0.007), indicating that women in Wt+ experienced increased BB (1.03 to 1.23) whereas women in Wt- experienced decreased BB (1.16 to 0.97). There was an interaction effect of resumption and weight on MOMr (p=0.027), such that the lowest decrease in MOMr (1.4 to 1.1) occurred in Wt+ women in Wt+ experienced increased BB (1.03 to 1.23) whereas women in Wt- experienced decreased BB (1.16 to 0.97). There was a main effect of weight on BB change (p=0.007), indicating that women in Wt+ experienced increased BB (1.03 to 1.23) whereas women in Wt- experienced decreased BB (1.16 to 0.97). There was an interaction effect of resumption and weight on BB (p=0.007), such that the largest decrease in BB (1.03 to 1.23) occurred in Wt+ women in Wt+ experienced increased BB (1.03 to 1.23) whereas women in Wt- experienced decreased BB (1.16 to 0.97). There was a main effect of weight on BB change (p=0.007), indicating that women in Wt+ experienced increased BB (1.03 to 1.23) whereas women in Wt- experienced decreased BB (1.16 to 0.97). There was an interaction effect of resumption and weight on BB (p=0.007), such that the largest decrease in BB (1.03 to 1.23) occurred in Wt+ women in Wt+ experienced increased BB (1.03 to 1.23) whereas women in Wt- experienced decreased BB (1.16 to 0.97). There was a main effect of weight on BB change (p=0.007), indicating that women in Wt+ experienced increased BB (1.03 to 1.23) whereas women in Wt- experienced decreased BB (1.16 to 0.97). There was an interaction effect of resumption and weight on BB (p=0.007), such that the largest decrease in BB (1.03 to 1.23) occurred in Wt+ women in Wt+ experienced increased BB (1.03 to 1.23) whereas women in Wt- experienced decreased BB (1.16 to 0.97). There was a main effect of weight on BB change (p=0.007), indicating that women in Wt+ experienced increased BB (1.03 to 1.23) whereas women in Wt- experienced decreased BB (1.16 to 0.97). There was an interaction effect of resumption and weight on BB (p=0.007), such that the largest decrease in BB (1.03 to 1.23) occurred in Wt+ women in Wt+ experienced increased BB (1.03 to 1.23) whereas women in Wt- experienced decreased BB (1.16 to 0.97). There was a main effect of weight on BB change (p=0.007), indicating that women in Wt+ experienced increased BB (1.03 to 1.23) whereas women in Wt- experienced decreased BB (1.16 to 0.97). There was an interaction effect of resumption and weight on BB (p=0.007), such that the largest decrease in BB (1.03 to 1.23) occurred in Wt+ women in Wt+ experienced increased BB (1.03 to 1.23) whereas women in Wt- experienced decreased BB (1.16 to 0.97). There was a main effect of weight on BB change (p=0.007), indicating that women in Wt+ experienced increased BB (1.03 to 1.23) whereas women in Wt- experienced decreased BB (1.16 to 0.97). There was an interaction effect of resumption and weight on BB (p=0.007), such that the largest decrease in BB (1.03 to 1.23) occurred in Wt+ women in Wt+ experienced increased BB (1.03 to 1.23) whereas women in Wt- experienced decreased BB (1.16 to 0.97). There was a main effect of weight on BB change (p=0.007), indicating that women in Wt+ experienced increased BB (1.03 to 1.23) whereas women in Wt- experienced decreased BB (1.16 to 0.97). There was an interaction effect of resumption and weight on BB (p=0.007), such that the largest decrease in BB (1.03 to 1.23) occurred in Wt+ women in Wt+ experienced increased BB (1.03 to 1.23) whereas women in Wt- experienced decreased BB (1.16 to 0.97).
samples were collected before, immediately after, and 90 min after exercise and were analyzed for serum levels of RANKL pathway (RANKL, OPG), cytokines (IL-6; Interleukin-6) and bone turnover markers (osteocalcin, CTx; collagen type 1 cross-linked C-telopeptide, Vitamin D).

RESULTS: As a result, there was no significant time x group interaction effect for RANKL pathway, cytokines, and bone turnover markers (N.S.). A significant time effect was observed for TNF-a (F=26.185, p<.001) but, post-hoc analysis showed no significant effect of the group effect (F=2.522, p=0.066) but, post-hoc analysis showed no significant effects. However, significant correlation was found among RANKL pathway, cytokines, and bone turnover markers. It was found that TNF-a had a positive correlations with RANKL (r=0.685, p<.000) and OPG (r=0.244, p<.021). In addition, study shows that Vitamin D had a negative correlation with RANKL (r=-0.323, p<.004) and OPG (r=-0.278, p<.008), and had a positive correlation with TNF-a (r=0.235, p<.036).

CONCLUSIONS: This results suggest that a single bout of exercise used in current study may not enough to induce changes in RANKL pathway, cytokines, and bone turnover markers in 20s women with maximal bone mass. We also found that TNF-a and vitamin D have positive and negative relationship with RANKL and OPG respectively. Supported by NRF Grant 2015S1A5A2A0101501.

224 Board #64 May 30 11:00 AM - 12:30 PM
Influences Of Alcohol Consumption, Physical Activity, And Body Composition On Areal Bone Mineral Density In Korean College-aged Female Students

SoJung Kim1, DongJun Sung1, JaeWoong Gu2, SeungBum Oh3.
1University of Massachusetts, Lowell, MA. 2Konkuk University, Chung-Ju, Korea, Republic of.

(Please list all authors properly)

PURPOSE: The purpose of this study was to investigate the most important factor among alcohol consumption, physical activity, and body composition that affect aBMD in healthy college-aged female students. METHODS: One hundred thirteen college females (21.9 ± 1.8 years, 161.8 ± 5.2 cm, 53.2 ± 6.0 kg) were recruited from the Universities in Seoul and Gyeonggi areas, South Korea. The aBMD of L1-L4 and non-dominant side of proximal femur (TH, total hip, FN, femoral neck) were measured using Dual Energy X-ray Absorptiometry. The alcohol consumption was determined by the frequency and amount of alcohol intake during the past 12 months using self-reported questionnaires (less than once per month, n=45; 2-4 times per month, n=53; 2-3 times per week, n=15). The total bone-specific physical activity (IBPAQ, average of past and current BPAQ) score was used to obtain a comprehensive account of lifetime physical activity related to bone health. A qualified research analyzed all values using an online BPAQ calculator (www.fitindexsign.com/BPAQ/). The X-scan plus II (Hospital body Composition Analyzer, Jawon Medical Korea) was used to measure height (cm), weight (kg), fat free mass (FFM, kg), and % body fat. RESULTS: Spearman’s correlation showed no significant relationships between the frequency of alcohol intake and aBMD of L1-L4 and TH and FN at non-dominant side of femur (p<0.05). But there were positive correlations between FFM and aBMD of L1-L4 (r=0.410, p<0.001) and FN (r=0.395, p<0.001). Also, positive relationships were found between %body fat and aBMD of L1-L4 (r=0.205, p<0.05), TH (r=0.302, p<0.01) and FN (r=0.282, p<0.01). The IBPAQ scores were positively related to aBMD of TH (r=0.299, p<0.01) and FN (r=0.292, p<0.01), but not found in L1-L4 (p>0.05). CONCLUSION: The most positive influential factor affecting healthy aBMD was FFM in college-aged female students, compared to %body fat and IBPAQ. Our study found that alcohol consumption did not affect aBMD variables and further studies are needed to determine its relations to aBMD in this population. Our findings suggest that maintaining healthy body composition would be the key for healthy bones in young college-aged females.

225 Board #65 May 30 11:00 AM - 12:30 PM
Sex-specific Mediation Of Physical Activity’s Effects On The Muscle-bone Unit In Active Young Adults.

Simon Higgins1, Chester M. Sokolowski2, Megha Vishwanathan3, Jessica G. Anderson1, Michael D. Schmidt1, Ellen M. Evans, FACSM2, Richard D. Lewis, FACSM3; 1Elon University, Elon, NC. 2University of Georgia, Athens, GA.

(Please list all authors properly)

Moderate-to-vigorous intensity physical activity (MVPA) promotes bone mineral accrual on periosteal surfaces. These adaptations are thought to largely result from mechanical forces applied to bones by contracting muscles. PURPOSE: To understand the pathway through which mechanical forces optimize cortical bone, we sought to identify the serial multiple mediation pathway through which measures of muscle mass and force interact with cortical bone during MVPA, in sex-specific models. METHODS: Time performed MVPA was assessed in aT-tests performed in young adults (n=147, 19.7 ± 7.0 yr, 52.4% female) using an Actigraph GT3X+ accelerometer. Cortical diaphyseal bone was assessed via peripheral quantitative computed tomography at the mid-tibia. Muscular strength of the knee extensors via Biodex isokinetic dynamometry was used to represent the mechanical forces applied to the tibia and thigh lean mass was assessed via dual-energy x-ray absorptiometry. RESULTS: Time performed recommended levels of MVPA (89.1 ± 27.29 minutes/day), with males performing 40.9% more vigorous intensity activity relative to females (p<0.05). Males absolute knee extension force, force relative to lean mass, and thigh lean mass were greater than females (59.9%, 16.1%, and 37.0%, respectively, all p<0.05). In combined-sex models, controlling for tibia length and age, the effect of MVPA on strength strain index (SSI) was completely mediated through two discrete pathways: 1) thigh lean mass (Coef. = 1.11, LCLI .48, UCLI 1.96), and 2) thigh lean mass and knee extensor force in sequence (Coef. = .26, LCLI .08, UCLI .65). However, in sex-specific models the effect of MVPA on pSSI was mediated through thigh lean mass in females (Coef. = .95, LCLI .18, UCLI 2.18) and knee extensor force in males (Coef. = .78, LCLI .04, UCLI 2.02). Bootstrapped confidence intervals confirmed the ratio (sex x MVPA) for these mediation pathways for measures of cortical structure but not density. CONCLUSION: The effect of MVPA on cortical structure in young adults appears to be mediated through a muscle mass, potentially paracrine, pathway, as well as through mechanical forces. Sex-specific pathways suggest that muscle force is influential in males but not females. These findings highlight potentially novel avenues for the sex-specific promotion of bone accrual.

226 Board #67 May 30 11:00 AM - 12:30 PM
Bone Mineral Content/Density And Muscle Strength In Young Women From Different Racial/Ethnic Backgrounds - A Pilot Study

JAPNEET KAUR, EDUARDO D.S. FREITAS, RYAN M. MILLER, AARON D. HEISHMAN, DEBRA A. BEMBEN, FACSMB, MICHAEL G. BEMBEN, FACS M. UNIVERSITY OF OKLAHOMA, NORMAN, OK. (Sponsor: MICHAEL G. BEMBEN, FACS M.)

(Please list all authors properly)

Race/ethnicity is a major factor influencing both bone mass and muscle mass (bone free lean mass - BFLM) since muscular forces can enhance bone strength by applying mechanical stress to the skeleton. PURPOSE: To examine group mean differences and the relationships between bone mineral content (BMC) and density (BMD) to BFLM and muscle strength in young women from different racial/ethnic backgrounds. METHODS: Twenty-seven young women aged 18-30 years self-identified themselves as Caucasian (n=6), South-Asian (n=5), East-Asian (n=4), Hispanic (n=6), and African-American (n=5). Body composition (fat, BFLM, and BMC) and total and regional BMD were measured using Dual Energy X-Ray Absorptiometry, while jump test, leg press, and bilateral isokinetic strength testing of knee flexors/extensors were used to quantify lower limb muscle strength and power. International Physical Activity Questionnaire (IPAQ) classified women into low, moderate or high levels of physical activity. Ethnic differences in each outcome variable were determined using one-way ANOVA, while Pearson correlation coefficients quantified relationships between variables. Statistical significance was set at p<.05. Results: Based on the entire sample (n=27), both total body BMD and BMC had significant positive relationships with total BFLM (r=0.78 and 0.87 respectively). Based on ethnicity, AA women had significantly higher total body and hip (left and right) BMC than His. Although non-significant, total BFLM values were highest for AA and lowest for EA and SA (47.7±9.6 kg vs. 37.9±5.5 kg and 37.8±5.5 kg respectively, p<0.09). Analysis of the entire sample also showed a significant positive relationship between MET minutes/week and total BFLM (r=0.45). As per IPAQ scores, highly active women had significantly lower percent body fat compared to moderately active women (26% ± 6% vs. 38% ± 7%; p<0.01). Finally, average muscular power (watts; W) during flexion at 60 deg/sec was significantly higher for Cau compared to EA and SA (54.98±18.74 W vs. 30.76±7.6 W and 27.7±9.0 W respectively; p<.01). Conclusion: These findings suggest that BMC and BMD are significantly related to total BFLM, and that BMC varies across the ethnic groups, however, further data collection and analyses will validate the current findings.

227 Board #68 May 30 11:00 AM - 12:30 PM
Gender Differences in Mechanical Properties of the Achilles Tendon: Longitudinal Response to Heavy Loading Exercise


(Please list all authors properly)

Gender differences have been observed in the mechanical properties of the Achilles tendon, helping to explain the increased risk of injury in males. However, the response and recovery of tendon mechanics to heavy loading exercise, as well as gender dependent responses, are not well understood. PURPOSE: Compare Achilles tendon mechanical properties between males and females prior to, immediately after, and 60-minutes following a heavy loading exercise. METHODS: 17 female (age: 24.0 ± 3.9 yrs; height: 167.4 ± 6.9cm; mass: 64.9 ± 8.5kg) and 18 male (age: 23.9 ± 1.5 yrs; height: 176.4 ± 6.4cm; mass: 77.7 ± 7.9kg).
Anterior Cruciate Ligament (ACL) tear is major concern in soccer. Although ACL reconstruction and its postoperative rehabilitation are successfully performed, knee instability and neuromuscular control deficits are often prevalent at the time of return to play process. **PURPOSE:** To investigate effect of postoperative rehabilitation protocol on postural control (PC) changes in three time points following ACL reconstruction in male soccer players. **METHODS:** National level male soccer players (n = 16, age 24.7±3.9 years) volunteered in the study. Players performed postoperative rehabilitation protocol that had emphasis on enhancing postural stability (PS), muscular strength, and limb symmetry 6 times per week for 23 weeks. Static pressure measurements were obtained on a platform Footscan (RSscan International, Belgium). The following tests of PS were taken: bilateral narrow standing position (BS) with 2 levels of vision (eyes open and closed) for 30 seconds and single leg standing (SS) position test on injured and non-injured leg for 60 seconds. The tests were performed: (a) postoperatively, before rehabilitative intervention, five months (b), and 10 months (c) following ACL reconstruction. Mixed design RM ANOVA, Bonferroni’s post hoc tests and partial eta squared (ηp2) were used for statistical assessment. **RESULTS:** The main factor (Time) revealed significant effect on PS both for BS (F2,60 = 56.39, p<0.01, ηp2 = 0.65) and SS (F2,60 = 40.37, p<0.01, ηp2 = 0.57). Post-hoc test revealed significant improvement of PC improvement after intervention (BSa = 151.34±8.41 mm, BSb = 127.00±6.56 mm, p<0.01) as well as follow-up effect (BSB = 127.00±6.56 mm, p<0.01) and follow-up effect (BSB = 127.00±6.56 mm, p<0.01). We found a significant interaction effect between observed factors (Time*Leg) within observed time (F2,60 = 24.81, p<0.01, ηp2 = 0.45). Participants significantly improved PC on injured leg (SSa = 1748.63±78.81 mm, SSb = 1281.75±62.70 mm, p<0.01); however, postural control SSb was non-significant compared to SSC (p>0.05). **CONCLUSION:** The postoperative rehabilitation protocol demonstrated favorable PC improvements following ACL reconstruction in elite male soccer players. Also, our findings indicated importance of continuous rehabilitation after 5 months following ACL reconstruction in order to eliminate asymmetry in PC.

**A-45 Free Communication/Poster - Anterior Cruciate Ligament Injury**

**Wednesday, May 30, 2018: 7:30 AM - 12:30 PM**

**Room: CC-Hall B**

- **Board #69**
  - **May 30 11:00 AM - 12:30 PM**
  - **Neuromuscular Changes During Return To Play After ACL Surgery In Elite Soccer Players**
  - Frantisek Zahalka, Tomáš Malý, Dalí Sugimoto, Lucía Malá, Lea Cibell, Arnold Baca, Charles University, Prague, Czech Republic. *Boston Children’s Hospital, Boston, MA.*
  - *200 Board #1**
  - **May 30 11:00 AM - 12:30 PM**
  - **Interlimb Asymmetries Post ACL Reconstruction During Drifting**
  - Jamie Kronenberg1, Nicole Veltri1, Danielle Pasquale1, Joshua M. Tomé1, Patrick McKeon1, Kathy J. Simpson1, Rumit S. Kakkar1. *Ithaca College, Ithaca, NY.*
  - University of Georgia, Athens, GA.

**Purpose:** ACL reconstruction (ACLR) after a complete ACL tear is aimed at restoration of the mechanics of the limb. After reconstruction, neuromuscular mechanics of the lower extremities (LE) may change asymmetrically. Since the ACL is comprised of inert tissue, it has lower adaptability under stress. Abnormal force distribution between the LE joints of ACLR can increase the risk for a secondary tear while running. The purpose of this study is to use 2-Dimensional (2D) motion analysis to assess limb asymmetries in individuals with ACLR during sprints. **Methods:** 6 ACLR (4 females, 2 males, age 19-24, 1.5 yrs post-surgery) & 6 BMI-matched controls (MC) participated. Participants ran at a maximum (MAX) self-selected speed/sprint for 30s on a treadmill. 2D data were recorded via Apple iPads and analyzed via Kinovea® for max joint angular displacements (AsgDisp: max flexion to extension) at the hip, knee and ankle in the sagittal plane. AngDisp were compared between groups using Kruskal-Wallis H Test. Limb symmetry indices (LSI) were calculated (Involved/Hip gait length). To determine the differences in quadriceps function between impulsive and non-impulsive loaders during walking gait. **Methods:** Forty-five volunteers with unilateral ACLR participated in this study (32F, 20±3 years old, 71±19 kg, 1.7±0.1 m, 23±15 range [7.5-9.8] months post-ACLR). **Results:** 31% of the subjects were identified as Impulsive loaders. However, there were no significant differences in Impulsive and Normal loaders for RTDmed (0.41±0.46 vs. 0.42±0.44, p>0.06), RTDpeak (2.5±1.9 vs. 2.6±1.6, p>0.06). There were no significant differences in terms with an anterior cruciate ligament injury. **Conclusion:** Roughly 1/3 of our subjects were identified as Impulsive loaders. This statistic mirrors the risk of knee OA development (~30%) in the first decade following ACLR. Our data suggest that this relationship is not associated with quadriceps function. Future research is necessary to determine the role of the HST in knee OA development and the factors that contribute to its presence.
Evidence exists of the semitendinosus tendon (ST) physically regenerating following harvest for ACL reconstruction. However, the quality of regenerated tissue, indicated by elastic modulus, is not well understood. The time-dependency of this regeneration is also important post-ACL reconstruction as the hamstring muscle group is inherently protective of the ACL. PURPOSE: Assess the quality of ST regeneration, as measured with shear modulus, as a function of time post-ACL reconstruction with comparisons to healthy controls. METHODS: Ultrasound Shear Wave Elastography determined shear modulus of the ST tendon on 10 ACL reconstructed individuals (age: 21.61 ± 1.6 years, height: 171.68 ± 5.2 cm, mass: 71.47 ± 1.1 kg, Tegner scale: 5.91 ± 0.1) and 10 healthy individuals (age: 20.62 ± 2.0 years old, height: 173.4 ± 9.3 cm, mass: 71.61 ± 13.8 kg, Tegner scale: 5.61 ± 1.1). Time since ST harvest averaged 4.3 years (range: 0.75 – 12.6 years) and all individuals were cleared to return to full activity by their physician. While prone with the knee at full extension and relaxed, three ultrasound images (AIXPLORER, Supersonic Imagine S.A., France) were acquired of the distal ST tendon. Linear correlation was used to assess the relationship between quadriceps LSIs and KFM and GRF LSIs. Spearman rho was used to examine the relationship between quadriceps LSIs and KFA LSIs. Paired samples t-tests were used to compare dependent variables between limbs (α=0.05).

RESULTS: Isometric strength LSI (r=0.30, p=0.05) and RTD LSI (r=0.37, p=0.01) were associated with KFM LSI. Isometric strength LSI (r=0.34, p=0.02) and isokinetic strength LSI at 60° (r=0.40, p=0.01) and 180° (r=0.31, p=0.05) were associated with knee flexion excursion LSI. Isometric strength at 180° (r=0.39, p=0.01) was associated with GRF LSIs. Uninvolved limbs had greater GRF (2.48 ± 0.77 vs. 2.23 ± 0.69 BW, p=0.034) and KFM (0.17 ± 0.04 vs. 0.14 ± 0.04 %BW*height, p<0.001) compared to involved limbs. CONCLUSIONS: ACLR limbs had smaller GRF and KFM compared to uninvolved limbs. This may indicate a compensatory strategy to underload the involved limb during landing. The weak correlations between quadriceps strength LSIs and LSI included may indicate that critical factors such as impaired neuromuscular control play a role in re-injury influence landing symmetry.

Evidence of the semitendinosus tendon (ST) physically regenerating following harvest for ACL reconstruction. However, the quality of regenerated tissue, indicated by elastic modulus, is not well understood. The time-dependency of this regeneration is also important post-ACL reconstruction as the hamstring muscle group is inherently protective of the ACL. PURPOSE: Assess the quality of ST regeneration, as measured with shear modulus, as a function of time post-ACL reconstruction with comparisons to healthy controls. METHODS: Ultrasound Shear Wave Elastography determined shear modulus of the ST tendon on 10 ACL reconstructed individuals (age: 21.61 ± 1.6 years, height: 171.68 ± 5.2 cm, mass: 71.47 ± 1.1 kg, Tegner scale: 5.91 ± 0.1) and 10 healthy individuals (age: 20.62 ± 2.0 years old, height: 173.4 ± 9.3 cm, mass: 71.61 ± 13.8 kg, Tegner scale: 5.61 ± 1.1). Time since ST harvest averaged 4.3 years (range: 0.75 – 12.6 years) and all individuals were cleared to return to full activity by their physician. While prone with the knee at full extension and relaxed, three ultrasound images (AIXPLORER, Supersonic Imagine S.A., France) were acquired of the distal ST tendon. Linear correlation was used to assess the relationship between quadriceps LSIs and KFM and GRF LSIs. Spearman rho was used to examine the relationship between quadriceps LSIs and KFA LSIs. Paired samples t-tests were used to compare dependent variables between limbs (α=0.05).

RESULTS: Isometric strength LSI (r=0.30, p=0.05) and RTD LSI (r=0.37, p=0.01) were associated with KFM LSI. Isometric strength LSI (r=0.34, p=0.02) and isokinetic strength LSI at 60° (r=0.40, p=0.01) and 180° (r=0.31, p=0.05) were associated with knee flexion excursion LSI. Isometric strength at 180° (r=0.39, p=0.01) was associated with GRF LSIs. Uninvolved limbs had greater GRF (2.48 ± 0.77 vs. 2.23 ± 0.69 BW, p=0.034) and KFM (0.17 ± 0.04 vs. 0.14 ± 0.04 %BW*height, p<0.001) compared to involved limbs. CONCLUSIONS: ACLR limbs had smaller GRF and KFM compared to uninvolved limbs. This may indicate a compensatory strategy to underload the involved limb during landing. The weak correlations between quadriceps strength LSIs and LSI included may indicate that critical factors such as impaired neuromuscular control play a role in re-injury influence landing symmetry.
and decreased peak pressure (F_{pum} = 20.98, p < 0.001). Also, a significant main effect for group (regardless of landing) for gastrocnemius muscle was found showing that the ACL group landed with reduced gastrocnemius activity (F_{pum} = 11.27, p < 0.002).

**CONCLUSION:** Unplanned landing showed greater injury predisposing factors compared with planned landing. The ACL group showed nearly similar landing biomechanics to the control group during both landing tasks. However, the ACL group used a protective landing strategy by reducing gastrocnemius activity.

**Optimal mechanical loading is necessary to decrease the risk of posttraumatic osteoarthritis (PTOA) following anterior cruciate ligament reconstruction (ACLR) and lesser mechanical loading early following ACLR may increase the risk for PTOA onset. T1ρ magnetic resonance imaging (MRI) has been used to measure cartilage composition at early time points following ACLR.**

**PURPOSE:** To determine the association between proteoglycan density of femoral cortex derived from T1ρ MRI relaxation times and instantaneous vGRF loading rate (vGRF-LR) during walking gait 6 months following ACLR.

**METHODS:** Twenty-nine individuals (52% female, BMI = 24±3 kg/m^2) underwent magnetic resonance imaging (MRI) after ACLR. MRI was performed using a 3T MRI scanner. The knee was positioned at 90° flexion with the subject in the supine position. Following magnetization, a single-shot spine-echo sequence was acquired in the sagittal plane with a flip angle of 180°. The sequence was repeated 20 times, with an inter-repetition interval of 4.4 sec. The MRI images were processed using the MRtrix3 software package. The weight bearing MFC and LFC cartilage was manually segmented into posterior, central, and anterior regions of interest (ROI) based on the location of the meniscus in the sagittal plane. Affine and deformable registration techniques were used to register the ACLR limb to the uninjured limb. Inter-limb mean T1ρ relaxation time ratios (RTR = ACLR limb / uninjured limb) were calculated for each ROI. Separate, stepwise linear regressions were used to determine the unique associations between vGRF outcomes and T1ρ RTR in each ROI after accounting for walking speed and meniscal injury (AR (\text{ΔR}) P<0.05).

**RESULTS:** In the ACLR limb, lesser vGRF during gait was associated with lesser proteoglycan density in the posterior region (AR (\text{ΔR}) P<0.02) and central LFC (AR (\text{ΔR}) P<0.02), as well as the posterior (AR (\text{ΔR}) P=0.05) and central MFC (AR (\text{ΔR}) P=0.01), vGRF-LR in the ACLR limb and all vGRF outcomes in the contralateral limb did not significantly associate with T1ρ RTR for any ROI.

**CONCLUSIONS:** Individuals with lesser vGRF in the ACLR limb presented with lesser T1ρ relaxation times. Individuals with lesser vGRF in the ACLR limb presented with lesser T1ρ relaxation times. This may indicate a protective strategy for reducing the risk of PTOA in the ACLR limb. One of the repercussions of an ACL tear and subsequent reconstruction (ACLR) is a period of protracted quadriceps muscle weakness. While total force output is an important measure, the quality of this force, represented by quadriceps force steadiness (QFS), has been rarely investigated. Steadier force production implies smaller and/or less frequent force fluctuations, which may signal better control and efficiency. Additionally, QFS studies have centered on submaximal contractions. While this is valuable, athletes need to be able to safely and efficiently load the knee during maximal effort situations such as jumping and cutting.

**Purpose:** To quantify the degree of asymmetrical QFS and strength between healthy and ACLR limbs during maximum voluntary isometric contractions (MVIC).

**Methods:** Seventy-two subjects who had an ACLR (38F, 20.2 ± 5.9 years old) underwent isometric strength testing six months post-surgery. Each subject completed five quadriceps MVIC’s for five seconds each on both legs. The torque-time curves were analyzed using MATLAB code. In order to quantify the steadiness, the plateau region of the torque-time curve was first extracted utilizing force derivative cutoffs to define the outer boundaries. A 2nd order polynomial was fit onto the extracted curve to represent an “ideal” force output response (uniform concavity) that was consistent but subject-specific. The outcome variable (error from the “ideal” curve) was normalized to the force magnitude at each point (discrete normalization) and expressed as a percentage. A paired two sample t-test was used to assess differences between limbs (p<0.05).

**Results:** There was a significant difference in both QFS and mean strength between the ACLR and non-reconstructed limb respectively at 0.91 ± 0.31% and 0.73 ± 0.31% (p<0.001), as well as mean torque of 114.4 ± 41.8 Nm and 194.4 ± 56.3 Nm (41% deficit, respectively) (p<0.001). The results show a significant disparity in an ACLR knee in both quadriceps strength and QFS in comparison to a healthy knee. The lack of steadiness is a result of more frequent and/or higher magnitude force fluctuations over the loading phase. We speculate that these fluctuations results in a hindered ability to control the quadriceps which may lead to an increased injury risk and decreased performance.

**Conclusion:** The results show a significant disparity in an ACLR knee in both quadriceps strength and QFS in comparison to a healthy knee. The lack of steadiness is a result of more frequent and/or higher magnitude force fluctuations over the loading phase. We speculate that these fluctuations results in a hindered ability to control the quadriceps which may lead to an increased injury risk and decreased performance.
Changes in cortical activity are hypothesized to be related to the high incidence of ACL re-ruptures. Presumably, these differences are a result of the loss of somatosensory signals of the ligament and changes in nociceptor activity due to pain and swelling.

**PURPOSE:** To investigate the differences in electrocortical activity between patients with an ACL-reconstruction and healthy controls.

**METHODS:** 12 patients one year post ACL-reconstruction and 12 healthy controls were compared during the execution of functional hop tests and a force-reproduction task (without visual feedback and with visual disruption) at biomechanical function (force reproduction and EMG (Root-Mean-Square)) and electrocortical activity using a EEG power analysis (Alpha-1, Alpha-2, Beta-1 and Theta activity frequency bands were determined). Between-group differences and differences between the study condition without visual feedback and the study condition with visual disruption were examined.

**RESULTS:** No differences in functional outcomes and biomechanical function (p>0.194) exist between ACL-reconstructed patients and healthy controls. However, ACL reconstructed patients showed a significant higher Theta-power in the parietal cortex (p<0.038) and pre-frontal cortex (FS, p=0.038) compared to healthy controls during force reproduction without visual feedback. Visual disruption leads to higher power values at Fz (Alpha-1: p=0.050, Beta-1: p=0.010, Theta: p=0.050), F8 (Beta-1: p=0.034), P3 (Alpha-1: p=0.002, Theta: p=0.034), P4 (Alpha-2: p=0.041, Beta-1: p=0.019) and P7 (Alpha-2: p=0.006) in the healthy control group, while in the ACL reconstructed group only Alpha-2 power at T4 was significantly higher (p=0.050).

**CONCLUSIONS:** Differences in electrocortical activity seem to be present in patients one year after ACL-reconstruction, while patients in both groups tended to be equal in terms of biomechanical function. In line with previous research by Baumeister et al. (2011) ACL reconstructed patients probably more rely on their visual system for an adequate planning and control of motion. This could be a compensation mechanism for the loss of sensory input out of the affected ACL and could be a point of therapeutic entry in the prevention of re-ruptures in the future.
CONCLUSIONS: There is a suggestive relationship between KVA asymmetry during running and the magnitude of VGRF, KABM during SSC. Imbalances in knee kinematics during running could potentially be used as a screening tool to detect abnormal ACL loading kinetics during dynamic tasks like SSC.

Following lower extremity surgery, athletes demonstrate altered running mechanics particularly with regard to lower extremity joint moment impulses. The effect of speed and sex on joint impulses, even among healthy individuals, has not been investigated and describing these effects may facilitate more appropriate comparisons between injured and healthy athletes. PURPOSE: To determine the influence of sex and speed on hip extensor (H\text{EXT}), knee extensor (K\text{EXT}), and ankle plantarflexor (A\text{PF}) moment impulses during running. METHODS: Whole body kinematics and ground reaction forces were collected for 99 NCAA Division I collegiate athletes (52 males) during treadmill running at 2.68, 3.35, and 4.47 m/s. Athletes were healthy at time of testing and had no history of lower extremity surgery. H\text{EXT}, K\text{EXT}, and A\text{PF} were calculated during each stance phase and averaged across strides. Joint moment impulses for the right limb were compared between sex and speed using 2-way repeated measures ANOVAs. RESULTS: A significant sex by speed interaction (p < .01) for K\text{EXT} was observed. Females exhibited greater K\text{EXT} than males at all speeds (mean difference range, 6.8 to 15.2%). Among females, K\text{EXT} decreased significantly at each speed (-21.0 ± 0.04 Nm/kg, -21.0 ± 0.04 Nm/kg, -19.0 ± 0.03 Nm/kg at 2.68, 3.35, and 4.47m/s, respectively; p < .05). There were no significant speed effects among males (p ≥ .08). No significant interactions (p ≥ .08) were present for H\text{EXT} or A\text{PF}, though there were significant sex and speed main effects. Females demonstrated smaller H\text{EXT} and A\text{PF} than males (mean difference, 20.2% and 14.6% for H\text{EXT} and A\text{PF} respectively, p < .01). Across sexes, H\text{EXT} increased significantly with speed (p < .01) at 4.47 m/s was significantly lower than all other speeds (-39.0 ± 0.05 Nm/kg, -39.0 ± 0.05 Nm/kg, -38.5 ± 0.05 Nm/kg at 2.68, 3.35, and 4.47m/s, respectively; p < .01). CONCLUSIONS: Both sex and speed must be considered when evaluating the relative contribution of the hip, knee, and ankle during running. Females demonstrate greater K\text{EXT} than men at the same running speed but smaller H\text{EXT} and A\text{PF}, indicating an increased reliance on the knee joint. As running speed increases, males increase demand at the hip while females shift demands away from the knee and primarily toward the hip.

243 Board #84 May 30 11:00 AM - 12:30 PM 
Do Selective Pressures on Pelvic Dimensions Influence Risk of Running Injury Development? 
Naomi E. Frankston, Kevin Hunt, Jacob E. Vollmar, Ashley B. Nguyen, John J. Davis, IV, Andrea K. Chomistek, Allison H. Gruber. Indiana University, Bloomington, IN. (Sponsor: Joseph Hamill, FACSM) 
(No relevant relationships reported)

Sex differences in endurance running may be attributed to selective pressures on pelvic dimensions imposed by birth requirements. However, Warrenre et al. (2015) found that pelvic width did not have a significant effect on locomotor economy. However, a wider pelvis in females may explain higher rates of running related overuse injury (RROI). Physical activity (PA) during development is a confounding factor rarely considered when assessing injury risk, however early engagement in PA may be protective for RROI. PURPOSE: To determine whether pelvic dimensions and age PA began are risk factors for RROI. METHODS: 28 female and 17 male collegiate cross country runners completed two 12 minute steady state, submaximal (mean RER = 0.87) treadmill trials one of which involved receiving real-time feedback on vertical oscillation with the instruction to reduce the displayed value. Breath-by-breath VO\text{2} data was averaged over the last minute of the trial and expressed as kcal·kg\text{−1}·km\text{−1}. Vertical oscillation data was averaged over the entire trial. Repeated-measures ANOVAs were applied to VO\text{2} and vertical oscillation data to test for significant effects of real-time feedback. RESULTS: B-15 mins kg, massage reduced vertical oscillation (10.04 ± 1.99 cm vs. 8.78 ± 2.03 cm, p < .008), but did not improve running economy (1.10 ± 0.09 kcal·kg\text{−1}·km\text{−1} vs. 1.07 ± 0.10 kcal·kg\text{−1}·km\text{−1}, p < .072). CONCLUSION: Reduction in vertical oscillation did not produce an improvement in the economy of trained runners.

244 Board #85 May 30 11:00 AM - 12:30 PM 
The Effect of Real-Time Feedback on Vertical Oscillation and Running Economy 
Richard Robinson, Teresa Rose, Hannah Jones. University of Indianapolis, Indianapolis, IN. (No relevant relationships reported) 

PURPOSE: Investigate whether real-time feedback could reduce vertical oscillation and improve running economy. METHODS: 6 male and 4 female collegiate cross country runners completed two 12 minute steady state, submaximal (mean RER = 0.87) treadmill trials one of which involved receiving real-time feedback on vertical oscillation with the instruction to reduce the displayed value. Breath-by-breath VO\text{2} data was averaged over the last minute of the trial and expressed as kcal·kg\text{−1}·km\text{−1}. Vertical oscillation data was averaged over the entire trial. Repeated-measures ANOVAs were applied to VO\text{2} and vertical oscillation data to test for significant effects of real-time feedback. RESULTS: B-15 mins kg, massage reduced vertical oscillation (10.04 ± 1.99 cm vs. 8.78 ± 2.03 cm, p < .008), but did not improve running economy (1.10 ± 0.09 kcal·kg\text{−1}·km\text{−1} vs. 1.07 ± 0.10 kcal·kg\text{−1}·km\text{−1}, p < .072). CONCLUSION: Reduction in vertical oscillation did not produce an improvement in the economy of trained runners.
Loadrates for RFS and MFS, but only moderately correlated with loadrates for FFS (Table 1). Specifically, VTA was strongly correlated (r = 0.71) with all loadrates with the exception of RTA with VILR for FFS (Table 1). Generally, VTA was strongly correlated with all loadrates (r > 0.66). RTA was also strongly correlated with both loadrates for RFS and MFS, but only moderately correlated with loadrates for FFS (r < 0.47). Conclusion: The strong correlation between VTA and all loadrates (VALR, VILR, RILR) across all FSP suggests that tibial acceleration is a reliable surrogate for loadrates.

### Methods

Participants: 169 runners (74 F, 95 M, age: 38.6±13.0 yrs) running at 2.68 m/s on an instrumented treadmill. VTA and vertical resultant tibial acceleration (VTA, RTA) were averaged for 8 consecutive left steps. Correlation coefficients (r) were calculated between tibial accelerations and loadrates.

### Results

All tibial accelerations were significantly correlated across all loadrates with vertical and resultant tibial acceleration across footstrike patterns (FSP) in runners. Correlation coefficients (r) were calculated between tibial accelerations and loadrates. The relationship between landing alignment and loadrates has not been well established.

**PURPOSE:** To investigate the association between sagittal plane foot angle (FA) and tibial angle (TA) to vertical loadrates in both healthy and injured footstrike (FFS) and rearfoot strike (RFS) runners.

**METHODS:** This was an ongoing study with 52 healthy runners (35 RFS, 17 FFS) and 24 injured runners (34 RFS, 10 FFS) for a total of 76 runners (51 M, 25 F; age: 34±11.4 yrs). Vertical average loadrate (VALR) and vertical instantaneous loadrate (VILR) were obtained while running at 2.68 m/s on an instrumented treadmill. All runners reported 0/10 pain during the assessment. Sagittal plane FA and TA at footstrike were measured from video recording using an open-source program. Positive FA designated RFS. Positive TA defined as angle anterior to knee. Correlation coefficients (r) were computed for FA and TA with VALR and VILR (p<0.05; trend: p < 0.10).

**RESULTS:** Healthy FFS - FA and TA were negatively correlated with VALR and VILR. Injured FFS - Trend toward negative correlation between TA and both VALR and VILR. Healthy FFS - TA was negatively correlated with both loadrates. Injured FFS - No significant correlations.

**CONCLUSION:** In contrast to current thought, preliminary results suggest that increasing FA and TA at footstrike are associated with decreasing vertical loadrates. This relationship was strongest for the healthy FFS runners and weakest for the FA of both healthy and injured FFS runners.

**Abstract**

Running injuries have been associated with increased vertical loadrates, measured with forceplates. Tibial acceleration, which can be measured in the field with wearable technology, has been suggested as a surrogate for loadrates. However, the validity of this assumption is unknown.

**Purpose:** To determine the correlation between vertical and resultant loadrates to vertical and resultant tibial acceleration across footstrike patterns (FSP) in runners.

**Methods:** Participants: 169 runners (74 F, 95 M, age: 38.6±13.0 yrs) presenting at a running injury clinic. This included 25 forefoot strike (FFS), 17 midfoot strike (MFS) and 127 rearfoot strike (RFS). Participants ran on an instrumented treadmill (average speed 2.52±0.25 m/s), with a tri-axial accelerometer attached at the left distal medial tibia. Subjects running with pain <10/10 on aVAS pain scale during the treadmill run were included. Vertical average, vertical instantaneous and resultant instantaneous loadrates (VALR, VILR and RILR) and peak vertical and resultant tibial accelerations (VTA, RTA) were averaged for 8 consecutive left steps. Correlation coefficients (r) were calculated between tibial accelerations and loadrates.

**Results:** All tibial accelerations were significantly correlated across all loadrates with the exception of RTA with VILR for FFS (Table 1). Specifically, VTA was strongly correlated with all loadrates (r > 0.66). RTA was also strongly correlated with both loadrates for RFS and MFS, but only moderately correlated with loadrates for FFS (r < 0.47).

**Conclusion:** The strong correlation between VTA and all loadrates (VALR, VILR, RILR) across all FSP suggests that tibial acceleration is a reliable surrogate for loadrates.

### Methods

Participants: 169 runners (74 F, 95 M, age: 38.6±13.0 yrs) running at 2.68 m/s on an instrumented treadmill. VTA and vertical resultant tibial acceleration (VTA, RTA) were averaged for 8 consecutive left steps. Correlation coefficients (r) were calculated between tibial accelerations and loadrates. The relationship between landing alignment and loadrates has not been well established.

**Purpose:** To investigate the association between sagittal plane foot angle (FA) and tibial angle (TA) to vertical loadrates in both healthy and injured footstrike (FFS) and rearfoot strike (RFS) runners.

**Methods:** This was an ongoing study with 52 healthy runners (35 RFS, 17 FFS) and 24 injured runners (34 RFS, 10 FFS) for a total of 76 runners (51 M, 25 F; age: 34±11.4 yrs). Vertical average loadrate (VALR) and vertical instantaneous loadrate (VILR) were obtained while running at 2.68 m/s on an instrumented treadmill. All runners reported 0/10 pain during the assessment. Sagittal plane FA and TA at footstrike were measured from video recording using an open-source program. Positive FA designated RFS. Positive TA defined as angle anterior to knee. Correlation coefficients (r) were computed for FA and TA with VALR and VILR (p<0.05; trend: p < 0.10).

**Results:** Healthy FFS - FA and TA were negatively correlated with VALR and VILR. Injured FFS - Trend toward negative correlation between TA and both VALR and VILR. Healthy FFS - TA was negatively correlated with both loadrates. Injured FFS - No significant correlations.

**Conclusion:** In contrast to current thought, preliminary results suggest that increasing FA and TA at footstrike are associated with decreasing vertical loadrates. This relationship was strongest for the healthy FFS runners and weakest for the FA of both healthy and injured FFS runners.
S38 Vol. 49 No. 5 Supplement

MEDICINE & SCIENCE IN SPORTS & EXERCISE®

250 Board #91 May 30 11:00 AM - 12:30 PM
Muscle Activation Characteristics of the Posterior Oblique Sling System in High and Low Economy Runners
Nicolé K. Rendos1, Moataz Eltoukhy2, Wesley N. Smith2, Christopher M. Kuenze1, Joseph F. Signorile2. 1Andrews Research & Education Foundation, Gulf Breeze, FL; 2University of Miami, Coral Gables, FL. Michigan State University, East Lansing, MI.

Sling systems are chains of global muscles and their innervating fascia that facilitate sequential muscle patterns and rotational lumbo-pelvic stability during movement. During running, sling systems promote a reciprocal gait pattern between the upper and lower extremities. The Posterior Oblique Sling (POS) connects the latissimus dorsi (LD) and contralateral gluteus maximus (GM) through the thoracolumbar fascia and provides a pathway for mechanical transmission between the pelvis and trunk during running. PURPOSE: To examine muscle activation patterns of the POS as they differ between high (HI) and low (LO) economy runners at different running speeds. METHODS: Recreational runners (11M, 14F, height 1.73 ± 0.07m, mass 70.3 ± 11.7 kg, age 28.6 ± 5.1 yr) performed running economy test and were classified as HI or LO (n = 10) based on published normative data. On a separate testing day, runners completed overground running trials at a 10K race pace (10K) and long slow distance training pace (LSD). There were no differences between groups in running paces. Muscle activation patterns of the POS were measured using electromyography. Mixed design ANOVAs were conducted to determine differences among ages and economy groups in muscle onset time (ON), muscle offset time (OFF), peak amplitude (AMP), time of peak AMP (PEAK), and root mean square (RMS). RESULTS: A significant interaction was seen in GM PEAK (F1,33) = 4.8, p = .039) where PEAK occurs later in the gait cycle during LSD in LO (4.6% HI vs. 9.3% LO). A significant interaction was seen in LD AMP (F1,33) = 21.0, p < .001; RMS: F1,33) = 26.6, p < .001) during LSD compared to LO. CONCLUSION: Muscles in the POS work in a defined sequential pattern throughout the gait cycle with significant variability at different speeds and between HI and LO runners.

251 Board #92 May 30 11:00 AM - 12:30 PM
Trunk Kinematics Comparison During Self-selected Treadmill Jogging Between Age Groups
Rumit S. Kakar1, Zachary Finer1, Natalie Knight1, Joshua M. Tome2, Yumeng Li2, Kathy J. Simpson1. 1Ithaca College, Ithaca, NY; 2California State University, Chico, Chico, CA. University of Georgia, Athens, Athens, GA.

PURPOSE: Differences in gait parameters during walking and running with advancing age have been reported, though little is understood of the effects on age on intra-trunk motions during running. Research has shown that spinal mobility, decreases with advancing age; however, the impact on running activities is less known. Knowledge of normative ROM of different trunk segments during running can be essential in prescription of safe physical activities and for rehabilitation. Purpose was to compare ROM in the transverse plane during shod running at a self-selected speed. METHODS: Two adult groups, young (YA: n = 20; 21- 40yr; 33.2 ± 4.8yr) & middle-age (MA: n = 22; 41- 65yr; 54.7 ± 7.8yr), participated (mass = 68.9 ± 15.4, 69.5 ± 17.0 kg; height = 1.73 ± 0.07, 1.7 ± 0.07m; moderate to vigorous physical activity = 7.0 ± 1.5). Sagittal plane foot angular velocity was measured using IMUs (240Hz). The maximum angular velocity (maxAV) of the first foot strike during the stance phase was measured and classified as FFS or RFS. Footstrike patterns (FSP) were studied to use for feedback purposes in gait retraining and in relation to the development of running injuries. Differentiation between both legs might provide insights in the unilateral nature of injury development. Inertial Measurement Units (IMUs) have proven useful to assess running mechanics in the field. Foot angular velocity at the instant foot strike occurs may be used to classify FSP. IMU-based systems could serve as a tool in gait retraining to provide real-time feedback on FSP and be easily scalable to larger populations like RCTs. RESULTS: Two runners showed a FFS, one runner a MFS and two runners a RFS. Figures 1 shows the 95% confidence region of the left and right foot for both S01 and S05. CONCLUSIONS: The angular velocity based algorithm identified the FSP of two runners as RFS, one as MFS and two as FFS. Subtle intra-individual differences in angular velocity did not affect the overall classification, but could be of interest to tailor feedback in gait retraining and investigate the unilateral nature of injury development.

252 Board #93 May 30 11:00 AM - 12:30 PM
IMU Based Foot Strike Classification Algorithm For Real-time Feedback And Research Purposes In Running
Erik Maartens1, Ma Paquette2, Clare E. Milner, FACSM2, Jaap Bururke1, Jesper Reenaldal1. 1Roesingh Research and Development, University of Twente, Enschede, Netherlands; 2University of Memphis, Memphis, TN.

Purposes: To classify and quantify inter- and intra-individual differences in FSP between the left and right foot on a treadmill, using an angular velocity based algorithm. METHODS: Data was collected as part of a larger study. Data of 5 healthy experienced runners (5 M, age 27 ± 5.9 yrs; height 181.8 ± 5.7 cm; weight 71.3 ± 4.8 kg) was used to confirm that runners had different strike patterns at 5.9 m/s on a treadmill. Sagittal plane foot angular velocity was measured using IMUs (240Hz). The maximum angular velocity (maxAV) prior to and the minimum (minAV) after initial contact were used to classify FSP as either a rear foot strike (RFS, maxAV< 4.5, minAV< -2 rad/s), a mid foot strike (MFS, maxAV<4, minAV>-8 rad/s) or fore foot strike (FFS, maxAV>4, minAV>-8 rad/s) for each participant. For each participant, 50 steps were used to calculate the 95% confidence regions for the left foot, right foot and the grouped data for both feet. RESULTS: Two runners showed a FFS, one runner a MFS and two runners a FFS. Figure 1 shows that the 95% confidence regions for both the left and right foot. CONCLUSIONS: The angular velocity based algorithm identified the FSP of two runners as RFS, one as MFS and two as FFS. Subtle intra-individual differences in angular velocity did not affect the overall classification, but could be of interest to tailor feedback in gait retraining and investigate the unilateral nature of injury development.
and BWS on metabolic costs during running still await clarification. PURPOSE: To investigate metabolic costs during backward and forward running at different BWS conditions. METHODS: Nine subjects (40.9 ± 14.4 years) completed backward running and forward running on a lower body positive pressure treadmill at their mode-specific preferred running speed (PS) for 0%BWS, 20% BWS, and 50% BWS conditions. Oxygen uptake, heart rate (HR), rating of perceived exertion (RPE), and stride frequency (SF) were measured. Oxygen uptake, HR, RPE, PS, and SF were analyzed using a 2 (running direction) x 3 (BWS conditions) repeated measures analysis of variance (α = 0.05). RESULTS: HR, RPE, PS, and SF were not influenced by the interaction of direction and BWS (P=0.05). HR and RPE were not different between directions (P=0.05) but were different between BWS conditions (P<0.05). Specifically, HR and RPE during backward and forward running were lower with increasing BWS. Additionally, oxygen uptake was influenced by the interaction of direction and BWS (P<0.01). Oxygen uptake during running at 50%BWS was significantly lower than when running at 0%BWS, regardless of direction of locomotion (e.g., 36.9 ± 7.0 ml/kg/min and 27.5 ± 7.1 ml/kg/min for 0%BWS and 50%BWS during forward running, respectively, P<0.001). However, oxygen uptake was not significantly different between directions, regardless of BWS (P=0.05). Furthermore, PS and SF were different between directions (P=0.01) and between BWS conditions (P=0.05). Specifically, PS was higher and SF was lower during backward and forward running with increasing BWS. PS during backward running was 29%–42% lower than that of forward running. SF during backward running was 7%–12% higher than that of forward running. CONCLUSIONS: These observations demonstrate that a change in direction of locomotion may not influence metabolic costs and RPE during running at given BWS conditions, although PS and SF were different between backward and forward running. Furthermore, our observations indicate that a change in BWS influences metabolic costs, RPE, PS, and SF for both backward and forward running. Supported by JSPS Grant Number 16K01663.

A-47 Free Communication/Poster - Interventions and Health Promotion

Wednesday, May 30, 2018, 7:30 AM - 12:30 PM
Room: CC-Hall B

254 Board #95 May 30 9:30 AM - 11:00 AM
The Influence of Activity Trackers on Physical Activity, Cardiorespiratory Endurance, Body Composition, and Exercise Motivation
Michael A. Smith¹, Melissa Powers², Larissa Boyd³, Thomas Hancock¹. ¹University of Oklahoma, Norman, OK. ²University of Central Oklahoma, Edmond, OK. (No relevant relationships reported)

PURPOSE: The purpose of this research was to examine the influence of activity trackers on physical activity (PA), cardiopulmonary endurance (CRE), body fat percentage (BF%), and exercise motivation. METHODS: Forty-eight healthy volunteer participants aged 18-72 who did not achieve more than 3000 metabolic equivalent of task minutes (METmin) per week of physical activity (PA) were recruited to participate in a 12-week walking intervention. Participants were given the International Physical Activity Questionnaire (IPAQ), exercise motivation inventory (EMI-2) survey, tested for anthropometric measures, and tested for CRE at baseline and final testing. Participants were divided into an activity tracker group and a control group. RESULTS: Thirty-four participants (female = 29, male = 5) completed the full 12-week study. Analyses revealed no significant differences between the treatment and control groups for PA, CRE, BF%, or motivation from baseline to final testing. There were significant improvements in PA measured by the IPAQ for both groups from baseline (M = 1042.71 METmin, SD = 882.57) to final testing (M = 2931.34, F = 13.016, p = .001); however, step counts did not improve for either group from baseline to final testing. Mean difference in step counts were 1,897 steps and 1,614 steps for the testing and control groups respectively. There were significant improvements in CRE for both groups from baseline to final testing (Mean difference = 2.24 ml0.0 (kg·min)⁻¹, F = 13.016, p = .001). CONCLUSIONS: Analyses revealed that the walking program may have been effective for improving PA and CRE, but that activity trackers did not provide any additional benefits. The conclusion is that activity trackers alone may not be an effective tool for the improvement of PA, CRE, BF%, or motivation.

Lifestyle Behaviors and Muscular Strength in Young Adults
Henry Piascik, Kristofer S. Wisniewski, Gabrielle M. Brennan, Sara D. Diether, Patricia Fitzgerald, Maura J. Jerguski, Stephen LoRusso, Baruch Vainshelboim. Saint Francis University, Loretto, PA. (No relevant relationships reported)

Lifestyle Behaviors and Muscular Strength in Young Adults
Henry Piascik, Kristofer S. Wisniewski, Gabrielle M. Brennan Sara D. Diether, Patricia Fitzgerald, Maura J. Jerguski, Stephen LoRusso, Baruch Vainshelboim. Saint Francis University, Loretto, PA.
Sedentary lifestyle behaviors and poor muscular strength are associated with morbidity and mortality and are important determinants of general health. The association between these is less known in young population, given that assessing muscular strength is challenging in most clinical settings. PURPOSE: To assess the association between lifestyle behaviors and muscular strength in a pilot cohort of young adults. METHODS: Ninety-four participants (20.2 ± 1.6 years, 46 men, 48 women) were assessed for self-reported physical activity and sitting time [Global Physical Activity Questionnaire (GPAQ)] and strength tests [isometric deadlift, 1RM bench press and 1RM leg press]. Pearson’s correlations were analyzed between the variables. RESULTS: Means of the sample were as follows: sitting time (M: 5.7 ± 2.7 hours/day, W: 6.8 ± 2.8 hours/day), physical activity (M: 10,977.6 ± 11,068.3 METmin/week, W: 7,189.9 ± 4,481 MET-min/week) isometric deadlift [M:229±106 (kg), W:96±26 (kg)], 1RM Bench Press [M:5±21 (kg), W:39±9 (kg)] and 1RM Leg Press (M:210±106 kg), W:153±43 (kg)]. Moderate correlations were found between physical activity and 1RM bench press (r=0.45, p=0.01) and 1RM leg press (r=0.39, p=0.027) in women subjects only. CONCLUSION: Self-reported physical activity is associated with upper and lower body strength in women, suggesting the GPAQ as relatively reliable tool for muscular strength evaluation in young female population. However, future studies are needed to confirm these results.

256 Board #97 May 30 9:30 AM - 11:00 AM
Increasing Physical Activity in Office Workers - An RCT Of Treadmill Workstations.
Frida Bergman, Viktoria Wahlström, Patrik Wennberg, Carl-Johan Boraxbekk, Ann Sörn, Fredrik Öhberg, Tommy Olsson. Umeå university, Umeå, Sweden. (No relevant relationships reported)

Purpose: Our primary hypothesis was that an intervention with treadmill workstations would increase time spent walking. Secondary hypotheses were a decrease in time spent sitting with a concomitant increase in time spent standing and in light intensity physical activity (LPA) leading to positive effects on body measurements and body composition.

Methods: The intervention group received a treadmill workstation at their office desk during 13 months. Daily time spent sitting, standing and walking and number of steps was measured with activityPal®. Daily time in LPA and MVPA was measured with Actigraph®. Body weight, BMI and waist circumference were measured according to standardized protocols. Dual X-ray Absorptiometry was used to estimate body composition. Mixed models was used for the statistical analysis, with group, day of week (weekday/ weekend), time point and gender as fixed effects and age as a covariate. p<0.05 was considered significant.

Results: Eighty participants were included. The intervention group significantly increased their time spent walking at all follow-ups, with a difference at 13 months of 22 minutes (p=0.001) and 1645 steps per day (p<0.05), respectively, versus controls. Concomitantly, they decreased their time spent sitting with a concomitant increase in time spent standing and in light intensity physical activity (LPA) during 13 months versus baseline. We also found a decrease in LPA with 19 minutes per day (p=0.05), and of 17 minutes per day for MVPA (p<0.001) at 13 months versus baseline at weekends.

Conclusion: The control group increased their time spent sitting with 25 minutes per day (p=0.05) and decreased the time spent standing with 35 minutes per day at weekdays (p<0.001) compared to baseline. There was also a decrease in LPA with 14 minutes per day (p=0.01) and in MVPA with 6 minutes per day (p=0.01) versus baseline during weekdays, with a decrease in sitting time with 36 minutes (p<0.05) at weekends.
We there were no significant changes in body measurements or body composition.

Conclusion: It is possible to increase daily walking time by introducing treadmill workstations at offices. A decreased MVPA within the intervention group may contribute to lack of effects on body measurements and body composition. It is therefore important that future interventions aim at both reducing sedentary time as well as increasing, or at least remaining, MVPA levels.

Abstracts were prepared by the authors and printed as submitted.
BACKGROUND: According to the World Health Organization (2016) cardiovascular diseases are the main cause of death in the world population. In Mexico it represents 44% of the total deaths, considering an approximate of 100,000 annual deaths, in subjects with ages ranging from 45 years and older, with a higher prevalence in men than in women. Several studies showed the benefits of practicing physical activity reducing risk factors with a minimum of 60 minutes per day. PURPOSE: To assess the effects of an exercise program on the values of cholesterol and triglycerides in a group of adults with obesity in the northern center of Mexico.

METHODS: This pre-post study was conducted in two fitness centers. 60 subjects (52 ± 2 years), 33 women and 27 men during 16 weeks. Subjects were randomly divided into three groups of twenty. Control group without intervention. Outdoor Group, a program with a frequency of 5 days per week and a duration of 60 minutes in outdoor cardio activities. Fitness Group a program of physical conditioning of strength and resistance with a frequency of 5 days per week and a duration of each session of 90 minutes. The lipid profile was measured in blood plasma. RESULTS: The main results showed after comparing both measurements that total cholesterol values decreased into OG (p=0.003) and a significant decrease in FG (p=0.001). The women of the FG showed a significant decrease in tracycride values (p=0.008). CONCLUSIONS: Cardiovascular risk seems to be regulated by gender and by type of program. Both the outdoor exercise program and the fitness program show evidence of improvements in health. Into future research we recommend to increase the number of subjects and include other endocrine and metabolic variables.

CONCLUSION: These preliminary data provide support for facilitated health coaching methods such as FTMI. Results show the independent use of a FT can also have small benefits. Additional work is needed to determine the optimal dose and intervention strategies for patients with LBP.

Prolonged sedentary behavior may be associated with mortality and other health risks. Research shows a correlation between adiposity and interrupted sedentary time, supporting efforts for increasing workplace activity. PURPOSE: To determine if body composition changed following a 6-month intervention using sit-to-stand workstations (STS). METHODS: Participants included staff and faculty members of the University of Central Oklahoma. Participants (N=31) were randomly assigned to a treatment group (TG: n=16) and a control group (CG: n=15). Participants were advised to maintain current activity-related behaviors. Height was measured at baseline using a stadiometer, and body composition was assessed pre and post intervention. RESULTS: There were no significant differences between or within groups were found (p>0.05). Effect sizes were minimal. Small improvements occurred in all variables in the intervention group, but only for lean mass in the control group. CONCLUSIONS: Standing for at least 2 h/d may provide modest benefits to body composition. Future research should examine changes over a longer treatment time. This project was funded by the University of Central Oklahoma, Research and Sponsored Programs office.

Exercise referral schemes are clinical exercise interventions used in non-clinical settings throughout the UK as a mechanism to increase physical activity. This study aimed to investigate levels and health conditions of medically referred individuals. At present, the literature reviewing the impact of exercise referral schemes on PA levels, well-being, and quality of life is inconsistent.

PURPOSE: To determine if exercise referral schemes positively influence PA levels in a large cohort of of individuals through a 6-month intervention.

METHODS: Data were obtained from 7412 participants (Female N= 4965 [49.96, +/- 14.37y], Male N=2447 [53.15, +/- 14.75 y] ) referred from hospitals (N=605), medical centres (N=406), outreach (N=353) and GP surgeries (N= 6048) to fourteen exercise referral schemes located across England. The participants’ self-reported METs per week were calculated at the start and end of the scheme to determine whether the clinical exercise intervention had any impact on participants’ PA levels. Scheme lengths were either (N=1749) or 12 weeks (N= 5663) in duration and situated in leisure environments. PA programmes consisted of both aerobic and resistance training tailored to the individual. A paired samples t-test was conducted to determine if a statistically significant difference existed between pre- and post scheme PA levels.

RESULTS: METs per week were combined for both the 6- and 12-week groups. There was a statistically significant increase of 290.9 METs/min per week from pre- to post-scheme for the participants (Pre= 856.1, +/- 1278 METs/min/week, 95% CI [827, 885] to Post= 1147 +/- 1801 METs/min/week; t(7411) = -34.18, p<0.001, 95% CI [1475, 1509], with a pairwise correlation of 0.367.

CONCLUSIONS: This is one of the larger samples to study PA levels in UK adults after completion of an exercise referral scheme. The results showed a significant pre-post increase in MET/min/week, although sustainability of this change is not known. Long-term follow-up of participants, including a comparison group and deeper analysis of other health behaviors, is to be conducted to support the initial findings.
Workers spend a quarter of their lifetime, and up to half of their waking adult lives, at work or commuting. The sedentary aspects of work have been associated with increased health risks. Workplace health promotion programs are the ideal locations for impacting health behaviors. PURPOSE: To compare the effects of short duration, high intensity internal training (HIIT) and traditional walking or increased steps on anthropometric, body composition and body weight changes over a 12-week period.

METHODS: Subjects (N=11) were obese, sedentary female volunteers, assigned into one of two exercise groups. Both groups increased their exercise and steps up to 5 days/week for 12 weeks monitored via an activity tracker, a Movband™

The intervention group (N=5) (42.9±8.3 yr, 197±4.2±6 lb body wt; BMI-33.8±2.2 kg/m²; mean: SD) exercised for (15.0±3.5 min) which consisted of eight different routines: no significant changes were determined between the mode of exercise, upper and lower extremity, 2 cardio segments, 2 total body, yoga and abdominal exercises. The step group (N=7) (48.4±4.96 yr, 192±7±2±6 lb body wt; BMI-32.1±1.9 kg/m²; mean: SD) increased their steps up to 10,000 for 12 weeks. Relative (%) body fat was measured via DEXA scan, along with five anthropometric measurements prior to and after 12 weeks. Independent samples t tests probed for significant differences at the p<0.05 level. Values are expressed as mean±standard deviation. No significant changes were determined between the resistance and step groups for the pre-post anthropometric measurements: biceps, waist, abdomen, hips and thigh (13.5±1.3, 13.1±1.3 vs. 12.5±0.8, 12.2±0.9; 36.0±1.3, 42.4±2.1 vs. 35.0±0.2, 34.6±2.2; 42.1±5.1, 44.1±2.7 vs. 41.0±2.2, 41.0±2.0; 45.6±1.9, 44.9±2.0 vs. 44.6±2.0, 44.0±0.3, 25.0±2, 4.24±2.1, 17±2.5 vs. 18±2.5, 17±1.5, respectively). Pre-post relative fat measurements and body weight changes were not significantly different between the resistance and step groups (45.3±1.8, 44.2±2.1 vs. 45.3±1.4, 45.5±2.5 vs.; 197.4±2.7, 198.0±2.16 vs. 192.7±2.26, 192.6±2.8 lb, respectively). CONCLUSION: This work is suggestive that there are no differences between the mode of exercise, short duration HIIT exercise compared to increased steps regarding anthropometric measures, relative percent fat and body weight changes over a 12-week period.

Conclusions: To determine if a physical activity (PA) intervention improved parent’s knowledge of physical activity recommendations during the intervention period.

Supported by: Research/Creative Activity Award, East Carolina University Character count (without spaces): 1494 max: 2000

WEDNESDAY, MAY 30, 2018

Abstracts were prepared by the authors and printed as submitted.
It seems that exercise decreases severity of depression and morbid thoughts, even at baseline. The educational program seems to benefit exercising and non-exercising participants but those that established the regular exercise improved the most.

The Effect of Early Life Undernutrition on Voluntary Physical Activity in Mice.
Eric C. Leszczynski, Ashley N. Triplett, David P. Ferguson. Michigan State University, East Lansing, MI.

Regular physical activity reduces the risk of cardiovascular disease, Type II diabetes, and metabolic syndrome. Perinatal undernutrition has been shown to program the development of chronic disease. PURPOSE: To determine if early life undernutrition influenced frequency and duration of wheel running (measure of physical activity) in mice as adults. METHODS: Using a cross-fostering model, pups were undernourished during gestation (GUN, N= 8) or during lactation (PUN, N= 8) by feeding FVB mothers a low protein diet (8% protein) causing growth restriction. The control group (CON, N= 7) was fed a normal protein diet (20% protein) throughout gestation and lactation. At 21 days of age, all pups were weaned and fed a control diet. At PN45, mice were then individually housed in cages with free-moving running wheels which recorded number of spins per day (Columbus Instruments). Average spins per day were calculated on days 5 and 6 for three weeks, and a two-way ANOVA was run comparing the main effects of diet and gender on average wheel spins. RESULTS: There was a significant difference between GUN mice (2953.625 ± 296 spins day-1), CON (22988.7 ± 296 spins day-1) and PUN (19667.5 ± 274 spins day-1) (p<0.05). There were no significant differences between male and female groups. CONCLUSIONS: Based on the data, postnatal undernutrition elicits an impairment in physical activity engagement. Thus, the developmental processes that occur during this time period are suspected to program adult physical activity level.

Squatting With Elastic Bands Facilitates More Weight Used And Time Under Muscle Tension
Nicole L. Rogers1, Javier Gene1, Alvaro Juesas2, Pedro Garagallo2, Andres Gene1, Rosario Salvador1, Juan C. Colado3, Michael E. Rogers, FACSM4, 1Wichita State University, Wichita, KS, 2University of Valencia, Valencia, Spain. (Sponsor: Michael E. Rogers, FACSM)

In has been shown that the variable resistance associated with elastic band training improves strength and several other outcomes. However, the efficacy of combining elastic bands (EB) with traditional resistance exercises is not well defined. PURPOSE: To evaluate performance (kg used and number of repetitions) during the squat exercise using free weights (FW) versus FW with EB applied with tension at the sticking point (50 degrees of knee flexion). METHODS: Twenty healthy, physically active men (25.5±4.7 yr) with resistance training experience performed four squat conditions on a Smith Machine in random order: (A) 10 maximum repetitions (RM) with FW; (B) 10RM with CLX EB added at the sup-stand-up position (SUP) with the weight of 10RMFW; (C) number of repetitions with CLX EB added at the SUP using the weight of 10RMFW; (D) number of repetitions with CLX EB added at 50 degrees of knee flexion prior to the SUP using the weight of 10RMFW. Goniometer, tactile markers, and metronome were used to standardized range of motion and pace of movement. The eccentric phase was performed at a pace of 2 sec with a 1 sec pause before the concentric phase performed with maximum velocity. A validated baseline was used to measure kg. Friedman test identified differences between conditions and Wilcoxon signed-rank tests examined where differences occurred. RESULTS: Condition D employed more (p<0.05) weight than the other conditions (+24.70%). Conditions C and D performed more RM than the other conditions (8.4 and 3.45, respectively) with significant differences between conditions 3 and 4. CONCLUSIONS: Performing resistance exercises with EB increased the kg employed and time under muscle tension. This could be because EB provide an additional element of variable tension that changes through the range of motion. Combining EB with traditional weight training exercises may enhance the training effect.

Effect Of Kinesitherapy And Massage To Injury Skeletal Muscle Repair'S Histomorphology And C-reactive Protein
Ming Li, Qinglong Liu, Yinghong Yin, Qian Wang. 1Zhejiang University College of Medicine, Hangzhou, China, 2Anhui Normal University, wuhu, China. (No relevant relationships reported)

Abstract
Purpose: The project is based on mice acute blunt contusion model. And we use muscle histomorphology and C-reactive protein as observation targets. Hope our research result can help improving fitness enthusiasts' health knowledge level and offer choice to injury rehabilitation method.

Method: Project chooses 60 adult male healthy SD mice(360±22.7g) and use self-made tool to hit mice’s right tibialis anterior muscle. After that we use randomization separate 60 mice into 4 groups, each group follow its own recovery group. Collecting injury and health tibialis anterior muscle specimens after injury 2 day, 5 day, 8 day, 12 day, 16 day. Using HE staining method deal with muscle samples and observe its histomorphology. Using ELISA to measure the CRP level in serum. The result shows us inflammation level and span.

Result: (1) Regular Observation: These symptoms are vanishing in 6th day of massage group, 8th day of massage with kinesitherapy group, 10th day of kinesitherapy group, 16th day of spontaneous recovery group.

(2) Histological Observation: Mice acute blunt contusion model can cause all mice right tibialis anterior muscle construction destroy, muscle fiber break and increase interval. After each groups’ therapy, tibialis anterior muscle’s form repaired within several days.

(3) C-reactive protein: (1) MASSAGE+KINESITHERAPY GROUP C-reactive protein level back to normal time and degree compare with spontaneous recovery group, have showing significant difference(p< 0.05). (2) MASSAGE+KINESITHERAPY GROUP C-reactive protein level back to normal time and degree compare with Kinesitherapy Group and Massage Therapy with Kinesitherapy Group have show significant difference(p< 0.05).

Conclusion: Kinesitherapy and massage therapy can enhance muscle strength, correct injury skeletal muscle arrangement, tissue construction completion. Meanwhile, improve muscle microenvironment, reduce inflammatory cells infiltration and accelerate inflammatory cells elimination, decrease cellular stress response which come from muscle fibers degradation and shorten reaction span. In conclusion, kinesitherapy and massage therapy is the most efficiency rehabilitation therapy in skeletal muscle injury acute stage.

Changes In Cortisol Levels With An Aquatic Resistance Workout Versus A Weight Workout
Juan C. Colado1, N. Travis Triplett1, Jorge Flandez2, Joaquin Madera1, Victor Tella1, Nicole L. Rogers3, Michael E. Rogers, FACSM4, 1University of Valencia, Valencia, Spain. 2Appalachian State University, Boone, NC. 3Austral de Chile, Valdivia, Chile. 4Wichita State University, Wichita, KS. (Sponsor: Michael E. Rogers, FACSM)

Aquat exercise training could be an effective type of strength training. However, the response of cortisol to aquatic exercise versus training with traditional weights has not been determined. PURPOSE: To compare the response of cortisol during similar resistance training protocols performed in an aquatic medium versus traditional weights. METHODS: 8 healthy, physically active males (24.8 ± 2.6 yr) with resistance training experience performed two conditions in random order: (a) 6 sets of horizontal shoulder abduction and flexion/extension of both the shoulder and the elbow with a flat paddle-type device (782 cm2 of projected frontal area) in each hand; and (b) 3 sets of exercises performed with dumbbells: (i) standing horizontal shoulder abduction, (ii) horizontal shoulder adduction, and (iii) shoulder flexion; and with pulley: (iv) standing pull-over, (v) biceps curl, and (vi) elbow extension. Rest between sets was 1-2 min. Aquatic exercises were performed at a pace that permitted the maximum number of repetitions in 15 sec. Weight exercises were performed with a load that permitted the same number of repetitions as the corresponding aquatic exercise pace. Cortisol blood samples were obtained from an antecubital vein in basal status, immediately after finishing each workout, and after 60 min of rest (60REST). RESULTS: Basal cortisol was 22.83±6.67 ng/ml. Post-workout and 60REST values were: (i) aquatic: 26.71±5.73 and 24.02±10.17 ng/ml, respectively; (ii) weights: 24.29±8.12 and 18.96 ± 6.45 ng/ml, respectively. There were significant (p<0.05) differences in cortisol levels following both workouts compared to basal values (g2(4)=8.800). There was also a significant increase in cortisol immediately after the aquatic workout compared to weights (Z=−1.820) and a significant decrease in cortisol post- workout and 60REST with weights (Z=−2.240).

CONCLUSIONS: Cortisol levels were higher immediately and 60 min after the aquatic workout compared to weights. The higher cortisol level
and the slower pace of recuperation could indicate that this type of aquatic training provokes a higher intensity. This could be due to the higher stabilization needed to maintain postural control in the water.

Current guidelines recommend adults perform a minimum of 30-60 minutes of moderate-intensity physical activity (PA) at least 5 days a week or vigorous PA on at least 3 days. Throughout Equatorial Africa, these recommendations are largely unmet and unknown. Among adults in rural areas, rates of sedentary behavior are reported to be 65-72%; in urban areas, where supplies are more accessible, 78-80% of men and women are sedentary. Geographic prevalence of metabolic syndrome reflects this with a 5-fold increase in urban populations. Currently, data are limited on how much PA should be prescribed to reduce the incidence of illness and physical suffering in Equatorial African populations.

PURPOSE: To evaluate the effect of PA on health outcomes among Ugandan men and women.

METHODS: The Uganda National Household Survey gathered data from a random sample of Ugandan homes between 2012 and 2013. Variables related to PA were limited; we used “hours spent gardening,” “hours spent collecting water” as representations of daily activity. Dependent variables were whether subjects experienced an injury in the last 30 days, the number of days they reported “suffering” from illness or injury during that period, and the number of times they had to cease activity owing to illness or injury. Linear regressions tested the effect of PA on physical health outcomes.

RESULTS: Across the total sample, more hours spent gardening (p<0.001) and more hours spent collecting water (p<0.001) each individually associated with reduced frequency of suffering and the number of times subjects had to stop activity owing to illness or injury. Time spent gardening (p=0.328), water (p=0.346), or both (p=0.982) had no relationship with the incidence of injury in the last 30 days; the implication is that illness associates more strongly with PA than does injury. As subjects performed more PA, they reported less suffering and less obstruction of daily tasks.

CONCLUSION: These data offer a modest indication that PA and health are inextricable: increased engagement in activity corresponds to better health and less suffering. Owing to these preliminary associations and the lack of comprehensive data, there is a demonstrable need for governmental guidelines for PA and potentially the establishment of a Ugandan College of Sports Medicine.

The functional adaptations to isometric RT have been found to differ between, and highly specific to, the type of contractions performed e.g. explosive vs sustained contractions. However, it is unknown if isometric resistance training combining sustained contractions and brief explosive contraction (EC) increases both explosive and maximum strength, and if the strength gains would be specific to the training angle (joint angle specificity) explained by neural drive specific to the training angle. We also found angle specific changes in neural drive that appeared to underpin the joint angle specificity of MVT improvements after isometric RT.

PURPOSE: To determine if the effects of efibuddy on participants’ PA, 274 college students (167 females, mean age = 19.35±2.09 years) attended baseline and posttests and change scores were computed for each dependent variable (DV). After the baseline test, participants in the intervention group (n=187) downloaded Efibuddy and used it daily for four weeks. Efibuddy was a smartphone application developed to promote individual’s PA and included four behavior change techniques such as self-monitoring, setting goals, and provision of general health information. PA participation, self-efficacy, and exercise enjoyment were selected as the DVs of the study. A Pearson’s correlation analysis was employed on the raw data to examine if the data were suitable for multivariate analyses. The results displayed moderate linear relationships between the pretest and posttest scores on three DVs. Therefore, a 2 (group) x 2 (time) x 2 (gender) Multivariate Analysis of Variance (MANOVA) was conducted to examine the differences in the dependent variables. Wilk’s lambda was used to decide the statistical significance of the multivariate model.

RESULTS: There were no multivariate statistically significant interactions for Group x Time, Gender (Wilks’ A = 0.685, F = 0.996, F(6, 269)=0.100) and more hours spent collecting water (p<0.001) each individually associated with reduced frequency of suffering and the number of times subjects had to stop activity owing to illness or injury. Time spent gardening (p=0.328), water (p=0.346), or both (p=0.982) had no relationship with the incidence of injury in the last 30 days; the implication is that illness associates more strongly with PA than does injury. As subjects performed more PA, they reported less suffering and less obstruction of daily tasks.

CONCLUSION: The results of the study demonstrate that efibuddy has limited influence on young adults’ PA through a week period of time usage. These results echo previous studies exploring the relationship between smartphone applications and PA behaviors and more research is warranted for longer intervention with more vigorous engagement of usage.

In laboratory settings, replacing sitting with cycling improves cardiometabolic risk factors. However, changes to risk factors following a cycling intervention in the workplace have yet to be examined. PURPOSE: To quantify how a compact, stationary cycling device used in a sedentary workplace affects cardiometabolic risk factors. METHODS: Twenty-one inactive to recreationally active office workers who sat at work ≥6 h·d−1 visited the laboratory for baseline physiological measurements (resting blood pressure, blood lipid profile, VO2max, body composition, and 2-h oral glucose tolerance test). Participants were assigned to a 4-week intervention (n=12) or a 4-week control period (n=9). At the end of the control period, participants in the control group repeated the baseline physiological measurements and then began the workplace intervention. During the workplace intervention, participants were instructed to use the cycling device a minimum of 15 min·h−1 which would result in a total use of ≥2 h·d−1 during the weekday. Following the 4-week intervention period, the physiological measurements were repeated. RESULTS: Participants cycled for 4 and a half hours into a sedentary workplace improves some cardiometabolic risk factors in 4 weeks with no compensatory decrease in non-cycling physical activity. Therefore, compact cycling devices are a feasible intervention for a sedentary workplace.

Abstracts were prepared by the authors and printed as submitted.
INTRODUCTION: Non-communicable diseases represent a significant threat to human health and well-being, and carry significant implications including decreased quality of life and decreased physical functioning. The aim of this study was to evaluate the effects of attendance to a 12 month community-based chronic disease exercise rehabilitation program on measures of physical activity (PA) sedentary behaviour (SB) and physical function and to compare the results of those who attended regularly vs non-regular attenders.

METHODS: Participants (36.3% male; age (mean ± SD) 64.8 ± 6.5 years) with coronary artery disease, (n=119); chronic obstructive pulmonary disease, (n=101); peripheral arterial disease, (n=53); or type 2 diabetes, (n=46) were referred by a physician to a community-based chronic disease exercise rehabilitation program. Standard anthropometrics, timed sit-to-stand (STS), hand-grip, sit-and-reach test (SAR) and performance during a 6 min time trial (6MTT), PA and SB were measured at induction to the community-based chronic disease exercise rehabilitation program and after 12 months. Results are presented as mean ± SD. Attenders were classified as those who attended at least one class per week for 12 months.

RESULTS: At baseline, attenders had significantly more favourable measures of BMI, hip circumference, STS and 6 MTT, significantly higher stepping hours, min of moderate vigorous PA (MVPA) and step count, and spent significantly less time in SB > 90 min than non-attendees. Using baseline values as covariates, there was a significant difference in stepping hours, minutes of MVPA, step counts and BMI between attenders and non-attenders at 12 months. There was no significant difference at baseline for the number of sedentary bouts < 20 min, weight (kg), waist circumference and SBAR. However, all values were significantly different between attenders and non-attenders at 12 months.

CONCLUSIONS: Participants who attended chronic disease exercise rehabilitation program a minimum of one day per week for 12 months had significantly greater improvements in MVPA, SB and physical functioning than non-attenders.
CONCLUSIONS: The subject enjoyed and tolerated the intervention well without any adverse effects. The results of this single subject design were that BFR training can produce significant functional improvements, reduce restless leg syndrome symptoms and can be safely utilized with a patient with PD.

277 Board #118
May 30 9:30 AM - 11:00 AM
A Knowledge Based Intervention on Health and Physical Activity Knowledge and Behavior in Hispanic College Students
Ulka S. Karabulut1, Zasha Romero2, Paloma Mendoza3, Ricardo Parra1, Murat Karabulut1. 1UTRGV, Brownsville, TX. 2UTRGV, Edinburg, TX.
(No relevant relationships reported)

PURPOSE: To investigate the effects of an intervention on Hispanic college students’ basic health, healthy eating, and physical activity (PA) related knowledge and behaviors.

METHODS: Fifty-two (52) Hispanic college students (age = 24.16 ± 3.54) volunteered to participate in the study. Each subject read and signed the consent form prior to any measurements to take place. Demographic and anthropometric data including age, race, gender, major, height, weight, resting heart rate (RHR), blood pressure (BP), body composition (BC), waist (WC) and hip circumference (HC) were collected. Subjects completed The Food and Drug Administration’s (FDA) Health and Diet Survey (modified). They were randomly assigned to a control (CG) or an intervention (IG) group. IG received a pamphlet containing general health knowledge and guidelines about healthy eating and physical activity behaviors. After 4-5 weeks, both CG and IG visited the lab second time for post measurements. Godin’s (2011) Leisure-Time Exercise Questionnaire was used to quantify pre/post PA.

RESULTS: There was a trend for group*time interaction for DBP (p=0.09). The IG experienced a greater decrease in DBP. Both groups experienced similar changes in knowledge on BMI (p=0.01), amount of PA (p=0.04), and RHR (p=0.04) with time. A trend for group*time interaction was also reported on RHR (p=0.097). A significant interaction was found for students’ knowledge on the effects of trans fatty acid on heart disease (p<0.02). The IG became significantly more knowledgeable compared to the CG. There was a time main effect (p=0.05) and group*time interaction (p=0.05) for the knowledge regarding the role of saturated fat on heart disease.

CONCLUSIONS: Findings of the study showed that many college students lack or have misconceptions about common health related knowledge. Findings also indicated that simple methods such as providing pamphlets may be effective enough to increase students’ knowledge. Future studies should investigate the long-term effects of pamphlets and other simple educational strategies on retention of knowledge and behavioral change. In addition, since new technologies might be more appealing to young college students, the effectiveness of various new tech tools can also be used to increase the level of health related knowledge and behavioral changes.

278 Board #119
May 30 9:30 AM - 11:00 AM
The Moderating Effect of Baseline Depression and Age on the Efficacy of an Exercise Intervention on Preventing Postpartum Depression and Stress
Beth A. Lewis1, Shira Dunsiger1, Carrie Terrell1, Paloma Mendoza1, Maria Ayuso1, Jorge Lopez-Fernandez1, Maria Atkinson1, Joe Ciccolo1. 1Columbia University, New York, NY.
(No relevant relationships reported)

PURPOSE: Support for the efficacy of exercise interventions on preventing postpartum depression is mixed. Therefore, it is important to examine potential moderating variables. The purpose of this study was to examine the moderating effect of age and baseline depression on the effects of exercise on preventing postpartum depression and stress. METHODS: Participants were low active pregnant women (n=450; average age = 30.7 years) who had a history of depression and participated in a trial examining the efficacy of exercise on preventing postpartum depression and stress (variables assessed at 6 and 9 months). Participants were randomly assigned to: 1) 6-month telephone-bases exercise intervention (2) 6-month telephone-based wellness/support intervention or (3) usual care. RESULTS: The results demonstrated that students in both groups showed increase in positive mood (mindfulness, resilience, and self-esteem) and decrease in negative mood (self-criticism, self-correction) as a result of taking the respective physical activity lessons. However, compared to those in the fitness group, students in the yoga group showed significantly greater increase in mindfulness (yoga group: ΔM = -.64, fitness group: ΔM = -.31; F1,190 = 4.08, p < .05) and greater decrease in stress (yoga group: ΔM = -.70; fitness group: ΔM = -.35; F1,190 = 5.96, p = .02). CONCLUSIONS: This study confirmed the positive effect of physical activity on mood and stress. Furthermore, compared to the fitness lesson, the yoga lesson demonstrated greater effect on mindfulness and stress. This set of findings are meaningful to college students’ mental health. Taking one single physical activity lesson, especially yoga, can help students benefit of mindfulness and behaviors manage.

279 Board #120
May 30 9:30 AM - 11:00 AM
The Acute Effect of a Single Yoga Lesson on Mood and Stress among College Students
Zhonghui HE1, Xin Qi2, Jiajin Tong3, Senlin Chen4, Shuchang He4, E'Peking University, Beijing, China. 4Louisiana State University, Baton Rouge, LA.
(No relevant relationships reported)

PURPOSE: Yoga is an exercise mode that has gained popularity across the world over the years due to its physical and mental benefits (e.g., flexibility, relaxation, calmness). This study examined the acute effect of one yoga lesson on college students’ mood (both positive mood and negative mood) and cortisol level. METHODS: The study took place in a prestigious university in Beijing, China. The sample consisted of 192 students (Mean age = 19.76) enrolled in two types of physical activity courses offered at the university: yoga class (n = 98) or health-related fitness class (control group: n = 94). Both courses were 90 minutes long and taught by experienced physical education teachers following two separate lesson plans. The Chinese version of the Positive and Negative Affect Schedule Scale (PANAS; Watson, Clark, & Tellegen, 1988) was used to measure positive (e.g., mindfulness, resilience, self-esteem) and negative mood (e.g., self-criticism, self-correction). Saliva was collected to determine cortisol level which measures stress. The two measures were administered to students in both groups before and then 15 minutes after taking the physical activity class. A repeated measures variance was conducted to determine the time (pre- vs post-test), group (yoga vs fitness groups), and time x group interaction effects for mood and stress. RESULTS: The results demonstrated that students in both groups showed increase in positive mood (mindfulness, resilience, and self-esteem) and decrease in negative mood (self-criticism, self-correction) as a result of taking the respective physical activity lessons. However, compared to those in the fitness group, students in the yoga group showed significant greater increase in mindfulness (yoga group: ΔM = -.64, fitness group: ΔM = -.31; F1,190 = 4.08, p < .05) and greater decrease in stress (yoga group: ΔM = -.70; fitness group: ΔM = -.35; F1,190 = 5.96, p = .02). CONCLUSIONS: This study confirmed the positive effect of physical activity on mood and stress. Furthermore, compared to the fitness lesson, the yoga lesson demonstrated greater effect on mindfulness and stress. This set of findings are meaningful to college students’ mental health. Taking one single physical activity lesson, especially yoga, can help students benefit of mindfulness and behaviors manage.

280 Board #121
May 30 9:30 AM - 11:00 AM
Effects Of A 12-week Structured Exercise Intervention On Cholesterol
Brett Staniland1, Jorge Lopez-Fernandez1, Isabel Sanchez1, Tamara Itriurraga1, Maria Ayuso1, Elizabeth He1, Lou Atkinson1, Steve Mann1, Gary Liguori1, FACSM, Alfonso Jimenez1. 1Coventry University, Coventry, United Kingdom. 2GOFi Lab, Madrid, Spain. 3Aston University, Birmingham, United Kingdom. 4akactive Research Institute, London, United Kingdom. 5University of Rhode Island, Kingston, RI.
(No relevant relationships reported)

INTRO: The total cholesterol profile includes high and low-density lipoprotein, both of which contribute to cardiovascular disease (CVD) risk. This direct relationship between dyslipidaemia and CVD can be modified by increasing physical activity (PA), and a reduction in total cholesterol of 10.0 mg/dL has shown to reduce incidence of heart disease by up to 54% in adults. PURPOSE: Compare a structured exercise programme to usual exercise for the effects on total cholesterol in healthy, sedentary adults. METHODS: Members (54 males, age 43.3±10.8 y, and 20 females, age 42.9±7.6 y) of GOFi gym, Vallehermoso, Madrid, who had been absent for at least 60 days, were recruited and randomly grouped as control [CON=20], free gym use [FREE=20], and combined structured exercise [COMB=24], for a 12-week intervention. All participants were categorized as “at risk” according to ACSM Risk Stratification Questionnaire. CON were instructed to continue usual at-home habits; FREE were given free roam of the gym and exercised 2-3 days/week; COMB completed a programme of aerobic exercise, resistance training and flexibility training 2-3 days/week and also wore a physical activity tracking device. Cholesterol was obtained via the Accutrend Plus, and levels were compared pre and post intervention. RESULTS: Twenty one participants (28%) completed the study, (CON=6, FREE=6, COMB=9). Paired t-tests showed a significant decrease in total cholesterol for all groups; CON: -8.5 mg/dL (pre=208.5±13.11, post=200±19.4, p=0.048), FREE:
Most health coaching (HC) interventions have been delivered through telephone, web-based chatting, or face-to-face instruction. Despite the potentially positive impact of group-based HC by video conferencing (VC) on weight loss and metabolic health, individualized VC sessions have not been studied. PURPOSE: To assess changes in physical activity, body mass, metabolic markers (fasting blood, insulin, glucose, hemoglobin A1c [HbA1c], and HOMA-IR), in obese adults. METHODS: Thirty adults (body mass index [BMI] ≥ 30 kg/m²) were randomly assigned to three groups video conferencing group (VC), in person (IP) group, or a control group (CG), n=10 per group. Participants received a wireless body weight scale and step-tracking accelerometer (Withings, Inc., Cambridge, MA, USA) to synch with their personal smartphones and apps. Participants assigned to VC and IP groups received weekly HC individualized based on data uploaded over the 12-week intervention.

Steps/day and body weight loss were analyzed via analyses of covariance (ANCOVA). Between-group ANOVAs analyzed pre- and post-intervention changes in weight (kg), blood glucose, insulin, HbA1c, and HOMA-IR. RESULTS: Mean weight loss and percent weight loss (%) was greater (p<0.05) for VC (8.2±3.4kg; 7.7%) than IP (3.4±2.6kg; 3.4%) and CG (2.9±3.9kg; 3.3%) respectively. Steps/day were significantly higher in VC than IP at week 4 only and VC was significantly higher than CG at weeks 6, 8, 9, and 11 (p<0.05). No within- or between-group differences were found for glucose, insulin, or other metabolic markers. CONCLUSION: Our innovative, multidisciplinary, telemedicine health coaching delivered through VC led to more favorable changes in weight loss, physical activity (steps/day), and HOMA-IR than in-person or no health coaching. VC may be an economical approach to improve health and promote behavior change in obese adults. Future studies using VC health coaching in group and individualized formats, and for other population subgroups, are needed to investigate impacts of weight loss on other health outcomes. Supported by NIH Grant SUL1GM118797-02.
Purpose: To assess attendance and retention rates in inactive middle-aged adults of a fitness centre between a traditional PA plan and a structured PA program meeting ACSM guidelines.

Methodology: Eighty inactive middle-aged adults (44.3 ± 6.99 years; 77.89 ± 19.22 kg; 158.75 ± 36.08 cm) from a Spanish fitness centre voluntarily enrolled in this study. Participants were randomly assigned to two groups (Free Exercise [FE = 40]; Structured Program [SP = 40]) and proved to be inactive through IPAQ short version. Participants completed baseline measures including body composition, VO2max, cholesterol, triglycerides, blood glucose, flexibility, and muscular strength. During the ensuing 12 weeks, weekly attendance of both the FE and SP groups were tracked, with both groups initially agreeing to exercise 2-3 days per week for at least 20 sessions. FE group was introduced to trainers of the fitness centre and informed of group exercise sessions available. SP group received a structured program based on ACSM guidelines for PA.

Results: No baseline differences (p>0.05) existed between groups for age, body composition, VO2 max, haematoctic, Flexibility, and muscular strength. A total of 13 participants (16%) never attend the initial assessment, and only 20 members (25%) attended 20 days or more (FE=5 [12.5%]; SP=15 [37.5%]). Members of SP group attended more total days (15.73 ± 8.19) than FE group (7.79 ± 8.62) during the 12 weeks (p<.001; ES = 0.945; IC: 3.83 – 12.04).

Conclusion: Inactive adults receiving a structured PA program attended more days compared to those enjoying ‘free’ exercise, however, overall retention rate was still low for all participants. This pilot data shows the potential benefit of fitness centre providing structured daily programs to enhance retention.

---

Purpose: Although African Americans are more likely to die of a myocardial infarction than any other racial group, few data are available regarding the impact of exercise interventions in ‘at-risk’ black women as compared with their white counterparts. METHODS: Women ≥18 years without known cardiovascular disease with ≥1 coronary risk factor were enrolled in a community-based exercise program ≥3 days per week for 12 weeks. Exercise training intensity ~50-80% of functional capacity, using estimated heart rate (HR) and/or rating of perceived exertion (RPE) as the primary intensity modulators. Pre- and post-conditioning quality of life (QOL) assessments (Depression [PHQ-9] and level of daytime sleepiness), dietary fat intake, Duke Activity Status Index (DASI score), changes in cardiovascular efficiency (systolic/diastolic blood pressure [SBP/DBP]), HR, RPE during a standardized submaximal workload, and anthropometric measures, including body weight, body mass index (BMI), and waist circumference, were evaluated. RESULTS: Of 556 volunteers, 143 were excluded, leaving 413 women (222 white, 191 black; mean ± SD age = 61 ± 9) who met compliance criteria. Both groups demonstrated significant (P<0.05) post-conditioning decreases in BMI, waist circumference, resting SBP/DBP, total and low density lipoprotein cholesterol, reductions in HR, SBP/DBP, and RPE at a fixed submaximal workload, and in fat screener, depression, and sleep scores. DASI scores increased significantly (P<0.0001) for both groups, signifying increases in self-reported functional capacity. Women presenting with mild-to-moderate depression symptoms (n = 168) demonstrated the greatest decrease in PHQ-9 scores, averaging 8.9 and 3.5 at baseline and follow-up, respectively. Although 87 women (21%) experienced a musculoskeletal injury during the program, there were no exercise-related cardiovascular events. CONCLUSION: A progressive moderate-to-vigorous exercise intervention without preliminary exercise testing elicited comparable improvements in risk factors, anthropometric and QOL measures, and cardiovascular efficiency in ‘at-risk’ black and white women. These achievements were exercised levels below those recommended by contemporary Physical Activity Guidelines.

---

Purpose: To analyze the factors associated to the stage of behavior change among professionals from health institutions. Methods: The sample consisted of 1036 professionals (241 male and 794 female). The dependent variable was the irregularly active group of the behavioral stage questionnaire (proposed by Prochaska, 1988). The independent variables were: gender, age, BMI, waist circumference, presence of diseases, health perception and quality of life. Statistical analysis: Binary Logistic Regression (Odds Ratio (OR) and its respective 95% CI confidence intervals) were used to associate the study variables. Results: The factors associated with irregularly active behavior change were: gender, BMI, circumference of the abdomen, presence of disease, health perception and quality of life. On the other hand, age not associated with the stage of irregularly active behavior change, see table below. Conclusion: The irregularly active group presented a greater chance of being obese, having a cardiovascular risk, a negative health perception and a poorer quality of life.
PURPOSE: The major components of Metabolic Syndrome (MetS) are often associated with inflammation, decreased insulin sensitivity and impaired endothelial function, suggesting failure in the anti-oxidant defenses.

OBJECTIVE: To investigate the lipoperoxidation (MDA), total antioxidant performance (TAP), and glutathione-redox state in MetS patients under a lifestyle-modification program (LiSM).

METHODS: From the 112 subjects participating in the ongoing longitudinal project “Move for Health” (2009-2012) 57 attended the 20wk LiSM with nutritional counseling and combined aerobic (3 times/wk) and resistance (2 times/wk) exercises. All they had anthropometric, clinical, dietary quality (HEI), cardiorespiratory fitness (CRF) and plasma-biochemistry data. Plasma hydrophilic TAP was measured by an antioxidant assay. Plasma malondialdehyde (MDA), total and oxidized (GSSG) glutathione were measured by HPLC. Reduced (GSH) glutathione was estimated. Statistical Analysis Software (SAS version 9.1.3, SAS Institute, USA) was used for p<0.05 significance.

RESULTS: The sample was predominantly composed by females (72%), under 65 years old (55±8 yr), 65% obese, 59% taking medications and 33% smoking. Primary outcomes after LiSM were the decreasing of MetS by 33% (27% to 18%), BMI, WC and body fat and the increasing of HEI, CRF, HDL-C, GSH and plasma TAP. However, only subjects without MetS increased HDL-c, TAP and GSH and decreased GSSG/GSH ratio. After LiSM, subjects TAP-responsive (23%) differed from the non-responsive (≤3%) by presenting increased values of CRF, HDL-c and uric acid and decreased SBP. Additionally, the TAP-responsive group increased GSH and decreased GSSG as well as the GSSG/GSH ratio. In the presence of MetS the TAP responsiveness to LiSM was associated with decreasing WC, glucose and MDA values, while in the absence of MetS, the TAP responsiveness to LiSM was positively influenced by the increased HDL-c and GSH. The multiple-adjusted regression analysis showed GSH as influencing factor for plasma TAP changes, in the presence and absence of MetS. However, only the decreased GSSG discriminated the non-MetS subjects.

CONCLUSION: LiSM decreased MetS and increased TAP and GSH however, only GSSG discriminated MetS in a 20-wk LiSM intervention.

PURPOSE: The purpose of this study was to test the efficacy of arginine, alanine, and phenylalanine mixture (A-mix) ingestion at 1,500 mg/day in combination with the promotion of physical activity for abdominal fat reduction in overweight adults.

METHODS: A placebo-controlled, double-blind, parallel-group, randomized trial for 12 weeks was conducted with a 4-week follow-up period. The participants were aged 20-64 years old. The participants were randomly assigned to the A-mix or a placebo group, and were administered 500-mL test beverage containing 1,500 mg or 0 mg of A-mix, respectively, for 12 weeks. All participants endeavored to maintain a physically active lifestyle between week 0 and week 12 through monthly physical activity sessions. The primary endpoints were the 12-week changes in abdominal total, subcutaneous, and visceral fat areas, as assessed by computed tomography.

RESULTS: Of the 200 enrolled participants, 199 (99%) accomplished the per-protocol-based analysis for 194 participants demonstrated that the abdominal total fat area decreased significantly in the A-mix group compared with that of the placebo group (difference, 10.0 cm²; 95% confidence interval, 0.4-19.6 cm²; P = 0.041). Comparable outcomes were acquired for the abdominal subcutaneous fat area (difference, 7.4 cm²; 95% confidence interval, 0.1-14.7 cm²; P = 0.047). Of particular importance was that 46% of participants initially self-reported that they were physically active for more than 150 minutes per week, which shows many people underestimate their actual PA. Continuous monitoring of PA through wearable technology can be a useful modality aiding in weight loss.

CONCLUSIONS: Of particular importance was that 46% of participants initially self-reported that they were physically active for more than 150 minutes per week, which shows many people underestimate their actual PA. Continuous monitoring of PA through wearable technology can be a useful modality aiding in weight loss.

PURPOSE: Randomized Trial Of Amino Acid Mixture Combined With Physical Activity Promotion In Overweight Adults

Keisuke Ueda1, Hiroyuki Sasaki2, Takehiro Tsujimoto3, Chikai Sanbongi1, Shuji Ikegami1, Hiroyuki Kobayashi3, Yoshio Nakata1,1 Meiji Co., Ltd., Odaawa, Japan. The University of Tokyo, Meguro, Japan. Shimane University, Matsue, Japan. University of Tsukuba, Tsukuba, Japan.

Reported Relationships: K. Ueda: Salary; Meiji Co., Ltd. .

PURPOSE: The purpose of this study was to test the efficacy of arginine, alanine, and phenylalanine mixture (A-mix) ingestion at 1,500 mg/day in combination with the promotion of physical activity for abdominal fat reduction in overweight adults.

METHODS: A placebo-controlled, double-blind, parallel-group, randomized trial for 12 weeks was conducted with a 4-week follow-up period. The participants were aged 20-64 years old. The participants were randomly assigned to the A-mix or a placebo group, and were administered 500-mL test beverage containing 1,500 mg or 0 mg of A-mix, respectively, for 12 weeks. All participants endeavored to maintain a physically active lifestyle between week 0 and week 12 through monthly physical activity sessions. The primary endpoints were the 12-week changes in abdominal total, subcutaneous, and visceral fat areas, as assessed by computed tomography.

RESULTS: Of the 200 enrolled participants, 199 (99%) accomplished the per-protocol-based analysis for 194 participants demonstrated that the abdominal total fat area decreased significantly in the A-mix group compared with that of the placebo group (difference, 10.0 cm²; 95% confidence interval, 0.4-19.6 cm²; P = 0.041). Comparable outcomes were acquired for the abdominal subcutaneous fat area (difference, 7.4 cm²; 95% confidence interval, 0.1-14.7 cm²; P = 0.047). Of particular importance was that 46% of participants initially self-reported that they were physically active for more than 150 minutes per week, which shows many people underestimate their actual PA. Continuous monitoring of PA through wearable technology can be a useful modality aiding in weight loss.

CONCLUSIONS: Of particular importance was that 46% of participants initially self-reported that they were physically active for more than 150 minutes per week, which shows many people underestimate their actual PA. Continuous monitoring of PA through wearable technology can be a useful modality aiding in weight loss.

REPORTED RELATIONSHIPS: K. Ueda: Salary; Meiji Co., Ltd.
**Board #133** May 30 9:30 AM - 11:00 AM

**Validity Of Adhesive Worn Actigraph GT3X+ Accelerometer**

Anna Magee Morris, Roxanna Lopez, Eleanor Stevenback, Katherine H. Ingram, Ph.D., Kennesaw State University, Kennesaw, GA.

(No relevant relationships reported)

**PURPOSE:** The ActiGraph GT3x+ activity monitor (ActiGraph, Pensacola, FL) is typically worn with a belt around the waist, ankle, or wrist. Due to low compliance and observations of discomfort with belt-worn accelerometers, this study examines the validity of wearing the ActiGraph directly on the hip using an adhesive patch.

**METHODS:** Eleven participants (Age: 22 ± 1, BMI: 24.2 ± 4.2) wore two ActiGraphs for four days; one on a waist belt and the other attached using a Tegaderm-Film adhesive (3M Medical, Maplewood, MN). Data gathered from accelerometers were uploaded to the ActiLife software. Wear-time of both devices was validated with participants’ daily activity logs. Tri-axial motion data were then analyzed using a paired samples t-test.

**RESULTS:** Strong correlations were found on motion axes 1,2, and 3 (r = 0.946, 0.955, and 0.905, respectively, p < .001 for all).

**CONCLUSIONS:** When using ActiGraph GT3x+ accelerometer, adhesive worn devices may be a valid alternative to traditional belt-worn devices.

**Board #134** May 30 9:30 AM - 11:00 AM

Changes in Perceived Importance of Physical Activity and Nutrition for Health Following (S)Partners Intervention

Brennie R. Carlson1, Rachel Greco, 498552, Erich J. Petushek2, Karin A. Pfeiffer, FACSM3, Joseph J. Carlson1. 1Michigan State University Extension, East Lansing, MI. 2Northern Michigan University, Marquette, MI. 3Michigan State University, East Lansing, MI. (Sponsor: Karin Pfeiffer, FACSM)

(No relevant relationships reported)

Physical activity (PA) and nutrition are important components to prevent or reduce risk of cardiovascular disease (CVD) in youth. School-based programs designed to promote nutrition and PA behaviors have shown some success in improving these health behaviors and overall health status. A factor related to adopting nutrition and PA behaviors is an individual’s perceived importance of the behavior on health. **PURPOSE:** To determine whether perceived importance of PA and nutrition improves better in 5th grade students participating in a multi-level school and web-based Nutrition and PA intervention versus students receiving lessons alone (active comparison).

**METHODS:** Pre- and post-data were collected from 1060 students from 14 schools in Michigan, from 2008 - 2015 who participated in the (S)Partners intervention (n=810; 8 lessons, web modules, and college mentors); or an active comparison (n=250; 8 lessons only). Participants completed a self-report survey on perceived importance of PA and nutrition in relation to health (4 Point Likert scale).

**RESULTS:** Repeated measures ANOVA results revealed that there were no between-group differences or interaction in perception of importance of both PA (Mean(SD): Spatners pre = 2.32(0.74) and post = 2.48(0.66) vs Active pre = 2.19(0.72) and post = 2.38(0.72), and nutrition (Mean(SD): Spatners pre = 2.26(0.78) and post = 2.37(0.73) vs Active pre = 2.19(0.72) and post = 2.31(0.71)) in relation to health, however both groups increased over time in both measures (p <.001 for time). **CONCLUSION:** Both groups improved their perception of the importance of health benefits regarding PA and nutrition. Future analysis will be conducted on this data to determine how improvements in perception of the benefit of nutrition and PA behaviors contribute to adopting or maintaining nutrition and PA behaviors throughout life.

**Board #135** May 30 9:30 AM - 11:00 AM

Weight Status Differences In Light-intensity Physical Activity Increases From A Workplace Behavioral Intervention

Kara L. Gavin1, Jennifer A. Linde2, Nancy E. Sherwood3, Julian Wolfson2, Matthew P. Buman, FACSM3, Mark A. Pereira2. 1Northwestern University, Chicago, IL. 2University of Minnesota, Minneapolis, MN. 3Arizona State University, Phoenix, AZ. (Sponsor: Matthew Buman, FACSM)

(No relevant relationships reported)

**Purpose:** Workplace intervention targeting reductions in sedentary time and increases in light-intensity physical activity (LPA) may be effective at increasing LPA, especially among overweight and obese individuals, who may find it challenging to achieve recommended levels of moderate-vigorous physical activity. This study examined increases in LPA following 3 months participation in a workplace-based intervention targeting changes in sedentary and LPA time.

**Methods:** Data for this secondary analysis came from the Stand & Move at Work group-randomized worksite intervention trial conducted in 24 worksites throughout the Minneapolis-St. Paul, MN and Phoenix, AZ metropolitan areas. Recruitment began in January 2016. LPA was measured at baseline and 3 months (12 and 24 month data collections are ongoing) by activPAL accelerometers. Height and weight were measured at baseline by trained staff. Linear mixed models using an unstructured working correlation examined the association of BMI category with baseline work time LPA participation, all day LPA participation, and change in work time LPA participation from baseline to 3 months.

**Results:** Light intensity physical activity associated with BMI category

<table>
<thead>
<tr>
<th>Baseline Total LPA:</th>
<th>BMI Category</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI &lt;25</td>
<td>13.63 (2.80)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>BMI ≥25</td>
<td>7.77 (2.74)</td>
<td>&lt;.01</td>
</tr>
</tbody>
</table>

**Conclusion:** These findings show that while LPA differed significantly by weight status at baseline, change in LPA was not significant. A worksite sedentary and LPA intervention may be effective for individuals across BMI category. Future worksite health interventions including those that target health behaviors such as diet and/or physical activity, weight management, and stress reduction should seek to examine potential differential effects by weight status.

**Board #136** May 30 9:30 AM - 11:00 AM

Understanding Patient Experiences with Healthcare Providers and Exercise Promotion

Ann M. Sylvia. Bridgewater State University, Bridgewater, MA.

(No relevant relationships reported)

**Purpose:** Obesity-related diseases and disorders are the second leading cause of preventable death. The promotion of exercise from healthcare providers has been shown to significantly increase physical activity levels of patients. Prescribing exercise to obese patients to qualified exercise professionals has been identified as an opportunity to reduce the current rate of obesity. In order to use exercise as a form of medicine, it is recommended that physical activity counseling be a part of every wellness visit and that health care providers become active in counseling and referring patients to properly educated and certified professionals for exercise. The purpose of this study was to describe the type of information patients currently receive about regular exercise from primary healthcare providers (PHPs). **Method:** An exploratory descriptive study was conducted in an attempt to understand patient experiences with their healthcare providers regarding exercise promotion. Two dichotomous questions and one open-ended response were used to determine the nature of PHPs’ recommendations regarding participation in regular exercise and the qualifications of fitness professionals to support those efforts. **Results:** The sample consisted of 459 adult females representing three calculated BMI categories. 63.4% of participants indicated their PHP’s recommended they engage in regular exercise to support improved health. Through content analysis of open-ended responses of PHPs’ exercise recommendations, six distinctive categories representing types of recommended exercise (e.g., endurance training, group exercise) were identified. Of the participants indicating that their PHP’s recommendations included engaging in regular exercise, 100% received no information about qualified fitness professionals to guide their exercise efforts. **Conclusions:** While patients are being encouraged by PHPs to engage in exercise for improved health, the information being offered is limited to the type of exercise in which they should engage. No information is being provided to help patients identify a qualified exercise professional to support and guide their efforts to use exercise as a means of improving their health.
Squats are a popular closed-chain exercise that can benefit strength, power, balance, and range of motion. Proper squat technique includes varying depths and widths. Purpose: This study investigated sagittal plane knee and hip moments during 9 different squat variations. Methods: 10 healthy, college-aged adults (7 female, 3 male, mass = 67.4 ± 10.7 kg; height = 1.68 ± 0.08 m) performed body-weight squats at 3 widths (standard (shoulder width)), wide (150% of shoulder width), and widest (200% of shoulder width)) and 3 squat depths (shallow (55 degree knee flexion)), parallel (90 degree knee flexion), and deep (125 degree knee flexion)). Anthropometric, marker coordinate, and force data were combined to calculate peak hip and knee moments during the eccentric (downward) and concentric (upward) phases of the squat. 2x3 ANOVAs were used to evaluate the effect of squat depth and width on peak hip and knee eccentric and concentric moments. Results: Generally, concentric and eccentric hip and knee moments increased with greater squat depth and decreased with increased squat width. At the deep depth, the eccentric moments for the wide and widest stance widths decreased significantly less when compared to the standard width at the knee (standard = 1.23 ± 0.29 Nm/kg; wide = 1.09 ± 0.21 Nm/kg; widest = 0.98 ± 0.15 Nm/kg; p = 0.01) and at the hip (standard = 0.99 ± 0.21 Nm/kg; wide = 0.89 ± 0.19 Nm/kg; widest = 0.78 ± 0.17 Nm/kg; p = 0.001). At the parallel depth, the eccentric hip moment for the widest stance width (0.78 ± 0.13 Nm/kg) was significantly less than the eccentric hip moment for the standard (0.94 ± 0.18 Nm/kg) and widest stance widths (1.07 ± 0.20 Nm/kg) when compared to the wide (1.19 ± 0.21 Nm/kg) and standard stance widths (1.30 ± 0.28 Nm/kg; p < 0.01). Conclusions: Squat depth and stance width influence hip and knee joint moments, and both should be considered when performing a squat. If deep squats are used to increase lower-extremity muscle activation and overall work, increasing stance width will reduce sagittal plane hip and knee moments and possibly joint loads. Further research is needed to investigate other methods of reducing lower-extremity joint load while exercising.
Given that 60 million American households own at least one dog, there is growing interest in promoting dog walking to increase physical activity at the population level. An estimated 40% of dog owners do not walk the dog regularly, providing a large target population for intervention. Dog obedience training can plausibly serve as a means to increase physical activity and to strengthen the dog-owner bond, as a construct strongly associated with dog walking behavior.

METHODS: Forty-one healthy but inactive individuals (85% female; mean age = 40) who reported walking their dog ≤5 d/wk were randomized to a 6-week basic obedience training class (INT; n=21) or a wait list control group (CON; n=20). Participants recorded all dog walking bouts and wore an Actigraph GT3X+ on their right hip for 7 d at baseline and 6-weeks. T-tests assessed group differences in changes in dog owners’ self-reported dog walking behavior and device-measured moderate-to-vigorous physical activity (MVPA) after completing basic obedience training. RESULTS: At baseline, participants reported 48.5±62.7 min/wk of dog walking and averaged 22.0±22.2 min/d of MVPA. Intervention participants that completed post-program evaluation and improved upon.

CONCLUSION: To further increase patient and provider participation and adherence to the EIM@OSU program, facilitators and barriers to adherence need to be evaluated and improved upon.

The benefits of exercise on multiple health parameters has been well established, yet most individuals do not meet the recommended minimum standard of exercise, as defined by the American Heart Association (Garber et al., 2011; Thompson et al., 2003). Data suggests that supervision of exercise by an exercise professional improves exercise adherence, yet most studies and systematic reviews of referral based programs have failed to demonstrate their effectiveness (Garber et al., 2011; Orrow, Kimmonth, Sanderson, & Sutton, 2012; Williams, Hendry, France, Lewis, & Wilkinson, 2007). Exercise is Medicine at The Ohio State University (EIM@OSU) addresses many of the pitfalls of previously studied programs in order to increase patient participation and compliance with regards to exercise standards, and aims to encourage provider utilization of exercise in the prevention and treatment of chronic disease.

PURPOSE: To evaluate patient participation and adherence, as well as provider provider utilization of a unique referral-based exercise program (EIM@OSU).

METHODS: Retrospective review of the EIM@OSU program from July 2015–May 2017 examining patient participation and completion of phase I and phase II of the program, determination of patient facilitators and barriers to participation, and review of provider utilization of the program including barriers and facilitators.

CONCLUSION: To further increase patient and provider participation and adherence to the EIM@OSU referral program, facilitators and barriers to adherence need to be evaluated and improved upon.

Funding: NHLBI R01-HL11842 (Donnelly); NIDDK F32-DK103493 (Szabo-Reed)
Effects of 4-week Crossfit training on weightlifters' body composition

Shui-Chang Hsu, Jyun-Ru Chen, Szu-Kai Fu, Wei-Chin Tseng, Kuo-Wei Tseng, Chang-Chi Lai. Department of Exercise and Health Sciences, University of Taipei, Taipei, Taiwan

Abstract Background: Crossfit training includes Olympic weightlifting, gymnastics, and sprint. Previous studies revealed that crossfit training could increase cardiovascular fitness and decrease body fat, but it lacked crucial evidence for athletes, especially weightlifters. Purpose: The aim of this study was to determine the effects of 4-week crossfit training on weightlifters' body composition. Method: Eight college weightlifters participated in this study. All subjects were randomly assigned to two groups, which were resistance training group (RT, n = 4), and crossfit training group (CF, n = 4). Both groups received training 3 days a week for 4 weeks. Snatch performance and body composition from both groups were measured at week 0 and week 5. Results: The result showed that there was no significant difference between two groups in all variables. CF significantly decreased in average rate of force development (RFD), but significantly increased isotonic strength, thigh muscle mass at week 5. RT significantly decreased on average RFD of snatch, but significantly increased body fat at week 5. Conclusion: The results showed that muscle mass increased after a 4-week crossfit training, but body fat level did not decrease. Thus, crossfit training is not suggested to be adopted to rapidly lose weight in pre-competitive phase. Key words: body composition, high intensity interval training, body fat.
PURPOSE: We conducted a community-wide intervention to promote physical activity (PA) in Fujisawa, Kanagawa, Japan, since 2013. The intervention involves multi-level strategies, as part of which, community-dwelling elderly groups committed to exercising together were enrolled. This study aimed to assess the effects of community-based group exercises (CBGE) on increase and maintenance of PA level and dissemination of the PA message, as well as improvement of physical fitness.

METHODS: This study included 148 older adults (mean age: 75.7 ± 6.5 years, women: 66%) in 8 CBGE groups. The original 10-min exercise program (mean intensity: 2.7 METs, Ochiai et al. 2015) was introduced to groups voluntarily exercising together at least once a week at a city center or a park in their community. Based on Japanese PA guidelines, we have recommended the individuals perform “Plus Ten (+10-min of PA per day)” and disseminate the message to surroundings. In addition, we held group discussions about maintenance and dissemination of CBGE at exchange meetings. Dissemination of “Plus Ten” message, total duration of PA (exercise and daily activities) by the questionnaire, and physical fitness tests were assessed at baseline, 6-month, and 1-year follow-up. Statistical analyses included Wilcoxon signed rank test, paired t test and chi-square test.

RESULTS: We visited each group 5–6 times on goal assessment and follow-up in a year. The group exchange meeting was held 3 times. One year later, 137 (93%) continued CBGE and 11 (7%) dropped out due to health or relocation; 42 joined the group during the year. In neighborhoods, 79% of participants shared “Plus Ten” message. The median of total PA time at baseline and 1-year after was 780 and 840 minutes/week, respectively (P<0.01). Significant improvement was observed in 2.8 kg ± 0.1 vs 3.2 kg ± 0.1 (P<0.05) in the two-step test (1.3 ± 1.39, P<0.001) and chair standing test (22.9 ± 24.9 times/30 sec, P<0.001).

CONCLUSIONS: CBGE had high persistence rates, maintenance of PA, and improvement of physical fitness. Dissemination of subjective PA message from CBGE members can be effective in promoting community-level PA. Supported by the Japan Agency for Medical Research Development and Development (AMED), MEXT KAKENHI Grand Number JP14023054 and Keio Gijuku Academic Development Funds.

9% of school students in Chile have the normal physical fitness standards. Chile presents important socioeconomic and geographic differences. PURPOSE: Compare the cardiovascular risk, and physical fitness, according to sex, socioeconomic level and geographical region in a national sample of Chilean school students. METHODS: Descriptive cross-sectional study. Sample was composed of 10,381 students, who completed the national physical condition tests (SIMCE-EF). Variables included sociodemographic (sex, socioeconomic level, region), anthropometric indicators (weight, height, waist circumference, BMI), physical fitness was measured by lower limb strength (vertical jump test), abdominal strength (sit ups), upper limb strength (push ups), and trunk flexibility (sit and reach test), and effort heart rate (CFra test). The BMI, heart rate (HR) and waist height ratio (WHHR) were analyzed as predictors of cardiovascular risk. We use the T-Test, ANOVA Regression and Tukeys Test-Pairwise comparison with level of significance p < 0.01. RESULTS: The predictors of cardiovascular risk were (p < 0.01) when compared by region and socioeconomic level. Physical tests was (p < 0.01) in abdominal strength and lower limbs. Sex was (p < 0.01) in WHR and HR. There is an inverse relationship of statistical significance between WHR and HR in sit and reach and push ups. At regional levels, differences were also found to be statistically significant in averages and variances in extreme geographical zones. CONCLUSION: The differences found in the predictors of cardiovascular risk could apparently be explained due to the geographical and socioeconomic characteristics of each region. It is suggested that the physical fitness tests should consider the incorporation of variables that directly measure cardiovascular risk in Chilean school students.
311 Board #152 May 30 9:30 AM - 11:00 AM

Does Physical Activity Programming Influence Health and Wellness Attitudes in a Rural School District?

Madeline A. Lyon1, Timothy K. Behrens, FACSM1, Dick Carpenter2, Elizabeth Tucker1, Carmen Luna1, Juliene Field1, Cheryl Kelly1, 1Northern Arizona University, Flagstaff, AZ. 2University of Colorado Colorado Springs, Colorado Springs, CO. 3Kaiser Permanente Colorado, Denver, CO.

(No relevant relationships reported)

PURPOSE: To investigate the impact of a district-wide wellness program on students, parents, and staff in a rural school district. METHODS: In this one-group, pretest-posttest design, a high need (45.1% free or reduced lunch) rural school district in southern Colorado (USA; N=13 schools) was awarded a grant to implement physical activity (PA) programming. The wellness team developed a survey consisting of 29 questions on a five-point Likert scale (SA-SD). These questions asked about PA and its importance to the participants (e.g., community support for health and PA, withholding PA as punishment, importance of health and PA for participants, etc.). The survey was provided via email link to parents and staff, and to students in classes, during fall and spring semesters. Intervention activities included various programming and challenges (e.g. Playworks™, Weigh and win™, bike/walk to school/work, Fitbit challenges, etc.). Descriptive statistics were calculated for all variables of interest, and non-parametric tests were used to examine significant differences between fall and spring semesters. RESULTS: Surveys of parents indicated no significant improvements in PA variables across semesters. Staff surveys indicated three areas in which the spring survey were significantly worse (healthy eating/active living are important p=.04, free play is important p=.0001, effective to withhold PA as punishment p=.0472), though these findings were not practically meaningful. Student surveys indicated significant positive change in seven areas (healthy eating & active living are important p=.0001, personal health & wellness are important to me p=.001, my school provides opportunities for healthy eating and PA p=.0001), it’s acceptable to be withheld from PE/ recess as punishment p=.048, my community provides opportunities for healthy eating and active living p=.0091, how often do brain breaks occur? p=.005, what time of day to brain breaks occur? p=.0133), but the only “healthy eating/active living are important” and “community opportunities for healthy eating/active living” were practically meaningful. CONCLUSIONS: PA programming had a mixed influence. Future research should investigate similar phenomena in rural schools to better understand factors related to changes in PA awareness and behaviors.

312 Board #153 May 30 9:30 AM - 11:00 AM

The Influence Of Upper Extremity And Whole-body Movements On Energy Expenditure During Active Gaming Movements On Energy Expenditure During Active Gaming

Keith Naugle. IUPUI, Indianapolis, IN.

(No relevant relationships reported)

Active video gaming has recently become an entertaining tool used to exercise and increase energy expenditure. However, the evidence is mixed in regards to whether active gaming alone can facilitate energy expenditure similar to that of moderate intensity exercise, and likely depends on the type of movements elicited during game play. PURPOSE: To determine the influence of upper extremity and whole-body movements on energy expenditure during active gaming.

METHODS: Twenty-four healthy adults completed a training session and four experimental sessions. During each experimental session, participants played one of four active video games for two 15-minute periods, including two boxing-type games and two tennis games. During the first period, participants played the games at a self-selected intensity. During the second period, participants were given specific instructions designed to maximize movement during game play (standardized period). A portable pulmonary gas exchange measurement system measured energy expenditure during game play. Participants also wore an accelerometer on the hip to measure full body movement and one on the dominant wrist to measure arm movement. Accelerometry measures included percentage of time spent in whole body moderate to vigorous physical activity (MVPA), whole-body light physical activity, and whole-body sedentary time, as well as the same measures on the arm. Linear regression was used to determine the most important accelerometer variable in predicting energy expenditure (METs) during the self-selected intensity period and the standardized instructions period.

RESULTS: The regression on METs during the self-selected intensity period indicated that the accelerometer data predicted METs (p<.001), accounting for 47% of the variance. Whole body MVPA was the only significant variable (p=.008, Beta=.376), with percentage of time spent in whole body sedentary behavior approaching significance (p=.052, Betar=-.262). The regression on METs during the standardized period revealed similar results, with percentage of time spent in whole body MVPA the only significant predictor (p=.021, Betar=-.498).

CONCLUSIONS: These results suggest that maximizing whole body MVPA, and not just arm movements, is integral to facilitating energy expenditure during active game play.

313 Board #154 May 30 9:30 AM - 11:00 AM

Promoting Physical Activity Via Cooperative Extension

Katherine B. Gunter, FACSM1, Samantha Harden2, Anne Lindsay1. 1Oregon State University, Corvallis, OR. 2Virginia Tech, Blacksburg, VA. 1University of Nevada, Reno, Reno, NV.

(No relevant relationships reported)

Purpose: The aim of this study was to evaluate factors associated with physical activity (PA) promotion efforts via the cooperative extension (CE) system.

Methods: Cross-sectional survey distributed to Family and Consumer Science listservs across land grant institutions from all 50 states.

Results: Among responders (N=806), 625 (77.5%) completed ≥ 95% of survey questions and are included in this analysis. Respondents span the age categories of 18-29 (14.4%); 30-39 (18%); 40-49 (19.5%); 50-59 (27.9%); 60 (20.2%) and have been working with CE for 10.7 ± 9.5 years, and most (64.1%) spend ≥ 20% of their time working with government nutrition assistance education programs (SNAP-Ed and/or EFNEP). Most are county-based (73.2%) and work predominately in rural areas (60.1%). All agree or strongly agree that engaging in PA is important, however, only 40.5% and 50.6% personally meet or exceed the PA recommendations for muscle strengthening or aerobic activity, respectively. Forty-five percent implement PA as part of nutrition education lessons, while 8.3% and 19.8% lead stand-alone youth or adult PA programs, respectively. Nearly 60% are engaged in PA promotion efforts in school and community settings. Only 50.6% have attended trainings related to PA promotion and (43.6%) agree or strongly agree that CE leaders provide support for PA training opportunities. While 63.7% agree or strongly agree that CE leaders endorse PA promotion as a role and responsibility of CE personnel, only 44% and 40% respectively, report PA promotion efforts are a component of outcome and impact reports, or a documented expectation in extension position descriptions.

Conclusions: A majority of CE personnel across the U.S. engage in a variety of PA promotion and programming efforts, but gaps exist in training and administrative support or documentation of these efforts. Trainings to address PA promotion efforts and impact/outcome assessment are needed.

314 Board #155 May 30 9:30 AM - 11:00 AM

Integrated Development of Health Promotion Cloud-based Mobile Platform and Application in New Taipei City


(No relevant relationships reported)

Frailty will increase the risk of disability, reduce the average life expectancy of health. In 2015, the pre-frailty prevalence rate and the frailty prevalence rate from the frailty screening survey of the elderly health check was 48.8% and 13.3% respectively in New Taipei City’s 4 rural areas.

PURPOSE: As the result, the mayor declared the launch of the “Fit for Age APP” program in August 2015, which was designed to meet the needs of the pre-elderly and the elderly through the “Frailty and Muscle Strength Test”, “Exercise Nutrition Intervention” and “Data Record” orientations to achieve the goal of prevention and reversal of frailty.

METHODS: We aim to develop an entertaining “Fit for Age APP” which includes “Health Assessment”, “Sports, Diet and Nutritional Record” and “Health Communication”. Furthermore, sports, nutrition, and medical professional teams will undergo the “Backstage Management System” to monitor and give personal feedback timely. We hope the establishment of this multi-functional module and new type health APP not only can improve the use of APP capacity and frequency by the participants.

RESULTS: From August 2015 to the end of December 2015, the promotion, use, and participation of the Fit for Age program were as follows: 1)Promotion effectiveness: Activity promotion screenings: 6,588 sessions, the number of propaganda: 303,480 people, the average daily publicity are 43.9 games with 2023.2 person-time. The number of service bases for Fit For Age: There are 1,559 spots, with average a spot per neighborhood. The situation of media exposure of Fit for Age: Facebook, Line and other community media platform: a total of 22, news media exposure (electronic and flat): a total of 148, an average of 1.1 per day. 2)The use condition of the “Fit for Age APP”: The number of registration up to 31,566 people, the monthly population active utilization ratio: 40%, exercise recording utilization ratio: 23%, nutrition recording utilization ratio: 10%.

CONCLUSION: Through the APP and personal health feedback model, it can enhance personal health knowledge, change personal health attitude, and build self-manage healthy behavior, to achieve the goal of disease prevention and health for all.
With advances in smartphone technology, automatic physical activity (PA) detection and feedback applications that integrate with movement measuring devices (such as smartphone apps and heart rate watches) have become widely available and popularized. However, it is not known whether such automatic systems provide any additional advantage in motivating exercise compliance compared to traditional self-report systems. Purpose: To investigate if the integration of an automatic PA detection and feedback system provides any additional advantage in motivating exercise compliance as compared to a traditional self-report PA system. Method: We developed a Virtual Trainer (VT) exercise promotion program that encourages exercise compliance via a website and a smartphone application. A total of 119 inactive adults entered a randomized control trial under one of the following three conditions: 1) VT with a heart rate watch that allows automatic PA detection and feedback, or 2) VT with self-reported PA record, or 3) no VT (control) with self-reported PA participation. Exercise compliance data were retrieved from the VT PA record and a PA questionnaire (IPAQ) was collected at pre-, post-, and 3-months after intervention (maintenance). Results: All three groups improved PA compliance significantly (p<.01), although a slight drop at maintenance was observed. Two-way repeated measured ANCOVA (age & gender as covariates) found significant time effects (p<.01) but no interaction effect (p>.05). The IPAQ revealed that PA compliance in both VT conditions improved by more than double after intervention. Changes in exercise compliance between the three conditions were not different. Conclusion: In a web-based + smartphone app interactive exercise promotion program that promotes self-management of regular exercise training, the inclusion of an automatic physical activity detection and feedback system did not bring additional benefits compared to a traditional self-reported PA recording system.

316 Board #157 May 30 9:30 - 11:00 AM
Physical Education in the U.S.: Systematic Observations of Physical Activity, Lesson Length, and Class Size
Nicole J. Smith1, Thomas L. McKenzie, FACSM1, LCSU Fresno, Fresno, CA. San Diego State University, San Diego, CA.

(Purpose statements from the authors)

Obtaining widespread information (i.e., surveillance) on physical education (PE) is important for educators and policy makers to understand programs and make valid judgments to improve policy and practices. Most of the information about PE in the U.S. is derived from self-reports—often from respondents distal to actual lessons. The System for Observing Fitness Instrument Time (SOFIT) has been validated, used since 1989, and recommended as a surveillance tool for PE.

Purpose: To locate and synthesize studies that used SOFIT to objectively assess class size, lesson length, and moderate-to-vigorous physical activity (MVPA) during PE in U.S. elementary and secondary schools from 1991-2016.

Methods: Following PRISMA Guidelines, we searched 10 library databases and located 233 distinct SOFIT records. Of these, 137 full texts were reviewed, resulting in 20 studies eligible for the current analysis. Studies were included if they were (a) conducted in U.S. schools, (b) published in English in peer review journals, (c) assessed MVPA, lesson length, and class size, and if (d) data were not influenced by interventions. All observers were trained to use the SOFIT protocol.

Results: Data were collected during 5,606 PE lessons (3,469 elementary; 2,137 secondary) in 1,239 schools located in 17 states. There was substantial variation for all variables, both within and among the 20 studies. Secondary school lessons were longer (M=40.5 vs. 30.5 min), had more students (M=40.5 vs. 28.2), and provided more MVPA (M=46.5 vs. 38.4% of lesson time). Overall, only 3 studies met the nationally recommended standard for lesson 50% MVPA. Factoring in lesson length, students in these elementary and secondary schools accumulated only 11.6 and 18.8 MVPA min/lesson, respectively. Even with PE daily, accrued weekly MVPA time would be only about half the recommended amount (300, 2013). Class size in secondary schools also exceeded recommendations.

Conclusions: Direct observations of 5,606 PE lessons show elementary and secondary schools are falling short of national recommendations for MVPA and class size. Schools were not selected at random; therefore, a larger on-campus surveillance study is recommended in order to establish an objective database for PE. SOFIT has been validated and widely used and could serve as a surveillance tool.

317 Board #158 May 30 9:30 - 11:00 AM
Improving Functional Capacity And Physical Activity Through Education: Two-year follow-up Of Parque Study
José Messias Rodrigues da Silva1, Márcia Uchoa de Rezende2, Tânia Carvalho Spada1, Lucila da Silva Francisco2, Helenilson Pereira dos Santos2, Júlia Maria D’Andréa Greve2, Emmanuel Gomes Cioiac2, São Paulo State University (UNESP), School of Sciences, Campus Bauru, Bauru, Brazil. 2Traumatology, School of Medicine, University of São Paulo, São Paulo, Brazil, São Paulo, Brazil. 3Traumatology, School of Medicine, University of São Paulo, São Paulo, Brazil, São Paulo, Brazil. 4University of Guaruí (UNG) – SP, Guarulhos, Brazil. 5São Paulo State University (UNESP), School of Sciences, Campus Bauru, São Paulo, Brazil.

No relevant relationships reported

Purpose: The purpose of present study was to analyze the effects of an educational program emphasizing the regular practice of physical exercise on physical fitness, functional capacity and daily living physical activity levels in patients with knee osteoarthritis (OA).

Methods: Two hundred and thirty-nine patients (X male and Y female) under treatment for primary or secondary knee OA (degree I to IV in the Kellgren and Lawrence scale) at the public health system were randomly allocated to educational (EDU; n = 112) or control (CON; n = 127) groups. All subjects of EDU and CON have their physical fitness (six minute walking test (6MWT) and seat-and-reach test), functional capacity (stair climbing test) and daily living physical activity (IPAQ) - short version assessed at baseline (pre), and during 6, 12, and 24 months of follow-up.

Results: EDU improved (p<0.006) 6MWT at 6 months (10%), which were maintained at 12 months, and slightly reduced (5%) at 24 months. 6MWT also improved (p<0.006) in CON at 6 months, but it was of lower magnitude (4.5%) and returned to baseline at 12 and 24 months. EDU and CON showed similar improvements (p<0.05) in stair climbing at 6 months (CON = 13%; EDU = 12.3%), which were maintained at 12 and 24 months. EDU also showed an increased prevalence of “active” and “very active” subjects, as well as a reduced prevalence of sedentary subjects during follow-up (p<0.05). Although CON also showed an increased prevalence of “very active” subjects during follow-up, it was lower than that observed in EDU. Flexibility did not change during follow-up in both groups.

Conclusions: The present results suggest that an educational program promoting the regular practice of physical exercise may be an effective tool for improving physical fitness, functional capacity and daily living physical activity in patients with knee OA.
Square-Stepping Exercise (SSE) program improves cognitive function as well as lower-extremity functional fitness in the elderly. However, it is unclear which aspects of cognitive function are closely associated with performance in SSE. Given that SSE comprises stepping exercise while remembering step pattern, we hypothesized that working memory plays a key role in performance in SSE.

**PURPOSE:** The purpose of the present study was to test the hypothesis that performance in SSE is associated with working memory.

**METHODS:** Sixteen elderly people (10 males and 6 females, age: 72.9 ± 6.3 years, body mass index: 22.1 ± 3.2 kg/m²) participated in the study. The participants performed a combination of spatial delayed response (SDR) and Go/No-Go (GNG) tasks and SSE. SDR task requires working memory. GNG task requires response inhibition and interference control. The SDR task was graded into three levels of difficulty. Cognitive performance was assessed by reaction time (RT) and accuracy. In SSE, the participants performed a multiple directional step patterns on a mat that partitioned into squares. SSE was graded into five levels of difficulty depending on step pattern. Time to complete SSE was used to assess performance. One-way repeated measures analysis of variance was used for each variable. Pearson correlation analysis was performed to determine the correlation. Data were expressed as mean ± standard deviation. The significance level was set at p < 0.05.

**RESULTS:**
- RT in the SDR task increased with task difficulty (main effect: p < 0.001, level 1: 1.1 ± 0.2 sec, level 2: 1.8 ± 0.3 sec, level 3: 2.2 ± 0.4 sec), while accuracy was not altered. Time to complete SSE also increased with task difficulty (main effect: p < 0.001, level 1: 5.4 ± 0.7 sec, level 2: 8.6 ± 1.4 sec, level 3: 16.7 ± 1.7 sec, level 4: 18.0 ± 3.4 sec). Only eight participants completed SSE at level 2. RT in the SDR task was associated with time to complete SSE at level 2 (r = 0.54, p = 0.03). Performance in the GNG task was not associated with time to complete SSE.
- CONCLUSION: The moderate correlation suggests that performance in SSE is associated with working memory. Exercise intervention with square stepping may be particularly effective to improve working memory.

**CONCLUSIONS:**
- HealtheSteps is an acceptable program for improving the lifestyle habits of individuals at risk for chronic disease. Moving forward, the suggestions for improving the program delivery do not require significant changes to the program protocol.
Family-based pediatric obesity treatment programs have been shown to be effective in reducing obesity among children (Epstein, 2007). A BMI z-score reduction of 0.10 has been shown to achieve clinically meaningful risk factor reduction (Ford et al., 2010), with a 0.25 reduction to maximize risk reduction. An important aspect of combating childhood obesity is ensuring programs reach as many children as possible. Public health impact can be calculated by multiplying the reach of an intervention by its efficacy or effectiveness (Glasgow et al., 1999). PURPOSE: The purpose of this study was to determine the public health impact of Building Healthy Families (BHF): a 12-week family-based pediatric obesity treatment program in a mid-western community of 30,000. METHODS: BHF participants were ages 6-11 years (n=52, age: 9.28 ± 1.59 years) with a BMI ≥ 95th percentile. Participants were measured for mass and stature at baseline and post 12-week intervention for each of nine cohorts. BMI percentile and BMI z-score were calculated based on age and gender. Reach was defined as the number of children eligible for the program divided by those who initiated the program. Effectiveness was represented by change in BMI z-score between baseline and post intervention. Public health impact was calculated by multiplying the number of participants with a BMI z-score reduction of at least 0.10 divided by the number of children eligible for the program. Calculations were made for reach, effectiveness, and impact for all cohorts combined, and each individual cohort. RESULTS: The number of children meeting the eligibility requirements, and passively recruited, was 3,226. A total of 52 children initiated and completed the program for a reach of 1.61%. The overall BMI z-score change was −0.29±0.21. Public health impact was 1.5% suggesting that BHF resulted in clinically meaningful risk reduction for body composition and cardiometabolic health for 1.5% of children ages 6-11 in Kearney, NE. CONCLUSION: The BHF program is effective and increasing its reach is an important consideration to maximize its public health impact.
The relationship between cadence (steps/min) and intensity (metabolic equivalents; METs) has been primarily established with controlled treadmill-based studies. It may be possible to use music to shape performance of overground walking cadence and thus prescribe intensity. PURPOSE: To evaluate overground walking cadence entrainment to music at different tempos (beats per min; BPM) and its ability to modulate intensity in a predictable manner. METHODS: Ten participants (6 men, 4 women; age 22.6±1.9 years, height 172.5±11.8 cm, weight 79.3±18.8 kg) completed six 5-minute walking trials around an oval track (40 m). During these trials, participants listened to a single song and matched their foot strikes to the beat of the music. The song tempo was modulated to 80, 100, and 125 BPM (randomized) using a commercially available app. Participants were outfitted with a portable indirect calorimeter to measure intensity (METs). Cadence during all trials was measured via direct observation (hand tally). Mean absolute percent error (MAPE) was calculated to compare the accuracy of participants’ entrainment (prescribed versus actual cadence). A simple linear regression model was used to evaluate the relationship between cadence and intensity. RESULTS: Participants successfully entrained to the cadences prescribed by the song tempo, especially at faster speeds (MAPE: 3.58±5.63, 3.12±2.88 and 2.63±2.31 for 80, 100 and 125 BPM, respectively). Increased music tempo was associated with a linear increase in intensity across all trials (r=0.16, -2.14, r=0.63, p<0.001). MET values for 80, 100, and 125 BPM were 3.23±0.44, 3.84±0.59, and 5.27±0.78, respectively. CONCLUSION: Participants successfully entrained to the modulated tempo of a single song, and faster music tempos elicited increased intensity. Based on these findings, music entrainment appears to be an effective method for evoking desired cadences during walking. The findings further suggest that music may be selected according to its potential to evoke specific intensities of ambulation. Future studies should examine the relationship between music entrainment and intensity with various song styles.

PURPOSE: Evidence supports the importance of physical activity (PA) in reducing cardiometabolic disease (CMD) risk in adulthood. Less information is available about age-related declines in PA in young adulthood and PA-CMD risk associations in this life course period. The purpose is to describe methods/mechanisms to enhance PA for Healthy Body Healthy U (HBHU) clinical trial, which uses digital intervention strategies to promote weight management among young adults. Recruitment strategies and messaging will be discussed, as well baseline data on objectively measured PA and CMD-risk pertain. Methods: Participants successfully entrained to the modulated tempo of a single song, and faster music tempos elicited increased intensity. Based on these findings, music entrainment appears to be an effective method for evoking desired cadences during walking. The findings further suggest that music may be selected according to its potential to evoke specific intensities of ambulation. Future studies should examine the relationship between music entrainment and intensity with various song styles.

CONCLUSIONS: These preliminary findings indicate there may be periodic windows within young adulthood associated with age-related declines in PA. PA may play an increasingly important role in cardiometabolic control as at-risk young adults transition throughout the life course. Future research could target age-related declines in PA and focus on increasing light activity to reduce CMD-risk.

Aging is associated with a decline in functional fitness, which reduces mobility and impairs quality of life in older adults. PURPOSE: The aim of this study was to assess whether functional fitness tests (i.e., hand-grip strength, one-leg standing time with eyes open, step-test, leg extensor power, knee extensor strength) at age 70 years old (baseline) predict fitness at age 80 years old (10 years follow-up). METHODS: At baseline, 500 independent community-dwelling older adults (70 years old, 300 males and 300 females) performed functional fitness testing, with yearly testing for ten years thereafter. For this analysis, participants were divided into three groups: G1, performed testing each year for 10 years (n=180, 106 males, 74 females); G2, measured only at the 10-year follow up (n=343, 173 males, 170 females); and G3, deceased by 10-year follow up (n=80, 60 males, 20 females). Differences in functional fitness at baseline among groups within males and females were determined using one-way univariate analysis of variance (P<0.05).

RESULTS: Leg extensor power was significantly different between survivors and non-survivors (G1 vs. G3, G2 vs. G3) in males (G1: 14.8±3.5 watt/kg wt, G2: 14.6±3.6 watt/kg wt, G3:19.3±3.4 watt/kg wt) and females (G1: 9.1±2.6 watt/kg wt, G2: 9.0±2.6 watt/kg wt, G3:3.7±3.3 watt/kg wt). Knee extensor strength was significantly different between survivors and non-survivors (G1 vs. G3, G2 vs. G3) in males (G1: 1.21±0.2 kgf/wk, G2: 1.12±0.3 kgf/wk, G3:1.09±0.24 kgf/wk), but not in females. Similarly, one-leg standing time and hand-grip strength at baseline was only significantly different between groups in males (G1 vs. G3, G2 vs. G3) in one-leg standing time (G1: 79.3±42.2 sec., G2: 75.5±43.2 sec., G3: 63.0±45.0 sec.); HG strength, G1: 40.7±5.6 kg, G2: 38.2±5.6 kg, G3:38.0±5.5 kg, respectively). Baseline stepping was significantly different between groups (G1 vs. G3) in females, but not in males (G1: 71.1±11.0/10sec., G2: 70.1±13.0/10 sec., G3: 64.4±12.7/10 sec.)

CONCLUSIONS: Assessment of leg extensor power in older males and females may be an important addition to functional fitness assessment designed to predict healthy aging. Future intervention studies designed to improve leg power and its impact on daily activities could elucidate its role in healthy aging.
associated with femoral neck BMD (B = -.11, p < .015) and lumbar spine BMD (B = -.35, p < .001), but MVPA showed significant effect modifications on both femoral neck BMD loss (B = -.03, p < .042) and lumbar spine BMD loss (B = -.08, p < .017). Also, walking significantly moderated the association between depression and lumbar spine BMD loss in this age group (B = .05, p < .017). In 35-49 yrs old group, depression was significantly inversely associated with femoral neck BMD (B = -.07, p < .003), but walking significantly moderated the association (B = -.01, p < .029). In other age groups, depression was not significantly associated with BMD.

CONCLUSION: This study suggests that practitioners should include MVPA and walking in the depression treatment program to prevent comorbidity for bone mineral loss in young adults.

Corresponding: Miyoung Lee, mylee@kookmin.ac.kr

331 Board #172 May 30 9:30 AM - 11:00 AM Cardiorespiratory Fitness, Different Adiposity Exposures, and Cardiovascular Disease Mortality Risk In Healthy Women

Stephen W. Farrell, FACSM, Carolyn E. Barlow, Benjamin L. Willis, David Leonard, Andjelka Pavlovic, Laura F. DeFina. The Cooper Institute, Dallas, TX.

A Strategy To Reduce The Dropout Rate In A Volunteer-led Community Weight-loss Program

Ryoko Mizushima, Yoshiho Nakata, Xinhuo Zuo, Seiji Maeda, Kiyoji Tanaka, FACSM, Tsukuba University, Tsukuba, Japan. (Sponsor: Kiyoji Tanaka, FACSM)

A Strategy To Reduce The Dropout Rate In A Volunteer-led Community Weight-loss Program

We implemented a volunteer-led community weight-loss program within the Tsuchuira City (Japan) routine health promotion program in 2015. Although the participants successfully decreased their body weight, there was a relatively high dropout rate. We interviewed a focus group after the intervention, revealing a lack of understanding about the weight-loss program. To address this issue, we planned to increase communication among the participants in the subsequent 2016 trial.

PURPOSE: We examined the prospective associations among cardiorespiratory fitness (CRF), different adiposity exposures, and cardiovascular disease (CVD) mortality in women. METHODS: 19,838 apparently healthy women without history of CVD completed a comprehensive baseline health examination between 1970 and 2013. Clinical measures included body mass index (BMI), waist circumference (WC), waist-to-height ratio (W:Ht), percent body fat (%Fat), and CRF quantified as duration of a maximal treadmill exercise test. Women were classified by CRF as low (quintile 1), moderate (quintiles 2-3), and high (quintiles 4-5) as well as by standard clinical cut points for adiposity exposures. Hazard ratios (HRs) were computed using Cox regression analysis. RESULTS: During a mean follow-up period of 19.2 ± 10.3 years, 391 CVD deaths occurred. Adjusted mortality rates for high, moderate, and low CRF groups were 0.55, 1.28, and 2.0 deaths/10,000 women-years, respectively (p for trend < .001). Adjusted mortality rates of overweight women within each adiposity exposure were higher when compared with normal-weight women (p < .001). When grouped for joint analysis into 4 adiposity categories, there was a significant positive trend in CVD mortality across decreasing categories of CRF within each category of W:HT and %Fat, as well as within the normal and overweight BMI categories and the normal WC category (p < .03). CRF was not significantly associated with CVD mortality within the obese BMI or high WC categories. CONCLUSION: Higher levels of CRF are associated with lower CVD mortality risk in women, and attenuate the risk of CVD mortality in overweight women. The use of various adiposity measures to estimate CVD mortality risk in women may be misleading unless CRF is also considered. These findings support the 2016 American Heart Association Scientific Statement recommending that CRF measurement or estimation be included in routine clinical practice.

CONCLUSION: We reduced the dropout rate while obtaining equivalent weight loss by increasing communication among the participants during a volunteer-led community weight-loss program.

333 Board #174 May 30 9:30 AM - 11:00 AM Physical Activity Guideline Attainment and Gender Influence Chronic Disease Risks Among African American College Students

Amanda A. Price, Georgia McCauley, Vanessa Duren-Winfield. Winston-Salem State University, Winston Salem, NC. (Sponsor: Melissa C. Whitt-Glover, FACSM)

A Strategy To Reduce The Dropout Rate In A Volunteer-led Community Weight-loss Program

We implemented a volunteer-led community weight-loss program within the Tsuchuira City (Japan) routine health promotion program in 2015. Although the participants successfully decreased their body weight, there was a relatively high dropout rate. We interviewed a focus group after the intervention, revealing a lack of understanding about the weight-loss program. To address this issue, we planned to increase communication among the participants in the subsequent 2016 trial.

PURPOSE: We examined the prospective associations among cardiorespiratory fitness (CRF), different adiposity exposures, and cardiovascular disease (CVD) mortality in women. METHODS: 19,838 apparently healthy women without history of CVD completed a comprehensive baseline health examination between 1970 and 2013. Clinical measures included body mass index (BMI), waist circumference (WC), waist-to-height ratio (W:HT), percent body fat (%Fat), and CRF quantified as duration of a maximal treadmill exercise test. Women were classified by CRF as low (quintile 1), moderate (quintiles 2-3), and high (quintiles 4-5) as well as by standard clinical cut points for adiposity exposures. Hazard ratios (HRs) were computed using Cox regression analysis. RESULTS: During a mean follow-up period of 19.2 ± 10.3 years, 391 CVD deaths occurred. Adjusted mortality rates for high, moderate, and low CRF groups were 0.55, 1.28, and 2.0 deaths/10,000 women-years, respectively (p for trend < .001). Adjusted mortality rates of overweight women within each adiposity exposure were higher when compared with normal-weight women (p < .001). When grouped for joint analysis into 4 adiposity categories, there was a significant positive trend in CVD mortality across decreasing categories of CRF within each category of W:HT and %Fat, as well as within the normal and overweight BMI categories and the normal WC category (p < .03). CRF was not significantly associated with CVD mortality within the obese BMI or high WC categories. CONCLUSION: Higher levels of CRF are associated with lower CVD mortality risk in women, and attenuate the risk of CVD mortality in overweight women. The use of various adiposity measures to estimate CVD mortality risk in women may be misleading unless CRF is also considered. These findings support the 2016 American Heart Association Scientific Statement recommending that CRF measurement or estimation be included in routine clinical practice.

CONCLUSION: We reduced the dropout rate while obtaining equivalent weight loss by increasing communication among the participants during a volunteer-led community weight-loss program.

A Strategy To Reduce The Dropout Rate In A Volunteer-led Community Weight-loss Program

Ryoko Mizushima, Yoshiho Nakata, Xinhuo Zuo, Seiji Maeda, Kiyoji Tanaka, FACSM, Tsukuba University, Tsukuba, Japan. (Sponsor: Kiyoji Tanaka, FACSM)

We implemented a volunteer-led community weight-loss program within the Tsuchuira City (Japan) routine health promotion program in 2015. Although the participants successfully decreased their body weight, there was a relatively high dropout rate. We interviewed a focus group after the intervention, revealing a lack of understanding about the weight-loss program. To address this issue, we planned to increase communication among the participants in the subsequent 2016 trial.

PURPOSE: We examined the prospective associations among cardiorespiratory fitness (CRF), different adiposity exposures, and cardiovascular disease (CVD) mortality in women. METHODS: 19,838 apparently healthy women without history of CVD completed a comprehensive baseline health examination between 1970 and 2013. Clinical measures included body mass index (BMI), waist circumference (WC), waist-to-height ratio (W:HT), percent body fat (%Fat), and CRF quantified as duration of a maximal treadmill exercise test. Women were classified by CRF as low (quintile 1), moderate (quintiles 2-3), and high (quintiles 4-5) as well as by standard clinical cut points for adiposity exposures. Hazard ratios (HRs) were computed using Cox regression analysis. RESULTS: During a mean follow-up period of 19.2 ± 10.3 years, 391 CVD deaths occurred. Adjusted mortality rates for high, moderate, and low CRF groups were 0.55, 1.28, and 2.0 deaths/10,000 women-years, respectively (p for trend < .001). Adjusted mortality rates of overweight women within each adiposity exposure were higher when compared with normal-weight women (p < .001). When grouped for joint analysis into 4 adiposity categories, there was a significant positive trend in CVD mortality across decreasing categories of CRF within each category of W:HT and %Fat, as well as within the normal and overweight BMI categories and the normal WC category (p < .03). CRF was not significantly associated with CVD mortality within the obese BMI or high WC categories. CONCLUSION: Higher levels of CRF are associated with lower CVD mortality risk in women, and attenuate the risk of CVD mortality in overweight women. The use of various adiposity measures to estimate CVD mortality risk in women may be misleading unless CRF is also considered. These findings support the 2016 American Heart Association Scientific Statement recommending that CRF measurement or estimation be included in routine clinical practice.

CONCLUSION: We reduced the dropout rate while obtaining equivalent weight loss by increasing communication among the participants during a volunteer-led community weight-loss program.

We implemented a volunteer-led community weight-loss program within the Tsuchuira City (Japan) routine health promotion program in 2015. Although the participants successfully decreased their body weight, there was a relatively high dropout rate. We interviewed a focus group after the intervention, revealing a lack of understanding about the weight-loss program. To address this issue, we planned to increase communication among the participants in the subsequent 2016 trial.

PURPOSE: We examined the prospective associations among cardiorespiratory fitness (CRF), different adiposity exposures, and cardiovascular disease (CVD) mortality in women. METHODS: 19,838 apparently healthy women without history of CVD completed a comprehensive baseline health examination between 1970 and 2013. Clinical measures included body mass index (BMI), waist circumference (WC), waist-to-height ratio (W:HT), percent body fat (%Fat), and CRF quantified as duration of a maximal treadmill exercise test. Women were classified by CRF as low (quintile 1), moderate (quintiles 2-3), and high (quintiles 4-5) as well as by standard clinical cut points for adiposity exposures. Hazard ratios (HRs) were computed using Cox regression analysis. RESULTS: During a mean follow-up period of 19.2 ± 10.3 years, 391 CVD deaths occurred. Adjusted mortality rates for high, moderate, and low CRF groups were 0.55, 1.28, and 2.0 deaths/10,000 women-years, respectively (p for trend < .001). Adjusted mortality rates of overweight women within each adiposity exposure were higher when compared with normal-weight women (p < .001). When grouped for joint analysis into 4 adiposity categories, there was a significant positive trend in CVD mortality across decreasing categories of CRF within each category of W:HT and %Fat, as well as within the normal and overweight BMI categories and the normal WC category (p < .03). CRF was not significantly associated with CVD mortality within the obese BMI or high WC categories. CONCLUSION: Higher levels of CRF are associated with lower CVD mortality risk in women, and attenuate the risk of CVD mortality in overweight women. The use of various adiposity measures to estimate CVD mortality risk in women may be misleading unless CRF is also considered. These findings support the 2016 American Heart Association Scientific Statement recommending that CRF measurement or estimation be included in routine clinical practice.

CONCLUSION: We reduced the dropout rate while obtaining equivalent weight loss by increasing communication among the participants during a volunteer-led community weight-loss program.
risk. This may be related to the high BMI typically associated with these athletes. Blood pressure control in those reporting diabetes is also a concern, as the majority of those men had high blood pressure at screening.

PURPOSE: Metabolic syndrome (MetS) increases risk for chronic disease with diagnostic criteria including elevated systolic and/or diastolic blood pressure (SBP and DBP, respectively), triglycerides (TRG), glucose (GLU), waist circumference (WC), and reduced HDL-cholesterol (HDL). Although the prevalence of MetS is low among college students, risk factors for this condition are emerging in this population, especially in females. Moderate-to-vigorous physical activity (MVPA) is known to aid in the prevention of MetS risk factors. While WC is a component of MetS, it may also influence the effect of MVPA on other MetS components. Thus, this study aimed to explore the impact of WC on the association between MVPA and MetS risk factors in college-aged females.

METHODS: College-aged females (n = 328; 18.7 ± 1.2 y) were assessed for MetS risk factors using standard clinical methods with factor presence being defined by the Adult Treatment Panel III criteria. MVPA was measured using accelerometer (NL-1000; 4 valid, 10-h days of wear). Pearson's correlations were used to assess bivariate associations. Linear regression was used to examine whether there was a significant interaction between WC risk factor status and the associations between MVPA and MetS risk factors.

RESULTS: Among those with normal WC (NWC; n = 287), MVPA was significantly associated with SBP (r = -.228), DBP (r = -.216), TRG (r = -.140), GLU (r = -.129), WC (r = -.250) and HDL (r = -.200) all p < 0.05. Among females with high WC (HWC; n = 41), associations between MVPA and MetS risk factors were similar in magnitude or stronger, and significant for SBP (r = -.430), DBP (r = -.420), and WC (r = -.374; p < 0.05). Only the association between MVPA and SBP was significantly different across WC strata, with a stronger association observed among the HWC group (p < 0.05).

CONCLUSIONS: As hypothesized, these results suggest that WC moderates the association between MVPA and some MetS risk factors. Future research should aim to explore these associations among a larger sample with more variation in WC.

336 Board #177
May 30 9:30 AM - 11:00 AM
Prevalence of Obesity and Diabetes Mellitus in a Former Professional Football Player Population
Genevieve E. Smith, Gregory W. Stewar, FACSM. Tulane University, New Orleans, LA. (Sponsor: Gregory Stewart, MD, FACSM) (No relevant relationships reported)

PURPOSE: To provide information on the prevalence of obesity and diabetes mellitus (DM) in former professional football players. METHODS: For this cross-sectional study, 1106 former NFL players were sampled between April 2015 and July 2017. Height and weight were used to calculate BMI; blood samples were obtained from fasted subjects for analysis of fasting blood glucose and hemoglobin A1c. Subjects also completed a questionnaire regarding DM diagnosis. Subjects were assessed for obesity and DM status based on BMI, FBG, HbA1c, and questionnaire results, and stratified by age (20-39, 40-59, 60+), primary career playing position (Big, Big Skill, Skill), and race (Black, White, Other). Statistical analyses included 1-way ANOVA and Tukey post hoc analysis when variances were equal, or Dunnett C statistic for heteroscedastic data. T-tests were used to evaluate differences between groups. RESULTS: The prevalence of obesity (BMI ≥ 30) for this population was 63.6%, while the overall prevalence of DM and pre-DM was 13.8% and 6.7%, respectively. Prevalence of both DM and self-reported DM diagnosis increased with each 20 year increase in age (p<0.0001). There was a significant effect of BMI on DM status, with obesity more than twice as likely to be diabetic (odds ratio 2.375, 95% CI 1.555-3.628). The “Big” position group were more likely to be obese as compared with “Big Skill” or “Skill” (p<0.0001). Curiously, there was no difference in the prevalence of DM between any of the 3 position groups. When examined further, “Skill” had the highest prevalence of non-obese diabetics, while “Big” had the lowest (p = 0.0002), possibly explaining the lack of overall difference in the prevalence of DM between the 3 groups. Although White subjects were older than either Black or Other race subjects, Black subjects had higher BMI and prevalence of obesity than white subjects and, correspondingly, a greater prevalence of DM. CONCLUSION: Although patterns and trends may reflect those commonly observed in the general population, the prevalence of obesity and DM may be higher in this population than typically reported in the general U.S. population. Furthermore, there may be special consideration that must be given to a former player’s previous training with regards to his risk of developing diabetes, aside from current age, health, and BMI status.

337 Board #178
May 30 9:30 AM - 11:00 AM
Vigorous Intensity Volume, Not Total Volume Of Physical Activity, Predicts Adiposity In Young Adults
Minsuk Oh, Kathleen F. Janz, FACSM, Steven M. Levy. University of Iowa, Iowa City. IA. (Sponsor: Kathleen F. Janz, FACSM) (No relevant relationships reported)

Vigorous intensity volume, not total volume of physical activity, predicts adiposity in young adults.

PURPOSE: To investigate which daily level of physical activity (PA) is the best predictor of adiposity in young adults.

METHODS: Young adults aged 19.8 years (n = 182 females and 147 males) in the Iowa Bone Development Study were examined. PA was objectively measured by the ActiGraph accelerometer and classified into categories of m(i.e., sedentary, light, moderate, vigorous, total metabolic equivalent task (MET)) using the Crooter 2-regression model equation. Lean body mass and total body fat (kg) including visceral adipose tissue (VAT, g) were measured by dual energy X-ray absorptiometry. Associations between PA categories and adiposity were analyzed by partial correlation analysis adjusted for height and lean body mass. Multiple linear regression analysis was used to examine the most influential PA exposure for adiposity. All analyses were conducted separately by gender. Significance level was set at p < 0.05 or p < 0.01.

RESULTS: Body fat was negatively associated with both vigorous PA (r = -.20**, and total PA MET time (r = -.21**) in males. In females, body fat was negatively related with vigorous PA time (r = -.24**), and VAT had significant associations with SED (r = -.18) and all PA variables (moderate r = -.21*, vigorous r = -.21, and total METS time (r = -.22*) except light PA time. Multiple linear regression analysis indicated that the best predictor for body fat mass (after adjustment for height and lean body mass) was vigorous PA time for females (β = -.142, R² = .70, vigorous PA effect on R² for vigorous PA = .02) and males (β = -.216, R² = .50, R² for vigorous PA = .04). Other PA exposures including total PA METs time were not significant after vigorous PA entered the model.

CONCLUSION: Vigorous intensity volume of PA, not total volume of PA, is the best predictor of body fat mass in young adults. This result suggests that interventions should focus on running, cycling and other intense physical activities to help young adults maintain a healthy level of adiposity.

Funding: This work was supported by the National Institute of Dental and Craniofacial Research R01-DE12101 and R01-DE09551, and the General Clinical Research Centers Program from the National Center for Research Resources, M01. RR00059

338 Board #179
May 30 9:30 AM - 11:00 AM
Association Between Physical Activity Level, Body Composition And Muscular Strength Among Health Professional
João Henrique V. Pietri, Amauri dos Santos, João Pedro da Silva Junior, Diana Carolina Gonzalez, Victor Keihan Rodrigues Matsudo. CELAFISCS, São Paulo, Brazil. (No relevant relationships reported)

PURPOSE: To examine the association between physical activity level (PAL), body composition and muscular strength health among health professionals. METHODS: Physical activity level (PAL) was determined by pedometer, and steps counting was taken according to Tudor-Locke C et al. 2004. Sample consisted of 68 women and 11 men, with mean age 48.7 ± 9.3 years old. A pedometer (DIGI-WALKER/YAMAX) was used in the waist by the participants as soon as they wake up until they go to bed, removing the pedometer in cases involving water activities, during 7 days in a row, including a weekend. STATISTICAL ANALYSIS: The regression linear analysis with 95% Confidence interval for β was determined using SPSS 20.0, and a level of p<.05 was taken as significant. RESULTS: 33% of participants could be considered sedentary, not reaching at least 1000 steps per day. They presented a mean BMI 31.3 ±6.6 kg/m², and they performed only 3,256 ±1,223 steps per day. The prediction equation for PA was: PAL = 0.02 + 0.02 * Steps, and was the best predictor of body fat mass in young adults. This result suggests that interventions should focus on running, cycling and other intense physical activities to help young adults maintain a healthy level of adiposity.

Funding: This work was supported by the National Institute of Dental and Craniofacial Research R01-DE12101 and R01-DE09551, and the General Clinical Research Centers Program from the National Center for Research Resources, M01. RR00059

ACSM May 29 – June 2, 2018
Minneapolis, Minnesota
**339 Board #180 May 30 9:30 AM - 11:00 AM**

**The Influence of Physical Activity on Energy Balance and Resting Metabolic Rate in Adults**

Robert Buresh, FACSM; Yuri Feito, FACSM; Cassie Williamson; Brian Klibiszczewicz; Corrine Ellis; Leah Tsui; Anna Schlupp; Kelsey Shepard; Stella Volpe, FACSM.

*Kennesaw State University, Kennesaw, GA. Drexel University, Philadelphia, PA.*

(no relevant relationships reported)

Recent studies have suggested a constrained energy expenditure model, wherein the capacity of physical activity to increase total daily energy expenditure is limited by adaptations in resting metabolic rate.

**PURPOSE:** To assess the influence of physical activity energy expenditure (PAEE) (quantified with an ActiGraph GT3X+ activity monitor) on energy balance (EBAL) in a cross-sectional study of free-living adults. METHODS: 36 women (39.7 ± 14.8 years of age) and 12 men (33.0 ± 13.7 years of age) participated in this study. Height, weight, waist circumference, body composition, and resting metabolic rate were assessed. Participants wore ActiGraph GT3X+ activity monitors and documented dietary intake via food logs and photographs for 5 to 6 consecutive days. RESULTS: PAEE was correlated with EBAL (r = -0.42, p < 0.01). PAEE explained more than 21% of the variance in EBAL when applied using a quadratic model - EBAL = 0.001(PAEE) - 3.105(PAEE) + 635.6 (p = 0.011, r² = 0.214). Increases in PAEE were associated with decreases in EBAL up to approximately 1,100 kcal day⁻¹, beyond which no further reductions in EBAL were observed. The capacity of PAEE to reduce energy balance may have been limited, in part, by the inverse relationship between PAEE and resting metabolic rate (RMR) (r = -0.41, p < 0.01).

**CONCLUSIONS:** EBAL was reduced by increasing PAEE up to about 1,100 kcal day⁻¹, beyond which adjustments in RMR may contribute to further reducing EBAL. These findings support a constrained model of energy expenditure.

---

**340 Board #181 May 30 9:30 AM - 11:00 AM**

**Exercise and Anxiety in Adults with Arthritis and Other Rheumatic Diseases: Support for Evidential Value**

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

(no relevant relationships reported)

**PURPOSE:** Determine whether evidential value exists that exercise reduces anxiety in adults with arthritis and other rheumatic diseases (AORD). METHODS: Utilizing data derived from a prior meta-analysis of 14 randomized controlled trials that included 926 participants (539 exercise, 387 control) with AORD, a recently developed approach, P-curve was used to determine evidential value by assessing for publication bias and p-hacking. Binomial tests with p values categorized as either low (p < 0.025) or high (p > 0.025 up to > 0.05) were compared. In adults with AORD, evidential value of a true effect of exercise on anxiety was determined using the more robust Stouffer’s test to combine results across studies with half-p-curve results that were right-skewed (p value <0.05) or results in which both the half and full tests were right skewed (p value <0.10). Binomial and full p-curve tests based on Stouffer’s method were also used to determine if evidential value was inadequate or absent when a 33% power test was <0.05 for the full p-curve or the half p-curve and the binomial test was <0.01. Statistical power was calculated by comparing the expected p-curve for each possible value ranging from 5% to 99% and then choosing the power level that results in an expected p-curve most similar to the actual p-curve. To examine the influence of selected studies on p-curve results, findings were also examined by dropping the highest and lowest p-values from the analysis. All analyses were conducted using P-curve, version 4.0.52. RESULTS: The binomial test trended towards evidential value of a true effect regarding the benefits of exercise in adults with AORD (p = 0.11) while the more robust Stouffer’s test satisfied both conditions for evidential value (p = 0.002 for both full and half p-curves). Similarly, binomial (p = 0.867) and full p-curve (p = 0.953) results did not suggest that evidential value was inadequate or absent. Power analyses suggested a good fit for the observed p-curve. Results were generally robust when the most extreme values were either included or excluded. CONCLUSIONS: The lack of observed publication bias and p-hacking provide evidential support for the benefits of exercise on anxiety in adults with AORD.

Supported by NIH grant R01AR66136.

---

341 Board #182 May 30 9:30 AM - 11:00 AM

**Activity Pacing, Fatigue, Physical Activity And Quality Of Life In Adults With Multiple Sclerosis**

Ulric S. Abonie, Femke Hoekstra, Trynke Hoekstra, Cees P. van der Schans, Rienk Dekker, Lucas H. V. van der Woude, Florentina J. Hettinga. *University of Essex, Colchester, United Kingdom. University of Groningen, Groningen, Netherlands. (Sponsor: Carl Foster, FACSM)*

(no relevant relationships reported)

In response to fatigue persons with multiple sclerosis (MS) make several behavioural adaptations, such as resting and limiting activity, sometimes resulting in an unevenly spread activity pattern throughout the day, consisting of short activity peaks followed by long rest periods. These patterns are inefficient and have been linked to increased disability. Activity pacing is a behavioural strategy that is thought to help alter such inefficient patterns, yet little is known about how persons with MS naturally use this strategy to manage fatigue and optimise their daily activities.

**PURPOSE:** To examine how actively engaged persons with MS are in pacing decisions in daily life and what their perceived difficulty in preventing overactivity is. Also explore relations of this naturalistic pacing behaviour with fatigue, physical activity (PA) and health-related quality of life (HRQoL).

**METHODS:** 53 persons with MS (median age: 45 ± 10 years) filled in questionnaires on their active engagement in pacing decisions and perceived difficulty in preventing overactivity (5-point Activity Pacing Questionnaire), fatigue (7-point Fatigue Severity Scale), PA (time spent on activities using an adapted SQUASH) and HRQoL (RAND-12 post rehabilitation, collected within the ReSpAct program, a nationwide multi-centre program aimed at stimulating and promoting an active lifestyle in rehabilitation. RESULTS: Active engagement in pacing decisions and perceived difficulty in preventing overactivity were high (3.80 ±0.90 and 4.00 ± 1.50 respectively). Fatigue was moderately severe (5.78 ± 1.44). HRQoL was fairly good (33.02 ± 10.50). Fatigue was related to low HRQoL (β = -0.34; p < .019). No relations were found between active engagement in pacing decisions and fatigue, between active engagement in pacing decisions and PA and between active engagement in pacing decision and HRQoL.

**CONCLUSIONS:** The lack of associations between pacing and fatigue, PA and HRQoL despite the high engagement in pacing found in this study indicates the varied use of pacing. While some may be using pacing in response to high fatigue, others may be using pacing to optimise their daily activities. Guidance on pacing may lead to successful health outcomes in persons with MS.

---

342 Board #183 May 30 9:30 AM - 11:00 AM

**Association Between Sedentary Behavior, Body Composition, Muscular Strength And Quality Of Life Among Health Professionals**


(no relevant relationships reported)


**Center of Studies of the Physical Fitness Research Laboratory from São Caetano do Sul (CELAFISCs)**

aosseusagenda@gmail.com

**Objective:** To associate sitting time with body composition, muscle strength and quality of life in health professionals. Methods: The sample consisted of 1036 professionals (241 male and 794 female). Sedentary behavior was measured in minutes / day during the week (short IPAQ). Measures included BMI (kg / m²), abdominal circumference (cm), and handgrip (kg). Quality of life was divided into physical, psychological, social, environmental and general domains (WHOQOL-BREF - Statistical analysis: Multiple linear regression was used to associate the study variables). Results: Factors associated with sitting time comprised: age and the physical, psychological and social domains of quality of life. The percentage of fat, BMI, Abdomen circumference (cm), Muscular strength (kg) and the environmental and general domains were not associated with sitting time as it is shown in the table below.

**Conclusion:** In the present sample sitting time during a weekday presented an inverse association with age and the physical, psychological and social domains of quality of life.
Self-reported pregnancy symptoms may impact physical activity levels and dietary behaviors, thereby influencing gestational weight gain (GWG). However, little is known about the relationship between symptoms and GWG. **PURPOSE:** To examine the association among various pregnancy symptoms (fatigue, back pain, pelvic pain, swelling, and nausea) and GWG. **METHODS:** Women who were 14-20 weeks gestation were recruited into a physical activity and nutrition behavioral intervention. At study enrollment, women completed an online survey that assessed various demographic variables, height and pre-pregnancy weight, and the presence (yes/no) of fatigue, back pain, pelvic pain, swelling, and nausea. GWG was calculated by subtracting pre-pregnancy weight from last recorded weight during pregnancy (range: 31-40 weeks gestation). Linear regression analyses were utilized to investigate relationships among individual symptoms and GWG, controlling for gestational age at last weight and pre-pregnancy body mass index (BMI). An alpha level of 0.05 was used to determine statistical significance. **RESULTS:** Participants (n=38) averaged 28.7±4.1 years of age and 18.1±2.5 weeks gestation at enrollment. A majority of women were married (76.3%), college graduates (65.8%), white (86.5%), and employed (84.2%). Pre-pregnancy BMI averaged 27.9±10.4 kg/m², and gestational age at the last recorded weight averaged 35.9±1.6 weeks, with total GWG averaging 10.3±4.3 kg. Correlations between GWG and various factors were non-significant. **CONCLUSIONS:** Relationships among pregnancy symptoms and GWG warrant further investigation in larger, more diverse samples. This information could prove to be valuable targets for behavioral interventions seeking to optimize GWG and maternal-child health outcomes.

### Table 1. Subjects characteristics by BMI classification.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Normal</th>
<th>Overweight</th>
<th>Obesity Class 1</th>
<th>Obesity Class 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.2 ± 7.3</td>
<td>34.1 ± 7.6</td>
<td>35.6 ± 7.9</td>
<td>36.7 ± 8.8</td>
<td></td>
</tr>
</tbody>
</table>

**VO₂max =** maximal oxygen consumption. Data are presented as mean±SD. ANOVA test was used for differences between BMI categories. Bonferroni post-hoc tests were used. *p* = 0.001 vs all groups. **p** = 0.001 all groups are different.
PURPOSE: To identify longitudinal physical performance trajectories in midlife women and factors associated with each, with focus on physical activity and body mass index (BMI). METHODS: Participants were black (n=397) and white (n=416) women (age 42-57) from the Michigan and Chicago sites of the Study of Women’s Health Across the Nation (SWAN). A stair climb test (ascend and descend 4 steps, 3 cycles) was performed at up to 10 visits (min 2; max follow-up about 9 years). Growth mixture modeling was used to identify longitudinal trajectories in stair climb completion time. Physical activity was assessed with the Kaiser Physical Activity Survey (KPAS) and BMI was derived from height and weight (all from baseline). Analyses were stratified by race due to racial disparities in physical performance in this cohort and the broader literature.

RESULTS: We identified two distinct trajectories—a group with relatively stable performance over time and one that substantially slowed—for each race. For black women, 92.9% were in the stable group (median baseline 19.0 sec) and had only a small increase in completion time over follow-up. The group who slowed (7.1%) had a median stair test completion time of 27.5 seconds and slowed about 10 sec over follow-up. For white women, 88.4% were in the stable group (median baseline 17.0 sec). The group who slowed (11.6%) was significantly more active (when compared to the stable group) at baseline, though had a median baseline time of 24.0 sec and slowed about 5 sec over follow-up. Those who slowed had higher baseline BMI (black: 39.8 ± 8.6 vs 31.5 ± 7.3; white: 38.2 ± 7.5 vs 28.8 ± 6.6, p<0.001 each) and lower baseline KPAS scores (black: 6.2 ± 1.4 vs 7.4 ± 1.8; white: 6.7 ± 1.7 vs 8.3 ± 1.7, p<0.001 each) compared to those with stable stair climb time.

CONCLUSIONS: The majority of women had stable stair climb times, but those with higher BMI and lower physical activity tended to substantially slow. Identifying physical performance patterns in midlife may be instrumental in the development of tailored, early interventions for those at risk for steep declines in physical function. SWAN has grant support from the National Institutes of Health Grants U01NR004061; U01AG012505, U01AG012535, U01AG012531, U01AG012539, U01AG012546, U01AG012553, U01AG012554, U01AG012495.

College-age women exhibit particular susceptibility to establishing health behaviors resulting in unwanted weight gain or chronic dietary. Understanding the relative contribution of health behaviors to body composition could inform targeted interventions to correct unhealthy weight gain or loss. PURPOSE: To create a model describing relationships among physical activity (PA), aerobic fitness (VO2max), eating behavior traits and their association with body composition in female college students. METHODS: Female students (n = 98) were recruited from a freshmen-level university nutrition class. Percentage body fat (BFF) was assessed by bioimpedance. Dietary energy intake (EI) was determined using 24-hour dietary recalls following an overnight-fast. VO2max was estimated from 1.5-mile time trial performance. Energy intake (EI) was significantly related (r = 0.53) fitness. Soldiers who used rDS had higher rates of poor health behaviors, (poor sleep, tobacco use, unhealthy eating, hazardous drinking, physical activity), and psychosocial profiles (emotional/social fitness). HIIT and rDS use were dichotomized and multiple logistic regressions were used to determine associated demographics and health behaviors. Continuous psychosocial scores were analyzed with independent t-tests.

RESULTS: 38% of Soldiers did HIIT and 14% took rDS at least once per year. Soldiers who participated in HIIT were 1.56 times more likely to use rDS than those who did not. Soldiers who engaged in HIIT had increased odds of being active duty (OR = 1.47), and were similar along other military/demographic characteristics; Interestingly, HIIT was associated with lower rates of unhealthy behaviors - including poor sleep (OR = 0.78), tobacco use (OR = 0.83), poor eating (OR = 0.62), hazardous drinking (OR = 0.91), and low activity (OR = 0.73) - and with higher emotional (Cohen’s d = 0.22) and social (Cohen’s d = 0.53) fitness. Soldiers who used rDS had particularly increased odds of being active duty (OR = 1.29) and male (OR = 1.43). In contrast to HIIT, rDS-use was associated with higher rates of poor health behaviors, including poor sleep (OR = 1.38), hazardous drinking (OR = 1.34), and low activity (OR = 1.15). Psychosocial differences by rDS-use were minimal. Next, Soldiers were classified into four groups based on both HIIT (n=1923) and rDS-use (n=1923). There were no
notable differences between the HIIT+rDS group and the other groups, although the group not participating in HIIT and used rDS had the poorest health behaviors among the groups. **CONCLUSIONS:** HIIT is a popular form of exercise and is likely beneficial in moderation. However, Soldiers who engage in HIIT also have increased rates of rDS use, which could increase risk of adverse events. Even though HIIT and rDS are related to one another, they have distinct associations with health behaviors and psychosocial attributes.

**METHODS:** Three NHANES datasets covering six years (1999-2004) were included in this study, with a total of 6,648 records meeting the eligibility criteria. Fitness and body composition gender and age-specific percentile ranks were determined from norms published by the Cooper Clinic. A pair of matrices were created to report counts, means and standard errors by body composition level versus fitness level and BMI group versus fitness level.

**RESULTS:** The BMI matrix showed that 32.9 ± 1.0% of the population was classified as overweight, and 24.9 ± 0.9% was classified as obese. Further, 9.9 ± 0.7% and 6.7 ± 0.5% of the overweight and obese groups respectively, were classified in the top one-third for fitness tertiles. The body composition matrix (based on percent body fat) showed that 18.1 ± 1.0% were categorized in the lowest tertile, and 68.4 ± 1.3% were categorized in the lowest tertile (high percent body fat). Additionally, 6.6 ± 0.6% and 21.0 ± 0.9% of the overweight and obese groups respectively, were classified in the fittest tertile. **CONCLUSIONS:** These data support the notion that one can be “fit but fat,” but most are not. Further, there is a large discrepancy in defining “fit.” Two-thirds of the population was ranked below the 35th percentile in body composition (compared to 57.8% of the population qualifying as overweight or obese), and more of these individuals are of low fitness than in any other fitness category. These data further support the notion that BMI is a misleading classification and utilizing a more robust measure to qualify fitness may be necessary.

**PURPOSE:** To investigate whether patients change their PA behavior after the first diagnosis of CVD/CFVR.

**METHODS:** This study used cross-sectional and prospective study data from the Nijmegen Exercise Study. Participants’ PA and cardiovascular health information were collected from baseline and follow-up questionnaires. CVD was defined as a diagnosis of hypertension, stroke, heart failure, or angina. CVRF was defined as a diagnosis of CVD/CVRF.

**RESULTS:** The BMI matrix showed that 32.9 ± 1.0% of the population was classified as overweight, and 24.9 ± 0.9% was classified as obese. Further, 9.9 ± 0.7% and 6.7 ± 0.5% of the overweight and obese groups respectively, were classified in the top one-third for fitness tertiles. The body composition matrix (based on percent body fat) showed that 18.1 ± 1.0% were categorized in the lowest tertile, and 68.4 ± 1.3% were categorized in the lowest tertile (high percent body fat). Additionally, 6.6 ± 0.6% and 21.0 ± 0.9% of the overweight and obese groups respectively, were classified in the fittest tertile.

**CONCLUSIONS:** These data support the notion that one can be “fit but fat,” but most are not. Further, there is a large discrepancy in defining “fit.” Two-thirds of the population was ranked below the 35th percentile in body composition (compared to 57.8% of the population qualifying as overweight or obese), and more of these individuals are of low fitness than in any other fitness category. These data further support the notion that BMI is a misleading classification and utilizing a more robust measure to qualify fitness may be necessary.

**352 Board #193** May 30 9:30 AM - 11:00 AM

**Weight Status, Physical Fitness & Health-related Quality Of Life Among Chinese Adolescents**

Xiangren Yi, Meng Ding¹, Shuyuan Huang¹, Lei Zhang¹, Wenxin Chen¹, Nuo Yi¹, Peng Zhang, FACSM², Yong “Tai” Wang, FACSM². Shandong University, Jinan, China. Shandong Normal University, Jinan, China. East Stroudsburg University, East Stroudsburg, PA. 'the University of Texas at Tyler, Tyler, TX.

**PURPOSE:** The physical fitness on adolescents’ health-related quality of life (HRQOL) is an important health issue in China. The purpose of this study was to examine associations between body mass index (BMI), cardiorespiratory fitness (CRF), muscular skeletal fitness (MSF) and HRQOL among Chinese adolescents. **METHODS:** Participants were 10,007 students aged 14.14 ± 1.3 years (boys: 14.22 ± 1.31; girls: 14.12 ± 1.31) selected from 30 secondary schools in Shandong, China. Height, weight, 1000 m/800 m runs and the standing-long jump were measured to present BMI, CRF and MSF, respectively. HRQOL was measured by the Quality of Life Scale for Children and Adolescents (QLSCA).

**RESULTS:** Multiple regression analysis were employed to analyze the relationships among BMI, CRF and MSF and HRQOL. Women and physical fitness variables were partially associated with HRQOL in Chinese adolescents. Only several dimensions in ANCOVA showed a significant difference by BMI in this test. For boys, significant differences were found in physical sense, living convenience, self-satisfaction. For girls, the significant differences were observed only in social activity opportunity. For both boys and girls, the results also showed the higher MSF scores, the higher student partnership scores; the higher CRF scores; the lower scores in teacher and student relationship; and parent and children relationship. The multiple regression analysis demonstrated that BMI was significantly associated with social activity opportunities. For boys, CRF was associated with teacher and student relationship, self-satisfaction; whereas MSF was only associated with physical sense. For girls, CRF was significantly linked with parent and children relationship, learning capacity and attitudes and self-perception, while MSF was associated with self-perception and other factors.

**CONCLUSION:** Physical activity and physical fitness will be a crucial pathway in enhancing adolescents’ HRQOL in China.

**353 Board #194** May 30 9:30 AM - 11:00 AM

**Leisure-time Physical Activity Throughout Adulthood: Implications For All-cause, And Cause-specific Mortality**

Pedro F. Saint-Maurice¹, Diarmuid Coughlan¹, Sarah K. Keadle², Richard P. Troiano¹, Charles E. Matthews, FACSM. ¹National Cancer Institute, Rockville, MD. ²California Polytechnic State University, San Luis Obispo, CA. (Sponsor: Charles E. Matthews, FACSM)

**PURPOSE:** Limited evidence documents the benefits of leisure-time physical activity (LTPA) throughout adulthood. This study assessed changes in LTPA patterns over time and their potential to prevent mortality. **METHODS:** Participants and all-cause mortality (HR: 0.71 (0.68, 0.73)), 24% for CVD (HR: 0.66 (0.62, 0.70)), and 10% for cancer mortality (HR: 0.90 (0.83, 0.97)). Adults who were inactive at ages 15-35
Women continue to participate in sport at a lower rate than males at all ages. Girls who participate in sport gain many advantages (e.g., better bone health, greater cardiorespiratory fitness, better mental health). However, even with programs designed to emphasize participation, some women choose to continue sport participation, while others do not. Given the potential advantages and controversies currently surrounding testosterone and female sport participation, it is imperative to understand the characteristics of those who participate in and after having a child. Interventions to maintain or increase physical activity should be targeted at couples planning to get married or have a child. Pre-marital counselling and pre-natal clinics would be effective targets for interventions like financial incentives for gym or fitness group memberships.

### Board #195

**May 30 9:30 AM - 11:00 AM**

**Physical Activity Declines At Significant Life Events In Young Adults**

Jon Miller, Megan Winkler, Mary Christoph, Toben Nelson, Daheia Barr-Anderson, FACSM, Dianne Neumark-Sztainer.

*University of Minnesota, Minneapolis, MN.* *(Sponsor: Daheia Barr-Anderson, FACSM)*

*(No relevant relationships reported)*

**Purpose:** Predictable life events like marriage, birth of a child or gaining employment may be opportunities to intervene on health behaviors like physical activity. The purpose of this study was to determine which life events during the transition from adolescence to adulthood are associated with the greatest changes in moderate to vigorous physical activity (MVPA).

**Methods:** Adolescent participants in Project EAT (ages 11 to 18 at baseline and 23 to 36 at EAT-IV) were surveyed at four time points, roughly 5 years apart, on whether they had married or divorced, had children, begun or lost employment, begun or ended post-secondary education or left or returned to their parent’s home between each wave. Linear regression was used to model the effect of each of these life events on change in self-reported MVPA. Post-hoc four-way decomposition mediation analysis was conducted to examine whether the effect of having a child mediated the effect of getting married on change in MVPA. Results: Average reported MVPA declined from 6.5 hours per week at baseline to 4.3 hours per week at EAT-IV. Having a child was associated with a significant decrease in MVPA between waves 2 and 3 (0.84 hours per week, 95% CI: -1.39 to -0.30) and between waves 3 and 4 (-1.02 hours per week, 95% CI: -1.52 to -0.53). Getting married (+0.99 hours per week, 95% CI: -1.58 to -0.61), moving in with parents (+0.43 hours per week, 95% CI: -2.06 to -0.07), and leaving parents’ home (+0.17 hours per week, 95% CI: -1.97 to -0.17) were associated with significant decreases in MVPA between waves 3 and 4. The proportion of the total effect of getting married on physical activity that was mediated by having a child (proportion mediated: 0.42, 95% CI 0.16 to 0.69) was similar to the proportion of the total effect that was due to interaction with having a child (proportion attributable to interaction: 0.54, 95% CI 0.12 to 1.20). **Conclusion:** There is evidence in this study that physical activity declines both after getting married and after having a child. Interventions to maintain or increase physical activity should be targeted at couples planning to get married or have a child. Pre-marital counselling and pre-natal clinics would be efficient targets for interventions like financial incentives for gym or fitness group memberships.

### Board #196

**May 30 9:30 AM - 11:00 AM**

**Why Do Girls Play? Strength And Competitiveness But Not 2d:4d Ratio Are Predictive Of Retrospective Sport Participation In University Aged Women**

Elizabeth Vandenborn, Cayla Wood, Kevin Milne. *The University of Windsor, Windsor, ON, Canada.*

*(No relevant relationships reported)*

Women continue to participate in sport at a lower rate than males at all ages. Girls who participate in sport gain many advantages (e.g., better bone health, greater cardiorespiratory fitness, better mental health). However, even with programs designed to emphasize participation, some women choose to continue sport participation, while others do not. Given the potential advantages and controversies currently surrounding testosterone and female sport participation, it is possible that this hormone may predispose women toward sport participation. **Purpose:** To determine if the 2nd to 4th digit ratio (2DR) correlates with sport participation throughout adolescence and young adulthood in women. **Methods:** A cross-sectional analysis of indirect prenatal androgen concentrations (i.e. 2DR) was obtained from 92 females (aged 18-30y). Participant demographic, anthropometric, behavioral, and retrospective sport participation information was collected on one occasion. **Results:** 2DR was not significantly correlated with total sport participation (r = -0.650, p = 0.538). Secondary analysis revealed significant correlations between sport participation and max hand grip (r = 0.406, p = 0.000), sport competitiveness (Sport Orientation Questionnaire) (r = 0.475, p = 0.000) and Sport Aggression (Scale of Children’s Action Tendencies in Sport) (r = 0.240, p = 0.021). **Conclusion:** While 2DR does not, strength and the sport specific behavioural traits of competitiveness and aggression are able to predict retrospective sport participation. However, causality of these relationships could not be determined because some traits are likely strengthened through sport participation and androgens have been linked to strength, competitiveness, and aggression. Given that females participate in sport at lower rates than males, and that sport provides multiple social and health advantages, continuing to determine what factors influence female sport participation is necessary.
predicting health status of the fisher folks. This revealed high mortality and all-cause of cardiovascular disease risks among fisher folks signaling the need for multilevel interventions considering age and gender.

Adolescents, who are overweight or obese, are less likely to flourish, and more likely to bully others and experience emotional difficulties. However, it is unknown whether engagement in regular physical activity (PA) is associated with these measures among overweight and obese adolescents. PURPOSE: To examine associations between body mass index (BMI) and PA with measures of flourishing (flourishing, bullying and emotional difficulties). METHODS: Analyses included 12,592 adolescents, ages 10-17 years, from the 2011-12 National Survey of Children’s Health. Adolescents were grouped into categories based on BMI (overweight or obese) and PA (0-2, 3-4, or 5-7 d/wk). Outcomes included measures of flourishing (finishing tasks, staying calm when faced with a challenge, and showing interest in learning new things), emotional difficulties (excessive arguing and unhappiness) and bullying. Logistic regression models, adjusted for age, sex, household income, and education assessed the odds of each outcome comparing BMI classification and PA groups. RESULTS: Compared to overweight adolescents who engaged in 0-2 d/wk of PA, those who engaged in 5-7 d/wk of PA were 44% more likely to finish tasks, 37% more likely to stay calm, 39% more likely to show interest in learning new things, 27% less likely to argue excessively, and 42% less likely to be unhappy (p<0.001). Compared to obese adolescents who engaged in 0-2 d/wk of PA, those who engaged in 5-7 d/wk of PA were 41% more likely to finish tasks, 37% more likely to stay calm, 37% more likely to show interest in learning new things, 27% less likely to argue excessively, and 42% less likely to be unhappy, and 47% less likely to bully others (p<0.001). Furthermore, for adolescents who engaged in PA 5-7 d/wk, the odds of flourishing were significantly higher, and the odds of emotional difficulties and bullying were significantly lower (p<0.001). CONCLUSIONS: Overweight and obese adolescents that engaged in greater amounts of PA (≥3 d/wk) were significantly more likely to flourish, and less likely to experience emotional difficulties and bully others compared to adolescents that engaged in <3 d/wk of PA. This suggests that increasing engagement in physical activity may increase flourishing and decrease emotional difficulties and bullying behaviors among overweight and obese adolescents.

Cardiorespiratory fitness (CRF) is a strong and independent predictor of mortality risk, however, it is unclear whether the association between CRF and mortality is mediated by the adoption of physical activity (PA; acquired CRF) or by underlying intrinsic CRF. In response we examined the association of intrinsic and acquired CRF on risk of all-cause mortality in men and women using follow-up CRF data from the Aerobics Centre Longitudinal Study cohort.

RESULTS: Individuals who had intrinsically high CRF at follow-up had a 20% reduced mortality risk for every 1 MET increase in CRF after adjusting for age, sex, follow-up weight (p=0.05). Hazard ratios were not materially different after further adjusting for change in systolic blood pressure, smoking, alcohol intake, diabetes mellitus, total cholesterol, abnormal ECG, family history of CHD (HR: 0.82 (0.68, 0.98); p=0.05). Individuals who had acquired a high CRF at follow-up had a 32% reduced mortality risk for every 1 MET increase in CRF after adjusting for age, sex, follow-up weight (p=0.05). Hazard ratios were not materially different after further adjusting for common risk factors associated with premature mortality (HR: 0.72 (0.59, 0.87); p=0.05).

CONCLUSION: While both intrinsic and acquired CRF were associated with a reduction in all-cause mortality risk, individuals who became active and improved CRF had a lower risk of all-cause mortality than those with intrinsically high CRF. This is the first analysis to show that the way in which CRF is achieved influences its association with mortality.

Adolescents, who are overweight or obese, are less likely to flourish, and more likely to bully others and experience emotional difficulties. However, it is unknown whether engagement in regular physical activity (PA) is associated with these measures among overweight and obese adolescents. PURPOSE: To examine associations between body mass index (BMI) and PA with measures of flourishing (flourishing, bullying and emotional difficulties). METHODS: Analyses included 12,592 adolescents, ages 10-17 years, from the 2011-12 National Survey of Children’s Health. Adolescents were grouped into categories based on BMI (overweight or obese) and PA (0-2, 3-4, or 5-7 d/wk). Outcomes included measures of flourishing (finishing tasks, staying calm when faced with a challenge, and showing interest in learning new things), emotional difficulties (excessive arguing and unhappiness) and bullying. Logistic regression models, adjusted for age, sex, household income, and education assessed the odds of each outcome comparing BMI classification and PA groups. RESULTS: Compared to overweight adolescents who engaged in 0-2 d/wk of PA, those who engaged in 5-7 d/wk of PA were 44% more likely to finish tasks, 37% more likely to stay calm, 39% more likely to show interest in learning new things, 27% less likely to argue excessively, and 42% less likely to be unhappy (p<0.001). Compared to obese adolescents who engaged in 0-2 d/wk of PA, those who engaged in 5-7 d/wk of PA were 41% more likely to finish tasks, 37% more likely to stay calm, 37% more likely to show interest in learning new things, 27% less likely to argue excessively, and 42% less likely to be unhappy, and 47% less likely to bully others (p<0.001). Furthermore, for adolescents who engaged in PA 5-7 d/wk, the odds of flourishing were significantly higher, and the odds of emotional difficulties and bullying were significantly lower (p<0.001). CONCLUSIONS: Overweight and obese adolescents that engaged in greater amounts of PA (≥3 d/wk) were significantly more likely to flourish, and less likely to experience emotional difficulties and bully others compared to adolescents that engaged in <3 d/wk of PA. This suggests that increasing engagement in physical activity may increase flourishing and decrease emotional difficulties and bullying behaviors among overweight and obese adolescents.
CONCLUSIONS: The combination of FH and CRF showed a clear association with the risk of hypertension, and even participants with FH showed a lower risk of hypertension when the level of CRF was high. FH and CRF did not show a significant interaction. Therefore, these findings suggest that CRF might be equally beneficial for preventing hypertension in both people with and without FH.

Purpose: Air pollution has become a substantial environmental issue affecting human health and health-related behavior worldwide, especially in Beijing, China. Physical activity (PA) has been well demonstrated as a means to promote people’s health and well-being and is potentially being influenced by the air pollution. Yet, the effects of air pollution on PA behavior have not been well investigated. This study examined the impacts of air pollution on moderate to vigorous PA (MVPA) among college students in Beijing, China.

Methods: We conducted the follow-up health surveys on 9,095 freshmen from Tsinghua University in Beijing during 2013-2015, and their PA was measured by the “International Physical Activity Questionnaire” (IPAQ) questionnaire. Air pollution data included average hourly air quality index (AQI), PM$_{10}$, PM$_{2.5}$, SO$_2$, and NO$_x$ (µg/m$^3$) were measured by Ministry of Environmental Protection of the People’s Republic of China. The data were analyzed using the linear fixed-effect regressions. Results: One standard deviation (SD) increase in air pollution concentration in AQI, PM$_{10}$, PM$_{2.5}$, SO$_2$, and NO$_x$ was associated with a reduction in weekly total minutes of vigorous PA by 61.18, 43.14, 73.17, 20.73 and 19.66, respectively; a reduction in weekly total minutes of moderate PA by 80.10, 56.62, 93.52, 27.47 and 25.88, respectively; a reduction in weekly total minutes of MVPA by 147.17, 104.15, 171.90, 50.57 and 47.64, respectively. This result discouraged MVPA among college students. Future studies are warranted to replicate study findings in other subpopulations and China cities, and policy interventions are urgently called to reduce air pollution level in China.

CONCLUSIONS: The combination of FH and CRF showed a clear association with the risk of hypertension, and even participants with FH showed a lower risk of hypertension when the level of CRF was high. FH and CRF did not show a significant interaction. Therefore, these findings suggest that CRF might be equally beneficial for preventing hypertension in both people with and without FH.

The global burden of overweight and obesity is constantly rising for several decades. Physical activity (PA) is an essential determinant for health, prevention and treatment of many chronic diseases that are related to overweight and obesity. PURPOSE: In 2017, the EUBOHEALTH-Consortium was founded with the intention to promote health and normal weight for citizens in Central, Eastern and South Eastern Europe. In order to prepare a large-scale scientific study proposal, a needs assessment in form of a meta-analysis of the existing countries is being conducted. METHODS: A comparison of obesity prevalence and PA behavior between the countries of Croatia, Hungary, Estonia, Germany and the (estimated) European Union average is conducted based on the European Health Interview Survey (EHS), wave 2 (Eurostat, 2014). Data on non-work-related PA and effort involved in performing work-related PA were used. In addition, the time spent in health-enhancing aerobic PA was assessed and subdivided into four categories: zero, one to 149, 150 to 200 and above 300 minutes per week. All subjects were aged 15 years or over. RESULTS: In all four observed countries, the obesity prevalence was higher than the European Union average of 15.4% (Croatia: 18.0%, Hungary: 20.6%, Estonia: 19.9%, Germany: 16.4%). On average, 48.8% of the population of the EUBOHEALTH- Consortium reported being active in health-enhancing aerobic PA (Croatia: 58.6%, Hungary: 43.4%, Estonia: 52.3%, Germany: 28.8%). The most severe heterogeneity can be observed in performing muscle strengthening activities (EU-average: 24.2%, Croatia: 9.6%, Hungary: 23.7%, Estonia: 15.4%, Germany: 44.1%). CONCLUSIONS: There is a substantial need for the promotion of health-enhancing PA to stop the rising burden of associated diseases in several (European) countries. No comparable data from the fifth member state (Serbia) were available. The EUBOHEALTH-Project is funded by the German Federal Ministry of Education and Research.
Some athletes are willing to try any supplement or drug to enhance performance. Recent reports suggest cigarette smoking may improve endurance performance by inducing oxidative stress which would, in turn, stimulate an increase in hemoglobin and thus increase oxygen-carrying capacity. It is important to validate these claims, given the hazardous side effects of cigarette smoking. PURPOSE: Examine the influence of cigarette smoking on blood hemoglobin levels to determine if smoking stimulates training-like conditions for aerobic enhancement. METHODS: Hemoglobin and oximetry levels were measured in 594 smokers and 1,626 non-smokers across a wide age-range (ages 15 to 98). Independent variables were age, sex, obesity, smoking status, and presence of diabetes, COPD, or other respiratory diseases. Dependent variables were hemoglobin and oximetry. Independent-samples t tests and chi-square tests were used to detect group differences between smokers and non-smokers. Multiple linear regressions were used to isolate the effect of smoking on hemoglobin and oximetry. RESULTS: Subjects were 52.5±22.5 years of age, 55.7% were male, 16.5% were obese, average hemoglobin was 13.5± 1.9 g/dL, and oximetry was 97.0 ± 2.9%. Independent-samples t tests revealed cigarette smokers’ hemoglobin levels were 0.46 g/dL higher (p<0.001) and oxygen saturation to be 0.3 percentage points higher (p=0.042). Cigarette smokers were also 13.5 years older (p<0.001) and more likely to be male (p<0.001). Age (p<0.001) and sex (p<0.001) were strongly correlated with hemoglobin. When controlling for all significant confounders, multiple linear regression did not demonstrate a significant effect of cigarette smoking on hemoglobin (p=0.317) but it found a reduction of 0.4 percentage points on oximetry (p=0.005). CONCLUSIONS: Simple t-tests indicated cigarettes might confer an ergogenic advantage via elevations in hemoglobin and oximetry. This, left alone, could suggest inadequate oxygen saturation of the blood (owing to smoking) may simulate training-like conditions. However, the predominant explanatory variables were age and sex. It is not the smoking, but other subject factors of the person who smokes that influences hemoglobin levels. Controlling for confounders, smoking has no effect on hemoglobin and reduced oxygen saturation.
of being physically active and getting the proper amount of sleep should to be stressed to college students as this can impact their cardiovascular health at a young age. Additionally, discussing the development of cardiovascular risk factors needs to start with this age group, as some participants were noted as being pre-hypertensive or having a high waist circumference. Since this was a very active sample, additional studies need to examine these relationships with a wider variety of college students.

Although risk factors associated with cardiometabolic diseases (CMD) such as excess adiposity are oftentimes detected in young adults, most of the research examining these relationships has focused on middle-aged and older adults and those “at-risk” for chronic diseases. Given the U.S. trend of increased obesity prevalence with age and the high prevalence of metabolic abnormalities in normal-weight young adult females, understanding the link between body composition and CMD risk in young healthy females is important for developing intervention strategies for primary prevention of obesity and CMD diseases. PURPOSE: Therefore, the purpose of this study was to examine the associations of body composition with CMD risk factors in apparently healthy young adult females. METHODS: Twenty-five non-obese [body mass index (BMI) < 30 kg/m^2] apparently healthy females (22.6 ± 4.2 years) took part in this cross-sectional study. All participants had height, waist circumference (WC), body composition using Dual-energy X-ray Absorptiometry, resting heart rate (HR), blood pressure, and fasting biomarkers assessed. Bivariate correlations using Spearman’s ρ were used to examine the relationships of CMD risk factors with anthropometric obesity indices and body composition. Significance was set a priori at P<0.05. RESULTS: Significant associations were found between waist-to-height ratio (WHtR) and resting HR (Spearman’s ρ = 0.436, P = 0.03), cholesterol (ρ = 0.404, P = 0.04), low-density lipoprotein (LDL-C) (ρ = 0.475, P = 0.02), and glucose (ρ = 0.485, P = 0.01); BMI and resting HR (ρ = 0.41, P = 0.04), cholesterol (ρ = 0.437, P = 0.03), and LDL-C (ρ = 0.477, P = 0.02); total body fat percentage and resting HR (ρ = 0.365, P = 0.01); bone mineral content and glucose (ρ = -0.536, P = 0.007); and lean mass and glucose (ρ = -0.461, P = 0.02). WC was not significantly associated with any of the CMD risk factors. CONCLUSION: While WHtR was correlated with more CMD risk factors than other measures of body composition, the strongest correlation was found between total body fat percentage and resting heart rate. These data suggest that body composition may play an important role in cardiometabolic health in young adult females even when classified as apparently healthy and non-obese.

Upon euthanasia, the gastrocnemius muscle, liver, and brain were removed and stored at -80°C and analyzed for markers of oxidative damage (4-hydroxynonenal (4HNE) and protein carbonyls (OxyBlot)) and protein levels of the antioxidants superoxide dismutase 1/2 (SOD1/2), catalase (CAT), and glutathione peroxidase (GPX).

RESULTS: The survivability-log rank tests indicated that KD increased the lifespan of rats (p=0.009) when compared to SC. No significant difference in body mass was observed (SC=425.7±13.2, KD=435.9±5.8) or end (SC=428.0±25.4, KD=417.1±22.6) of the experiment, and liver and gastrocnemius mass at sacrifice was not significantly different between groups (p=0.05). Liver CAT protein levels were about 30% higher in KD, albeit not significant (p=0.062). Additionally, liver SOD1 protein levels were about 20% higher in KD, but again, this was not significant (p=0.094). No other significant differences in protein levels of antioxidants, 4HNE, or OxyBlot were observed in either the gastrocnemius, liver, or brain. CONCLUSIONS: Lifelong KD improves longevity in rats without altering body mass and our data show that the longevity benefits of KD come without altering oxidative damage or antioxidant protein levels in the gastrocnemius, liver, or brain.

### 370 Board #211
**May 30 9:30 AM - 11:00 AM**
**The Association of Body Composition with Cardiometabolic Risk Factors in Apparently Healthy Young Adult Females**
Oakland University, Rochester, MI.

(NO relevant relationships reported)

### 372 Board #213
**May 30 11:00 AM - 12:30 PM**
**The Effects of Choline Intake and Resistance Exercise Training on Strength Gains in Older Adults**
Chang Woock Lee^1\(^,\) Elfegy Galvan^2\(^,\) Teak V. Lee^3\(^,\) Vincent CW Chen^4\(^,\) Steve Bui^5\(^,\) Stephen F. Crouse, FACSM^6\(^,\) James D. Fluckey^6\(^,\) Stephen B. Smith^6\(^,\) Steven E. Ritchie^6\(^,\) University of Texas Medical Branch, Galveston, TX; ^2Pierce College, Woodland Hills, CA; ^3Georgian Court University, Lakewood, NJ; ^4Dixie State University, St. George, UT; ^5Texas A&M University, College Station, TX.

(NO relevant relationships reported)

### 371 Board #212
**May 30 11:00 AM - 12:30 PM**
**Lifelong Ketogenic Diet Feeding Increases Longevity, But Does Not Alter Oxidative Stress Markers in Rats**
Hailey A. Parry, Wesley C. Kephart, Petey Mumford, Matthew Romero, Cody Hamm, Chris Brooks Mobley, Yufeng Zhang, Michael D. Roberts, Andreas N. Kavazis, FACSM.
Auburn University, Auburn, AL. (Sponsor: Andreas N. Kavazis, FACSM)

(NO relevant relationships reported)

### 373 Board #214
**May 30 11:00 AM - 12:30 PM**
**Utilization And Efficacy Of The “Run Fueled” Smartphone Application Among Collegiate Endurance Runners**
Michelle Barrack^1\(^,\) Michael Fredericson, FACSM^2\(^,\) Emily Kraus^3\(^,\) Brian Kim^3\(^,\) Sonal Singh^4\(^,\) Kristen Gravani^5\(^,\) Beth Miller^6\(^,\) Aurelia Nativ, FACSM^6\(^,\) California State University, Long Beach, Long Beach, CA; ^2Stanford University, Stanford, CA; ^3University of California, Irvine, Irvine, CA; ^4University of California, Los Angeles, Los Angeles, CA; ^5Duke University, Durham, NC. (Sponsor: Aurelia Nativ, FACSM)

(NO relevant relationships reported)

**PURPOSE:** The micronutrient choline plays a major role in neurotransmission and skeletal muscle contraction. We conducted a randomized controlled trial to examine the effects of choline intake on skeletal muscle responses to resistance exercise training (RET) in older adults.

**METHODS:** Three groups of 50 to 69-year-old generally healthy men and women (n=77; age=59.2±6.6 years, height=168.4±6 cm, weight=79.5±16 kg, body fat=30.3±10 kg, male/female=15/22) underwent one of 12 interventions: 1) RET (3x/week, 3 sets, 8-12 reps, 70% of maximum strength [1RM]) and submitted treadmill logs (4x/week for 12 weeks, 37 participants). Participants’ diets (mean choline intake: 5.9 mg/kg lean/d) were supplemented with 0.7 mg/kg lean/d (Med), 2.8 mg/kg lean/d (High, n=11), or 7.5 mg/kg lean/d (High, n=13) of choline in the form of egg yolk. Body composition, bone density, and blood tests were performed before and after training.

**RESULTS:** ANCOVA tests showed Low choline intake, compared with Med or High choline intakes, resulted in significantly diminished gains in composite strength (leg press + chest press 1RM; Low: 19.4±8.2%, Med: 46.8±8.9%, High: 47.4±8.1%, p=0.034) and thigh muscle quality (leg press 1RM / thigh lean mass; Low: 12.3±6%, Med/High: 46.4±7.0%, p=0.010) after controlling for lean mass changes, betaine, and vitamin B₂. No differences were observed in lean mass gains, clinical markers of liver/muscle damage, or blood lipid profiles.

**CONCLUSION:** These data indicate that low supplemental choline intake negatively affects strength gains with RET in older adults.

This study was supported by U.S. Poultry and Egg Association.
weekly resources and/or dietary behavior change. RESULTS: Forty-eight (62.3%) of the 77 runners utilized one or more components of the 8-week curriculum. For Module 1, 39.6% (n=19) of the 48 runners engaging with the curriculum exhibited use of ≥80% of components, i.e. “high-use”. Twenty-three (47.9%) of the 48 application users completed one tip or more components of Module 2, four runners exhibited “high-use” of Module 2. Built-in assessments indicated that 75.8% (n=25) of 33 runners reported the Module 1 daily tips as “engaging and effective”, while 70.6% (n=24) of 34 runners rated that the tips could assist with dietary change. Among 11 runners completing the Module 2 assessments, 54.5% (n=6) reported making changes consistent with the nutrition goals. Runners indicating “Yes” the tips were “engaging and effective”, compared to “No”, “Unsure”, or those not completing the assessment exhibited higher use of Module 1 (i.e. 34.8 ± 2.5 vs. 34.8 ± 4.3 vs. 7.3 ± 3.2, p<0.001) and Module 2 (6.8 ± 1.2 vs. 3.6 ± 2.2 vs. 0.0 ± 0.0 components). All runners (n=4) exhibiting “high-use” of Module 1 and Module 2 reported dietary changes. CONCLUSIONS: A majority of runners (62.3%) engaged with one or more components of the “Run-Fueled” application, with over 70% of runners that completed the assessments rating the tips and resources as engaging, effective, and able to facilitate dietary change. Runners’ reporting dietary change consistent with their nutrition goals exhibited higher application use.

**Dietary protein consumed as a liquid supplement pre-sleep has been shown to increase morning resting metabolism without hunger suppression. However, the influence of whole-food protein consumed pre-sleep on metabolism is unknown.**

**PURPOSE:** To determine the effect of a whole-food protein (cottage cheese, CC) consumed pre-sleep on next-morning resting energy expenditure (REE), respiratory exchange ratio (RER) and appetite compared to an isocaloric/isosodium liquid casein protein (CP) supplement and a placebo (PL) in active women. METHODS: In a beverage-blended, randomized, cross-over design, ten active (physical activity ≥4 days/wk for at least 12 m) women (age, 23.1 ± 1.9 yrs; body fat, 22 ± 4.6%; means ± SD) consumed pre-sleep CC (160 kcals, 30g protein, 10g carbohydrate, 0g fat), calorie and nitrogen matched liquid CP, or PL (0 kcals) 30-60 min pre-sleep. Participants arrived at 1800 h for an overnight stay in the lab. 30-60 min prior to participants’ normal bed time and 2 h after a standardized meal, participants consumed CC, CP, or PL and then immediately underwent measurements of REE and RER for 30 min. Upon waking the next morning (0500-0800 h) measurements of REE and RER were repeated and subjective measures of appetite (visual analog scale) were recorded. Testing occurred during the follicular phase of menstrual cycle. Statistical analyses were conducted using repeated measures ANOVA. Significance was accepted at p ≤ 0.05. **RESULTS:** There were no significant differences in acute CC (1725±327; CP; 1718±24; PL, 1691±265 kcal/d, p=0.95) or acute CC (p=0.56) or morning REE (CC,1396±293; CP, 1361±175; PL, 1432±216 kcals/d, p=0.79) or morning RER (p=0.52). Subjective measures of appetite were not different between groups. **CONCLUSION:** In active women, pre-sleep consumption of CC does not alter REE or RER more than a CP or PL beverage. These data suggest the form of the nutrient does not alter the metabolic response.

Supported by Florida State University and Dymatize Nutrition, Inc.
as executive function within this population. However, it is unknown if prolonged exercise bouts, which induce great cardiovascular stress and fatigue, elicit similar improvements in cognitive function. PURPOSE: To investigate the acute and prolonged effects of electrical muscle stimulation (EMS) on executive function in middle-age and older adult recreational cyclists. METHODS: This field study was conducted at the Hotter’N Hell Hundred cycling event (HHH) in Wichita Falls, Texas (ambient temperature, 26ºC mean, 30ºC maximum; relative humidity, 75% mean, 93% maximum). Sixty recreational cyclists (52±9 y) were enrolled following informed consent. All cyclists were deemed for mild cognitive impairment via Mini-Cog assessment (4:1). Physical function was assessed utilizing a 3-meter usual gait speed measurement (1.08±0.16 m/s). At baseline (i.e., 1 day before HHH), participants were familiarized with the executive function pencil-paper test (Trail Making A and B Tests, TMT) and anthropometric measurements were recorded (146.5 % body fat, 28.4±5.1 kg body mass). Cyclists completed TMT prior to and immediately following the HHH event. Ratings of perceived exertion (RPE) were collected at 0, 98, and 164 km and total exercise time was determined at the finish line. Pre- and post TMT scores were compared via paired t-test and all data are presented as mean±SD.

RESULTS: After the HHH 164-km cycling event, cycle, there was a significant improvement (i.e., faster completion time; p=0.001) of executive function (pre vs post, 83±26 vs 75±21 s). The mean RPE at cessation of exercise was 16±2 and mean total event time was 61.5 ± 1.25 h. CONCLUSION: An acute bout of prolonged, moderate intensity endurance exercise (> 6h) increased performance of an executive function task in a cohort of middle-age and older adults. This suggests that such exercise may provide chronic improvements in attention, working memory, and cognitive flexibility which counteract age-related declines of cognitive function.

PURPOSE: Research demonstrates that acute exercise may enhance retention of multi-trial episodic memories. This work has examined the effects of exercise on the mean level of memory recall. However, no study has examined whether exercise can influence the acquisition of new items, which was the purpose of this experiment. METHODS: Using a randomized controlled trial design, participants completed either a high-intensity bout of treadmill exercise for 15-min (n=22) or sat for 15-min (n=22) prior to completing a multi-trial episodic memory task (RA VLT). This task involved recalling 15 words for 6 successive trials, as well as after a 20-min delay (Trial 7). The performance on the multiple trials was categorized into gains (items not recalled on Trial n that were recalled on Trial n+1) and losses (items recalled on Trial n that were not recalled on Trial n+1).

RESULTS: The exercise group recalled more words on Trial 6 (11.4 vs. 9.7; P= .009) and after the 20-min delay (10.9 vs. 9.4; P=.01). The exercise group (vs. control) had a smaller proportion of losses from Trial 3-4 (10.4% vs. 20.3%; P=.04) and had a greater proportion of gains from Trial 5-6 (38.5% vs. 14.8%; P=.01).

CONCLUSIONS: The exercise-induced multi-trial memory effect may be influenced by greater item gains and fewer item losses from exercise.

PURPOSE: During advanced aging passive exercise (PE) is becoming a valuable therapeutic intervention to improve physical and mental performances. In the present study chronic PE (electromagnetic field stimulation, EMF-S) was introduced to rats reaching the senescent age of 32 months in order to develop a translational model for supporting healthy aging, attenuating cognitive decline and to clarify the mechanism of action of EMF-S on brain and muscle tissues during advanced aging. METHODS: Male Wistar rats were treated with EMF-S for six weeks, 3 times per week, 24 min per session prior to the age of 32 months. The doses of stimulation were: 45, 95 and 1250µT (Santerra MCR System, Fuding, Germany). Psychomotority (horizontal and vertical ambulation in novel environment) was estimated in open field (OF), the attention ability in novel object recognition (NOR) test, and spatial learning, reference and working memories, in Morris water maze (MWM) tests. RESULTS: OF: EMF stimulation enhanced novelty-induced motility, especially that of vertical type after both the middle and high doses. NOR: EMF-S increased attention after middle and high doses (p<0.001 and p<0.01, respectively) reflecting an enhanced attentional capability based on memory enhancement. MWM: passive exercise facilitated the working memory type spatial learning in this test and the highest dose of 1250µT was clearly effective (ANOVA, p<0.024). CONCLUSION: The results obtained on cognitive tasks showed that EMF stimulation as PE is effective in senescent. PURPOSE: To investigate the acute and prolonged effects of passive exercise (PE) on memory function in rats. In the age of 32 months rodents showed rather deteriorated cognitive functions in our earlier studies. Furthermore, it may be added that the highest dose of 1250µT did not uncover undesirable side effects on the brain, which is promising for a wider therapeutic window. The results support the notion that PE may complete dementia prevention program. These animal studies can provide options to study the cellular and molecular mechanisms behind this treatment, helping human interventions. Supported by OTKA Grant K116511 in Hungary.

PURPOSE: Acute exercise during the memory consolidation stage can enhance memory, whereas acute psychological stress post-memory encoding has been shown to impair episodic memory function. However, no study has evaluated whether acute exercise during memory consolidation can attenuate the detrimental effects of psychological stress-injection on memory retrieval, which was the purpose of this experiment. We also evaluate potential gender-specific effects, which has yet to be explored in this context. METHODS: Forty-four university students completed a between-group randomized control trial. Participants completed the WMS-III Logical Memory sub-test prior to moderate-intensity walking for 15 minutes, or sitting for 15 minutes. After exercise or sitting, participants completed an oral presentation per the Trier Social Stress Test (TSST) method, and then re-completed the memory assessment. RESULTS: There was a group by gender interaction (F=1.52; P=0.02), but there was evidence of a group x gender interaction (F=4.11; P=0.04). In both groups, men had a greater decline in memory function from the TSST. From pre- to post-assessment, respectively, male participants’ Logical Memory scores decreased from 16.31 (3.4) to 14.54 (3.7), whereas female participants’ scores remained more stable 17.89 (2.9) to 17.28 (3.1). CONCLUSIONS: These findings suggest gender effects extend to paragraph and logical memory performance, as men experienced a larger decline in memory function following a social stressor, irrespective of an acute exercise response.

PURPOSE: To examine whether an acute bout of moderate intensity exercise improves working memory and subsequently decreases delay discounting. METHODS: Twenty-four healthy young adults (13 men, 11 women, age 18-35) completed a repeated psychomotority design was utilized in which participants first completed questionnaires assessing physical activity and impulsiveness. They then completed a 30-minute treadmill run at 65% Heart Rate Reserve or rest period. Following exercise, participants completed an intertemporal choice task, measures of working memory (n-back) and mood (PANAS). RESULTS: Preliminary results revealed exercise related changes in mood, specifically increases is positive affect and decreases in negative affect following exercise compared to rest. However, no differences in working memory performance or delay discount rates were observed between conditions. Future directions examining the influences of individual differences and acute vs. prolonged exercise interventions are described in this presentation.

CONCLUSION: These preliminary data suggest that although prolonged exercise interventions may effectively reduce delay discounting, an acute bout of moderate intensity exercise does not. These findings inform strategies for eliciting exercise-induced changes in decision-making and highlight the importance of intervention duration.
Pilates is a popular form of exercise for women, and previous studies have shown its effectiveness for improving physical and psychological health. Pilates is a mindful approach to exercise, stimulating awareness of body structure, muscle recruitment, and body alignment during movement. Thus, Pilates requires concentration on the body. However, the effects of Pilates on cognitive functions remain unknown.

**PURPOSE:** This study aimed to investigate the effects of Pilates on cognitive functions in middle-aged women through a randomized clinical trial.

**METHODS:** Forty-four middle-aged women (average age: 56.4 ± 7.3 yrs) were randomly divided into Pilates (n = 22) and control groups (n = 22). Pilates classes were performed for 60 minutes twice per week for 10 consecutive weeks. The control group underwent health education sessions three times during the intervention. Prior to the intervention and 10 weeks afterwards, cognitive functions were assessed by the Trail Making Test A/B and Stroop Color-word test. Repeated-measures analysis of variance was performed to compare between-group changes.

**RESULTS:** There were no significant differences between the Pilates and control groups for any measured variables (P > 0.05) despite Trail-Making Test B significantly improving from pre- to post-Pilates classes (161.5 ± 22.0 to 52.2 ± 9.6 s; P = 0.02). Cohen’s d = 0.55 without significant changes during the control phase (64.9 ± 16.3 to 62.4 ± 12.3 s; P = 0.53). There were no changes in Trail-Making Test A. Stroop interference time significantly weakened in both groups (Pilates: 154.6 ± 124.6 to 216.7 ± 95.6 msec; P < 0.01, control: 166.0 ± 133.0 to 258.8 ± 83.3 msec; P < 0.01) because only the neutral task significantly improved (Pilates: 1016.5 ± 109.2 to 918.0 ± 168.8 msec; P < 0.01, control: 1014.8 ± 163.2 to 887.5 ± 168.1 msec; P < 0.01).

**CONCLUSIONS:** Although there were no significant between-group differences, the Pilates group showed improvement in Trail-Making Test B. Further large clinical trials are warranted to determine the effectiveness of Pilates for improving cognitive functions.
PURPOSE: Acute exercise (AE) has been shown to have a positive effect on memory performance, however these results are not always observed. Although some studies control for factors such as age and gender, there may be physiological factors that affect memory and the relationship between AE and memory and that may help explain inconsistent results. Low-frequency power (LF) is suggested as a marker of baroreflex sensitivity (BRS), which is associated with memory performance. We aimed to investigate the influence of LF in the relationship between AE and memory. METHODS: 68 active adults (M=21.9, SD=3.9 yrs) were randomly assigned to 4 groups in relation to a memory task: 20-min AE prior (n=17), 20-min AE after (n=15), 10-min AE prior and 10-min AE after (n=19), and no exercise control (n=17). Baseline heart rate (HR) was collected for 5-min in the seated position, and R-R intervals were reduced to LF. AE consisted of cycling at 55-65% HR reserve and the memory measure was the Rey Auditory Verbal Learning Test 24-hr recall. RESULTS: A significant group x LF interaction was found (F(3,60)>2.79, p=.048), LF was a control group (r(15)=.637, p<.006) but not for the exercising groups (p=.05). Post-hoc tests revealed benefits to 24-hr recall only for the groups that exercised before (M=10.295, SE=.595 or both before and after (M=10.10, SE=.575) memory tasks compared to control (M=7.72, SE=.600, p=.002, p=.004, respectively). CONCLUSION: Evidence supports that baseline LF, as a marker of BRS, is associated with memory. Importantly, activating the sympathetic nervous system, through AE, prior to encoding appears to disrupt this relationship and improved memory performance.

The Effect of Acute Aerobic Exercise on Attention and Affect in Middle-Aged Women

Jonathan Little, Kara T. McNeill, Cara Poole, Eric E. Hall, FACSM, Theresa Ramos, Elizabeth S. Evans. Elon University, Elon, NC. (Sponsor: Eric E. Hall, PhD, FACSM)

PURPOSE: To explore the effect of one bout of moderate intensity aerobic exercise on attention and affect in healthy middle-aged women. METHODS: Five healthy women, age 55.2 ± 8.9 years, BMI 30.2 ± 4.4 kg/m², and percent body fat 35.5 ± 5.7% completed a 30-minute session of aerobic exercise on the cycle ergometer at a workload corresponding to 60% of VO2peak. Subjects also completed a 30-minute control session on the cycle ergometer at 0 Watts. Before and after each 30-minute sessions, participants completed two computerized tests of attention: The Digit Span Test and the Flanker Task. Performance on the Digit Span test was assessed by examining the mean forward digit span and mean backward digit span achieved. Performance on the Flanker Task was assessed by examining the error proportion and mean reaction time for the incongruent and congruent trials. Participants also completed the Activation Deactivation Adjective Checklist (AD-ACL) to assess affect (i.e. energy, tiredness, calmness, and tension) before and after both 30-minute sessions. RESULTS: Repeated-measures ANOVAs indicated that participants achieved a significantly higher forward vs. backward mean digit span (mean difference: 0.7 ± 0.2, p = 0.046) and that mean digit span performance significantly improved from pre- to post-session (mean difference: 0.5 ± 0.2, p = 0.033). Participants displayed a larger decrease in error proportion from pre- to post-session for the incongruent vs. the congruent trials of the Flanker Task (p = 0.058), as well as a significant decrease in mean reaction time pre- to post-session (mean difference: -23.0 ± 6.8 ms, p = 0.028) that was more pronounced for the 24-hr recall for the incongruent trials (p = 0.08). Participants also reported feeling significantly more energetic and less tired from pre- to post-session on AD-ACL subscale scores (mean differences: 3.5 ± 0.9, p = 0.003 and 4.7 ± 1.8, p = 0.052, respectively). CONCLUSIONS: Exploratory results suggest that 30 minutes of aerobic exercise may positively impact some aspects of attention in middle aged women. Participants reported feeling more energized and less tired after 30 minutes of activity. Additional ongoing investigation is needed to more clearly understand the impact of acute aerobic exercise on cognitive function in this population.

Exercise Training Related Changes in Verbal Fluency in Healthy Older Adults and Mild Cognitive Impairment

Allison P. Williams1, Zuleyha Ozturk1, Tina Mirzaazadeh1, Yasmeen Faroqi-Shah1, Kristy A. Nielsen1, J. Carson Smith, FACSM1,2. University of Maryland, College Park, MD. (Sponsor: J. Carson Smith, PhD, FACSM)

PURPOSE: To explore the effect of one bout of moderate intensity aerobic exercise (AE) on verbal fluency in healthy older adults (OTA) and mild cognitive impairment (MCI) populations. METHODS: Seventeen OTA participants and 18 MCI patients completed 12-week AE intervention consisting of supervised treadmill walking at a moderate intensity. Before and after AE, participants completed a phonemic verbal fluency task as part of a larger neuropsychological battery. Total word count and complexity of responses, measured by word frequencies and syllable length, were examined. RESULTS: There was no change in total word count. However, both groups produced words with greater frequency after ET (p = .016, partial eta-squared = .163). In addition, participants diagnosed with MCI produced words with fewer syllables after ET, an effect not observed in healthy controls (interaction p = .034, partial eta-squared = .129). CONCLUSIONS: These findings suggest 12-weeks of walking exercise training may modify lexical retrieval strategies, with a greater reliance on more frequently appearing words, and in the case of MCI, words that have fewer syllables. Our past finding of reduced semantic memory activation after ET suggests improved neural efficiency. These results could be interpreted similarly if producing more frequent and shorter words is adaptive in the case of MCI, words that have fewer syllables. Our past finding of reduced semantic memory activation after ET suggests improved neural efficiency. These results could be interpreted similarly if producing more frequent and shorter words is adaptive in the case of MCI, words that have fewer syllables.

There is overwhelming support for enhanced cognitive performance (CP) as a result of an acute bout of aerobic exercise. However, there is less research, and the research is less clear regarding the effects of an acute bout of resistance exercise (RE) on cognitive performance. PURPOSE: To investigate the effect of an acute bout of high-intensity RE on reaction time (RT), working memory (WM) & inhibition (IC) - parameters of CP. To determine if there were sex differences for RE & CP, & to examine the relationship between CP & RE-Total Load (TL). METHODS: 23 healthy males (9) & females (Age = 21.7±1.8 yrs) volunteered. Day 1: body composition (Bodypod) and VO2 max were assessed (VO2 max = 41.7±3.7 ml/kg/min, BF% = 18.1±6.5%). Day 2: Ss completed an initial battery of CP tests (impACT) & then completed 1-repetition maximums (1-RM) for 7 Res that made-up the RE routine. Days 3&4: Ss underwent either 30 minutes of semi-reclined Rest (R) or the RE routine. The RE routine consisted of 2 consecutive sets (12 reps) of each RE at 75% 1-RM, followed by a set of 3 RM. The RE routine order was counter-balanced. Days 2, 3&4 were separated by 1wk. Prior to (PreR & PreEx) & following R & RE routine (PostR & PostEx) Ss performed the impACT assessment for CP (Conditions 1 & 2). X(2Sex) ANOVAs with Repeated Measures & a priori contrasts were used to test for significant main effects & interactions for the CP variables. RESULTS: T-Tests confirmed Males (M) exhibited higher VO2 max, TL, RE-VO, & lower BF%. PreEx-PostEx RT (526+/-.56ms - 510+/-.58ms) was significantly reduced (p<0.02), whereas PreR-PostR RT (490+/-.53ms - 542+/-.63ms) did not differ significantly. None of the CP variables differed by Sex. RT-change (PreEx-PostEx) & TL & RE-VO were not significantly correlated. CONCLUSION: Following a single-bout of a high-intensity RE routine, RT was significantly reduced for M & F. However, WM & IC did not differ significantly following R or M for Females. M exhibited greater VO2 & VCO2, in response to greater TL, however the change in RT (PreEx-PostEx) was not related to TL the entire group or for M or F.
Neuromuscular efficiency is improved during exercise when attention is focused externally on the effects of movement, rather than internally on the generation of movement. Music is a form of external attentional focus which may yield additional psychological benefits during exercise. The impact of music on neuromuscular efficiency remains to be fully investigated.

**METHODS:** Apparently healthy subjects (N = 23; 12 men) completed an isometric elbow flexion task (40% of predetermined 3RM) for 1 min in three randomized, counterbalanced conditions: internal focus (INT), external focus with a simple distraction task (EXT), and external focus listening to music (MUS). Muscle activation of the biceps (BI) and triceps (TRI) brachii were recorded at 15 s intervals using a 4 channel Delays EMG system, and were used to compute cocontraction ratio (CCN). Heart rate (HR) was measured throughout the exercise tasks and recorded at 15 s intervals. Psychological characteristics of perceived exertion (RPE), effective valence, task-motivation, and attentional focus were measured at the end of each trial using single-item scales. Repeated measures 3 (condition) x 4 (time) ANOVAs were used to analyze the physiological variables (BI, TRI, CCN, and HR). Psychological variables were compared across conditions using a series of one-way repeated measures ANOVAs.

**RESULTS:** No significant interaction effect or main effect for condition was found for any of the physiological variables (p > .05), though there was a trend (p = .071, η² = .12) for decreased HR with MUS (91.41 bpm) compared to INT (93.87 bpm). There was a significant main effect of condition on RPE (p = .002, η² = .25), with a greater RPE in INT (13.87) compared to EXT (12.59) and MUS (12.61).

**CONCLUSIONS:** The primary finding from the current study was that external focus listening to music and a distraction task, reduced the perception of effort during brief single-joint isometric exercise, despite the fact that muscle activation and physiological demand were unchanged.

**REFERENCE:**

391 Board #232 May 30 11:00 AM - 12:30 PM
The Influence Of Self-generated Emotions On Aerobic Physical Performance: An Investigation Of Happiness, Anger, And Sadness
Brianda Cortez, Manuel Guillen, Roberto Baca, Teresa Loya, Alberto Garcia, Michelle Kowalski, Murat Karabulut. University of Texas Rio Grande Valley, Brownsville, TX.

**PURPOSE:** The purpose of this study was to test the influence of self-generated emotions on exercise performance during an aerobic workout on a cycle ergometer. A randomized within-subjects experimental design was used to test the hypotheses. The four randomized testing sessions included: the control (No-Emotion), sadness (SAD), happiness (HAPPY), and anger (ANGRY). Cycle ergometer seat demand were unchanged.

**METHODS:** Sixteen males (Mean ± SD: age = 23.1 ± 2.7 years; height = 162.7 ± 26.2 cm; weight = 82.6 ± 16.1 kg) performed 4 sessions of aerobic exercise on a cycle ergometer. Their fitness level was determined during the first 2 testing sessions. The remaining 4 sessions were testing conditions: (a) control (No-Emotion), (b) sadness (SAD), (c) happiness (HAPPY), and (d) anger (ANGRY). The exercise protocol consisted of 4 conditions: (1) warm-up, (2) aerobic exercise, (3) cool-down, and (4) recovery. The exercise protocol was as follows: Each testing session consisted of a 5-min warm-up, 15-min aerobic exercise, 5-min cool-down, and 5-min recovery. The exercise protocol was designed to determine whether forecasts about pleasure experienced during an exercise bout are more strongly related to behavior and intentions than forecasts about pleasure experienced after an exercise bout. The influence of self-generated emotions on exercise performance was measured using the ANOVA model for repeated measures.

**RESULTS:** No significant interaction effect or main effect for condition was found for any of the physiological variables (p > .05), though there was a trend (p = .071, η² = .12) for decreased HR with MUS (91.41 bpm) compared to INT (93.87 bpm). There was a significant main effect of condition on RPE (p = .002, η² = .25), with a greater RPE in INT (13.87) compared to EXT (12.59) and MUS (12.61).

**CONCLUSIONS:** The primary finding from the current study was that external focus listening to music and a distraction task, reduced the perception of effort during brief single-joint isometric exercise, despite the fact that muscle activation and physiological demand were unchanged.

**REFERENCE:**

392 Board #233 May 30 11:00 AM - 12:30 PM
Assessment Of Knee And Ankle Proprioception In Young And Old Adults Using The AMEDA
Nicholas P. Cherup, Savannah V. Wooten, Shayaan Qazi, Brian Zalma, Joseph F. Signorile. University of Miami, Miami, FL.

**PURPOSE:** To compare the active proprioception of the lower limbs and ankles in healthy young (YG) and older individuals (OG) using the AMEDA. **METHODS:** Forty-four persons (YG: n=22; OG: n=22) participated in the study. During lower limb (hip, knee) testing, participants were asked to touch a rear bar before kicking forward to strike a stop board placed at one of three positions (11cm, 16cm, 22cm). For the ankle, the foot was inverted to one of three angles (1=12o; 2=14o; 3=16o). Our testing included 3 conditions: condition 1 (C1=no difference between sequential positions), condition 2 (C2=minimal differences between sequential positions), and condition 3 (C3=maximum difference between sequential conditions). Participants were asked to identify all positions while blindfolded over the course of 50 trials. Two two-way ANOVA (condition x group) were used to examine the number of errors within each group at each joint position.

**RESULTS:** The YG made significantly more errors than the OG for the lower limb during C1 and C3 (p < .05). Furthermore, for the YG, the number of errors decreased from C1 through C3 (p < .05). The OG also produced significantly more errors than the YG in C1 for the left and right ankles (p < .05). The OG made more errors during C2 then any other condition for both ankles (p < .05). **Conclusion:** The YG made more JPS errors then the OG. These findings are contrary to the proposition that proprioception decreases with age. Based on these findings, older individuals appeared to be more aware of their knee and ankle joint positions. These differences may be attributed to the OG paying greater attention to their movement patterns during day to day activities as a precaution to reduce fall risk.

**REFERENCE:**

393 Board #234 May 30 11:00 AM - 12:30 PM
During Versus Post-Exercise Affective Forecasts: Some Affective Forecasts Are More Important than Others
Rachel M. Kahn, Zachary Zenko, Julia D. O’Brien, Dan Ariely. Duke University, Durham, NC. (Sponsor: Panteleimon Ekkekakis, FACSM)

**PURPOSE:** The purpose of this study was to determine whether forecasts about pleasure experienced during an exercise bout are more strongly related to behavior and intentions than forecasts about pleasure experienced after an exercise bout. **METHODS:** A four-item scale was generated to assess forecasted affect, both during and after a future exercise bout (Cronbach’s α = .97 and .98, respectively). These items consisted of bipolar visual analog scales (e.g., “I will feel terrible” to “I will feel wonderful”). Participants (N = 240, 51% men, 48% women, 1% non-binary, age: 36 ± 12 years) were randomly assigned to either (1) forecast their affect during their next exercise bout (i.e., “How will you feel during your next exercise session?”), or (2) forecast their affect 10 minutes after their next exercise bout ends (i.e., “How will you feel 10 minutes after your next exercise session?”). Participants also indicated the number of minutes of aerobic exercise they completed in the previous week and how many minutes they intend to complete in the next week. **RESULTS:** Forecasts about during-exercise affect were more strongly related to exercise intentions than forecasts about post-exercise affect (r = .46 vs. r = .22, Z = 2.34 p < .01). Likewise, forecasts about during-exercise affect were more strongly related to past exercise behavior than forecasts about post-exercise affect (r = .24 vs. r = .19, Z = 1.99, p = .05). **CONCLUSIONS:** Forecasts about post-exercise affective states explained 4.75% and 5.01% of the variance in exercise intentions and past behavior, respectively. However, forecasts about during-exercise affective states explained 23.52% and 20.70% of the variance in exercise intentions and past behavior, respectively. Researchers should consider more specific measures of affective forecasts; these data indicate that predictions about how one will feel at different times (e.g., during and after an exercise experience) are differently related to exercise behavior and intentions. Further, specifying a time point may help reduce participant confusion and measurement error.
Athletes need to maintain high concentration of attention in training and competition, while mental fatigue could damage their concentration, response and motor control abilities. However, there is a lack of research exploring the effect of mental fatigue on specific attention abilities of athletes.

**Purpose:** The present study is aimed to explore the effect of mental fatigue on athletes’ selective attention and involuntary attention from the evidence of behavioral and ERPs.

**Methods:** Thirty elite tennis players (16 male, 14 female) were randomly selected and separated into Experiment Group (EG, n=15, age 21.08±1.5) and Control Group (CG, n=15, age 20.92±1.04). The athletes in EG were in mental fatigue after 1 hour of Flanker task, while the athletes in CG relaxed and kept themselves clear-headed for 1 hour.

**Results:** Heart rate variability (HRV), behavioral index and Rating of Perceived Exertion (RPE) were measured to detect players’ mental fatigue during Flanker task which was divided into 4 periods (each stage 15 min). Selective attention (Pa3) and involuntary attention (Pa3a) were evoked by novel auditory oddball task before and after the Flanker task.

**Conclusion:** One hour of continuous cognitive task could induce psychological fatigue. Athletes’ involuntary attention and selective attention were damaged after mental fatigue.

**Abstracts were prepared by the authors and printed as submitted.**

---

**394 Board #235 May 30 11:00 AM - 12:30 PM**

**Effects Of Mental Fatigue Induced By A Continuous Cognitive Task On Attention Abilities Of Athletes**

Jianxiu Liu, Ruidong Liu, Chunmei Cao, Xindong Ma. Tsinghua University, Beijing, China. (Sponsor: LiLi, FACSM)

(No relevant relationships reported)

---

**395 Board #236 May 30 11:00 AM - 12:30 PM**

**Effects of Sedentary Behavior and Physical Activity on Cognitive Function are Conferred by Cortical Thickness**

Evan Pasha, Takashi Tarumi, Tsusaba Tomoto, Marcel Turner, Justin Repshas, Rong Zhang. University of Texas Southwestern Medical Center, Dallas, TX.

(No relevant relationships reported)

---

**396 Board #237 May 30 11:00 AM - 12:30 PM**

**Don’T Forget To Exercise: The Effects Of Different Forms Of Exercise On Memory**

Emma K. Wilkie, Carrie Cutler, Emily M. LaFrance, Christopher P. Connolly. Washington State University, Pullman, WA.

(No relevant relationships reported)

---

**397 Board #238 May 30 11:00 AM - 12:30 PM**

**Relationship between Affective State and Enjoyment of Acute Exercise**

Battogtokh Zagsuren, Colleen L. Geary, Hayley V. MacDonald, Mark T. Richardson, Jonathan E. Wingo, FACSM, Phillip A. Bishop, FACSM, James D. Leeper, Frances A. Conners. The University of Alabama, Tuscaloosa, AL. (Sponsor: Jonathan E. Wingo, FACSM)

(No relevant relationships reported)

---

Acute bouts of exercise have been shown to positively affect memory. Although the majority of previous research has focused on the effects of exercise on retrocognitive memory, recent findings suggest exercise may enhance prospective memory. The impact of yoga on prospective memory has not been previously examined.

**PURPOSE:** This study examined the effects of different forms of exercise on prospective memory (i.e., the ability to remember to execute tasks in the future) and retrospective memory (i.e., the ability to remember previously learned information).

**METHODS:** 145 students were randomly assigned to one of four groups: 1) treadmill running (R) (n=37), 2) kettlebell resistance exercise (K) (n=32), 3) yoga (Y) (n=35), or 4) sitting (S) (control group) (n=41). After exercising or sitting, participants completed a one-hour battery of neuropsychological tests that included two prospective memory tests: 1) an episodic prospective memory test (the reminder test) and 2) a habitual prospective memory test (the difficulty ratings test). To assess retrospective memory participants completed 1) a verbal memory test (CVLT-II) and 2) a visuospatial memory test (BVMT-R). Participants in the R, K, and Y groups performed video-guided exercise at a moderate level of intensity (50-70% of HHR) for 20 minutes, with a 5-minute warmup and a 5-minute cooldown. Participants in the S group watched an exercise video while sitting for 30 minutes.

**RESULTS:** There was no significant effect of exercise on the habitual prospective memory test (F(1,140)=.64, p=.59), but there was a significant effect of exercise on the episodic prospective memory test (p(3)=8.30, p=.04). Follow-up tests indicate that aerobic exercise led to fewer episodic prospective memory failures (11%) than resistance exercise (41%), yoga (31%), or sitting (27%).

**Conclusion:** Prospective memory is positively affected by exercise among college students. In contrast to previous findings, aerobic exercise specifically (but not resistance) appears to enhance prospective memory. This discrepancy may be due to differences in the time at which the prospective memory instructions were administered in the two studies.

Increasing exercise adherence is one of the main challenges in lifestyle interventions. Although the affective response to exercise has been investigated extensively, it is unclear whether one’s exercise adherence is influenced by pre-exercise affective state.

**PURPOSE:** To evaluate the relationship between pre-exercise affective state and enjoyment of acute bouts of walking of varying durations.

**METHODS:** Regularly active college-aged participants (n=29; mean ± SD age=21.2±2.3) completed 3 counterbalanced exercise sessions involving moderate-intensity (3–5 METs) walking at a moderate level of intensity (50-70% of HHR) for 20 minutes, with a 5-minute warmup and a 5-minute cooldown. Participants in the S group watched an exercise video while sitting for 30 minutes.

**RESULTS:** There was no significant effect of exercise on the habitual prospective memory test (F(3,141)=.71, p=.55; BVMT-R, F(3, 141)=.48, p=.70).

**Conclusion:** Prospective memory is positively affected by exercise among college students. In contrast to previous findings, aerobic exercise specifically (but not resistance) appears to enhance prospective memory. This discrepancy may be due to differences in the time at which the prospective memory instructions were administered in the two studies.
Cognitive decline is a problematic secondary complication of spinal cord injury (SCI), arising from chronic hypotension, undiagnosed brain injury, medications, or other systemic causes. In many other patient populations (the elderly, multiple sclerosis, Alzheimer’s disease), mild cognitive decline exerts a negative effect on quality of life (QOL). People with chronic SCI often report lower QOL than the general population, but the potential influence of cognitive function is unknown. **PURPOSE:** The purpose of this study is to examine relationships between cognitive function and QOL in individuals with and without SCI. **METHODS:** Individuals (n = 25) with and without SCI rated QOL with two global scales (EQ-5D, PROMIS physical/mental health), and two SCI-validated scales (Secondary Health Conditions Scale (SCS-M), SCI-QOL). Cognitive function was assessed using NIH Toolbox (Dimensional Change Card Sort, Flanker Inhibition Control & Attention, List Sorting Working Memory, Picture Sequence). **RESULTS:** Subjects with SCI rated physical function QOL dimensions (EQ-5D, PROMIS physical health, SCS-M) lower than non-SCI subjects (all p < 0.0002). QOL dimensions related to mental/functional (PROMIS mental health, SCI-QOL Positive Affect & Well-Being (PAWB)), Anxiety, Depression, Resilience did not differ between groups (all p > 0.7). Subjects with SCI reported greater Pain Interference and lower Ability to Participate than non-SCI subjects (both p < 0.011). In non-SCI subjects, correlations existed between cognitive test scores and certain SCI domains (Resilience R² = 0.46 to 0.72; PAWB R² = 0.29 to 0.51). No correlations between SCI and QOL emerged for participants with SCI. **CONCLUSIONS:** Individuals with SCI may report high mental/emotional QOL despite reporting low QOL on domains related to physical function and participation. Relationships between cognitive function and QOL were not observed in participants with SCI, despite robust associations in those without SCI. The relationship between the QOL domain Resilience and the cognitive trait “executive function” warrants further investigation. Supported by R01HD084645 and R01HD082109. REDCap access (Institute for Clinical and Translational Science) provided via the National Center for Advancing Translational Sciences (U54TR001356).

**Aging process and diseases such as hypertension contribute to cognitive impairment. Exercise training has been extensively recommended due to its benefits to the cognitive function in elderly. Inconsistent findings in the literature related to the better exercise training program for learning, executive functions and memory. **PURPOSE:** Compare the effects of two different exercise program (combined vs. aerobic) on cognitive function of hypertensive elderly. **METHODS:** Hypertensive medicated elderly (age 65.5±4, mini-mental state examination 25.4±3, geriatric depression scale 3.5±2.2, PAS 133.8±20, PAD 84±11) were allocated to combined training (CT, n=17), composed by the same aerobic protocol, three times/week, or to Aerobic Training (AT, n=13) control group. **RESULTS:** We compared delta of groups by ANOVA One-way followed by Hochberg post hoc test and by Kruskal-Wallis following by Mann-Whitney for parametric and non-parametric data, respectively. Data is presented in mean ± standard deviation. **RESULTS:** There was larger GML rule-break error reduction (P<0.05) for CT (2.7±6) and AT (2.7±4) compared to CG (2.3±4). There was a tendency (P=0.07) to improve recording short auditory memory (ISL) after 1.5±2 when compare to CG (0.0±0). No differences were found for latter recall. Furthermore, CT (2.6±2) reduced more depression scores (P<0.05) compared to AT (-0.7±0) and CG (0.1±1). **CONCLUSIONS:** The rule in break-rule errors suggest CT and AT improve attention, inhibitory control and working memory and only CT improve short term auditory memory in hypertensive elderly individuals. The improvement in short-term memory could be associated with the improved attention which could be also dependent of lower depression score in this group. **MEDICINE & SCIENCE IN SPORTS & EXERCISE®**

**Functional limitation can be a serious problem in burn survivors. Such individuals report physical limitations following a burn injury which leads to a perceived reduction in health-related quality of life that persists years after the initial injury. **PURPOSE:** We tested the hypothesis that well-healed burn survivors having prior burn injuries covering a large body surface area will have greater subjective and objective functional limitations compared to those with prior injuries covering a small body surface area. **METHODS:** Subjective information was collected through the SF-36 questionnaire, with a focus on the physical function domain. Objective measurements of functional ability included a maximal aerobic capacity test, timed-up-and-go, five times sit-to-stand, and timed stairs test. These variables were collected in three experimental groups of individuals (2 female) with burn injuries greater than 50% (high burn, HB) of their total body surface area (TBSA); 9 individuals (5 female) with burn injuries covering less than 50% (low burn, LB) of their TBSA; and 7 (3 female) non-injured control subjects (CON). **RESULTS:** Analysis of the perception of limitations in Physical Function from the SF-36 revealed a statistically significant difference between groups (P=0.0014). Further post hoc pairwise testing revealed that SF-36 Physical Function scores were higher in the CON group (99±2, p=0.002) and LB group (93±9, p=0.02) when compared to the HB group (71±1). No difference was found in the SF-36 Physical Function scores between the LB and control groups (p=0.99). Of note, this pattern of differences in the perception of physical limitations between the experimental groups was not reflected in the functional measurements. No significant differences were identified in maximum aerobic capacity (CON:32±10, LB:27±5, HB:29±5 ml/kg/min, p=0.65), five times sit-to-stand (CON:9±2, LB:10±2, HB:10±1.1 s, p=0.76), timed-up-and-go (CON:13±3, LB:13±2, HB:14±2 s, p=0.51), and timed stairs test (CON:11±2, LB:11±1, HB:11±2 s, p=0.85). **Conclusion:** Collectively, these data suggest that in burn survivors with injuries covering greater than 50% of their TBSA, perceived physical limitations do not reflect objective measures of functional ability. Supported by NIH Grant GM088865

**Individuals with Down syndrome (DS) commonly exhibit a mild to moderate level of cognitive impairment, which further affects quality of life in this population. Regular aerobic exercise has been shown to improve cognitive function in individuals with and without DS. However, if an acute bout of moderate intensity aerobic exercise has cognitive benefit in individuals with DS has yet to be explored. **PURPOSE:** To investigate the effect of an acute bout of aerobic exercise on cognitive function in individuals with and without DS. **METHODS:** Forty volunteers with and without DS (DS=20, 25 yrs; Control=20, 25 yrs) participated in this study. VO2peak was obtained via indirect calorimetry by an individualized maximal exercise treadmill protocol. Participants exercised at 60% of maximal capacity for 20 min on a separate day. Cognitive function tests (task completion time and accuracy of task completion, AQT) were measured before, immediately after, and 30 min after the submaximal walking bout. Individuals without DS performed an additional cognitive function test, the Flanker test, to avoid the known ceiling effect of the AQT. **RESULTS:** Individuals with DS exhibited impaired cognitive function compared to individuals without DS with slower task completion time and higher error rate. (p < 0.05 for both AQT components, task completion time and error rate, were not altered after 20 min of treadmill exercise in either group. However, improved reaction time and error rate on the Flanker test (immediate; 30 min post), suggest exercise positively benefited cognitive function among those without DS. (p < 0.05).
CONCLUSIONS: Our results indicate that individuals with DS may need a higher intensity or longer exercise time for cognitive improvement. In addition, in-depth cognitive function testing may be more sensitive in detecting changes with exercise in individuals with DS.

Aging is associated with a decline in cognitive and psychomotor functions, resulting in difficulties with daily activities such as driving. Cognitive function has been found to be associated with carotid intima-media thickness (IMT) and aortic stiffness (carotid-femoral PWV, cfPWV). These age-related decrements can be mitigated through routine aerobic exercise.

PURPOSE: To determine the effects of life-long aerobic exercise on cognitive function, driving performance, and cardiovascular health among older adults (65 – 84 years old).

METHODS: A cross-sectional design was utilized to compare 27 endurance-trained (ET) with 35 sedentary (S) older adults (70±5yrs). Older adults were excluded from the study if they were classified as having stage II hypertension, diabetes mellitus, cardiovascular diseases, or currently taking more than 1 medication for blood pressure or cholesterol. Driving performance and cognitive function were measured via driving simulator and a cognitive battery, respectively. Cardiovascular health consisted of assessing estimated VO_{max}, carotid IMT, and ccfPWV. Fitness comparisons were made using an independent sample t-test. Cognitive function and driving performance scores were transformed to Z-scores.

RESULTS: VO_{max} was higher among ET than S (41±9 vs 25±3 ml/kg/min, p<0.01). BMI was higher among S than ET (26±4 vs 24±4, p<0.01). There were no differences in brachial systolic blood pressure (131±13 vs 122±19 mmHg), ccfPWV (12±2 vs 12±2 m/s), carotid-IMT (74±.15 vs 76±.13 mm), and cognitive function scores (-0.5±.57 vs -0.9±.97) between the groups. However, ET performed better on the driving simulator (.18±.58 vs -.28±.92, p<0.05). Carotid IMT and cfPWV were moderately associated (r = .38, p < .01). VO_{max} was not associated with age, carotid IMT, or cfPWV. CONCLUSION: Enhanced cardiorespiratory fitness may mitigate age-related decrements in driving performance independently of central artery structure and function.

CONCLUSION: Our results indicate that individuals with DS may need a higher intensity or longer exercise time for cognitive improvement. In addition, in-depth cognitive function testing may be more sensitive in detecting changes with exercise in individuals with DS.

Aging is associated with a decline in cognitive and psychomotor functions, resulting in difficulties with daily activities such as driving. Cognitive function has been found to be associated with carotid intima-media thickness (IMT) and aortic stiffness (carotid-femoral PWV, cfPWV). These age-related decrements can be mitigated through routine aerobic exercise.

PURPOSE: To determine the effects of life-long aerobic exercise on cognitive function, driving performance, and cardiovascular health among older adults (65 – 84 years old).

METHODS: A cross-sectional design was utilized to compare 27 endurance-trained (ET) with 35 sedentary (S) older adults (70±5yrs). Older adults were excluded from the study if they were classified as having stage II hypertension, diabetes mellitus, cardiovascular diseases, or currently taking more than 1 medication for blood pressure or cholesterol. Driving performance and cognitive function were measured via driving simulator and a cognitive battery, respectively. Cardiovascular health consisted of assessing estimated VO_{max}, carotid IMT, and ccfPWV. Fitness comparisons were made using an independent sample t-test. Cognitive function and driving performance scores were transformed to Z-scores.

RESULTS: VO_{max} was higher among ET than S (41±9 vs 25±3 ml/kg/min, p<0.01). BMI was higher among S than ET (26±4 vs 24±4, p<0.01). There were no differences in brachial systolic blood pressure (131±13 vs 122±19 mmHg), ccfPWV (12±2 vs 12±2 m/s), carotid-IMT (74±.15 vs 76±.13 mm), and cognitive function scores (-0.5±.57 vs -0.9±.97) between the groups. However, ET performed better on the driving simulator (.18±.58 vs -.28±.92, p<0.05). Carotid IMT and cfPWV were moderately associated (r = .38, p < .01). VO_{max} was not associated with age, carotid IMT, or cfPWV. CONCLUSION: Enhanced cardiorespiratory fitness may mitigate age-related decrements in driving performance independently of central artery structure and function.

CONCLUSION: Our results indicate that individuals with DS may need a higher intensity or longer exercise time for cognitive improvement. In addition, in-depth cognitive function testing may be more sensitive in detecting changes with exercise in individuals with DS.

Aging is associated with a decline in cognitive and psychomotor functions, resulting in difficulties with daily activities such as driving. Cognitive function has been found to be associated with carotid intima-media thickness (IMT) and aortic stiffness (carotid-femoral PWV, cfPWV). These age-related decrements can be mitigated through routine aerobic exercise.

PURPOSE: To determine the effects of life-long aerobic exercise on cognitive function, driving performance, and cardiovascular health among older adults (65 – 84 years old).

METHODS: A cross-sectional design was utilized to compare 27 endurance-trained (ET) with 35 sedentary (S) older adults (70±5yrs). Older adults were excluded from the study if they were classified as having stage II hypertension, diabetes mellitus, cardiovascular diseases, or currently taking more than 1 medication for blood pressure or cholesterol. Driving performance and cognitive function were measured via driving simulator and a cognitive battery, respectively. Cardiovascular health consisted of assessing estimated VO_{max}, carotid IMT, and ccfPWV. Fitness comparisons were made using an independent sample t-test. Cognitive function and driving performance scores were transformed to Z-scores.

RESULTS: VO_{max} was higher among ET than S (41±9 vs 25±3 ml/kg/min, p<0.01). BMI was higher among S than ET (26±4 vs 24±4, p<0.01). There were no differences in brachial systolic blood pressure (131±13 vs 122±19 mmHg), ccfPWV (12±2 vs 12±2 m/s), carotid-IMT (74±.15 vs 76±.13 mm), and cognitive function scores (-0.5±.57 vs -0.9±.97) between the groups. However, ET performed better on the driving simulator (.18±.58 vs -.28±.92, p<0.05). Carotid IMT and cfPWV were moderately associated (r = .38, p < .01). VO_{max} was not associated with age, carotid IMT, or cfPWV. CONCLUSION: Enhanced cardiorespiratory fitness may mitigate age-related decrements in driving performance independently of central artery structure and function.
Healthy aging is a challenge to the world population, not only due to age related cognitive impairment but also dinapenia and sarcopenia which can affect strength dependent activities. Therefore, it is of interest to evaluate the effects of strength training concurrent with cognitive performance. The purpose of the study was to determine the effect of 12 weeks of strength training on cognitive performance changes in overweight older women. Twenty-one overweight older women were recruited and divided into a Control group (n = 5) and Intervention Group (n = 16). Participants had body mass, height, body mass index (BMI), waist circumference, waist to height ratio, Upper Lean Limbs (ULL) Lower Lean Limbs, (LLL) and cognitive performance measured. To evaluate differences between the control group and intervention group, a 2-way ANOVA with Tukey’s post hoc comparison was used. The results indicate that after the intervention period with strength training, there were no differences in anthropometric variables. However, significant differences were found (p < 0.05) in ULL, LLL and cognitive performance. Strength training in elderly overweight women exerts positive effects on upper and lower limb strength and also increases cognitive performance.

Purpose: The purpose of study was to examine the associations of objectively measured physical activity with executive functioning in Chinese young adults. Methods: Participants were 162 university students (45.7% females, mean age = 19.0 ± 1.1 years) recruited from a university in Shanghai, China. Participants’ daily physical activity was measured by hip-mounted accelerometers (Actigraph WGT3X-BT, Pensacola, FL, USA). The accelerometer data were analyzed using Actilife 6 software (Pensacola, FL, USA). Executive functioning was assessed by a task-switching paradigm programed using E-Prime 2 professional (Psychology Software Tools, Inc., Pensacola, FL, USA). The accelerometer data were analyzed using Actilife 6 software (Pensacola, FL, USA). IPAQ scores were stratified into two groups inactive and high PA. Cognition was assessed via neuropsychological test scores in five domains: Memory (Logical Memory I & II), Executive (CLOX 1, Trails A), Visual Spatial (CLOX 2, Trails B), Attention (Digit Span), Language (Animal Naming), and global cognition (MMSE). Results: After controlling for wear time of accelerometers, age and gender, moderate- to-vigorous physical activity (MVPA, β = –0.19, 95% CI, -0.35 to -0.03, p = 0.02) and light physical activity (LPA, β = –0.17, 95% CI, -0.34 to -0.01, p = 0.04) were associated with higher global reaction time (RT) switch costs. The findings suggested that higher levels of both MVPA and LPA were associated with better task-switching performance, as indicated by smaller global RT switch costs. No significant association was observed between total PA and global RT switch costs, despite a trend toward near statistical significance (β = –0.15, 95% CI, -0.31 to 0.01, p = 0.06). PA indicators were not associated with global accuracy switch costs, and no associations were observed between PA indicators and local RT or accuracy switch costs. Taken together, the results indicated that higher levels of MVPA and LPA were associated with some aspects of executive functioning measured by a task-switching paradigm.

Conclusion: Higher levels of objectively measured MVPA and LPA were associated with better performance on some aspects of executive functioning in Chinese young adults.

Parkinson’s disease (PD) is a progressive neurodegenerative disease that can lead to cognitive dysfunction including deficits in emotional recognition, which is the ability to identify facial expression of happiness, sadness, fear, anger and disgust. This deficit has been shown to lead to difficulties in social interaction and communication. High cadence cycling is a unique rehabilitation modality that has been shown to improve motor function in PD, but it is not known how this modality alters cognition. PURPOSE: To examine if three bouts of high-cadence cycling improved emotional recognition in individuals with PD. METHODS: Individuals (N=17) completed three sessions of high cadence cycling, on a custom motorized stationary cycle, consisting of a 5-minute warm-up at 50 revolutions per minute (rpm), 30 minutes of high cadence cycling between 75-85 rpm, and a 5-minute cool down. Emotional recognition was assessed using a computerized cognitive assessment battery at baseline and after (post-test) the three cycling sessions. The percentage of accurately identified emotions and the average reaction time to correctly select an emotion (emotion bias) was used for the analysis. RESULTS: Three bouts of high-cadence cycling resulted in a significant improvement in the accuracy of identifying emotions from baseline to post-test for disgust (0.007±1.2 vs. 0.71±1.17, p<0.015). There were also improvements in emotion bias from baseline to post-test for sad (-1.37±1.29 vs. -0.66±1.00, p=0.003), anger (-1.18±1.08 vs. -0.41±1.21, p=0.006) and fear (-1.60±1.33 vs. -1.10±1.25, p=0.030), but there were no significant changes in emotion bias for disgust (-1.55±1.28 vs. -1.23±1.15, p=0.130). CONCLUSIONS: Three bouts of high-cadence cycling improved several measures of emotional recognition, specifically negative-bias emotions. These findings suggest that high-cadence cycling could be a valuable rehabilitation modality for improving emotional recognition and potentially social interactions in individuals with PD. Support: Kent State University’s School of Health Sciences, Midwest American College of Sports Medicine, Ohio Parkinson Foundation Northeast Region Grant.
Exergaming has the potential to improve physical function, cognition and dual-task function, and could be an effective new strategy for reducing risk of falling in older adults. **PURPOSE:** To evaluate and test the safety, enjoyment, and physiological responses on custom Microsoft Kinect-based motion-tracking games that train specific dual-task function in older adults at risk for falls. **METHODS:** Community-dwelling older adults who reported current mobility difficulties or falling in the past year were included in the study. Participants played three newly developed exergames (Double Decision, Target Trackers, and Visual Sweeps) for 5 minutes each in random order. Heart rate (HR) was measured during each exergame, and blood pressure (BP), rating of perceived exertion (RPE) and the Physical Activity Enjoyment Scale were recorded immediately after each exergame. Student t-tests were used to examine the differences in variables at resting state and during/exercise. Repeated measure analyses of variance were used to examine the differences in variables among the three exergames. **RESULTS:** Seven participants (aged 76±6 years; 4 females) completed the study. The exergames did not cause any injuries. Average exercise HRs for Double Decision, Target Tracker, and Visual Sweeps were 7.57±5.58 bpm, 8.41±8.48 bpm, and 8.20±9.72 bpm; post-exercise HRs were 129.29±13.75/88.14±9.06 mmHg, 129.86±13.79/86.13±13.28 mmHg, 132.86±14.31/79.43±13.01 mmHg; post-exercise RPEs were 11.14±1.07, 10.14±1.21, and 9.86±1.86; and post-exercise enjoyment ratings were 81.22±0.14%, 90.61±0.18%, and 79.59±0.16%, respectively. Average exercise HRs were significantly higher than resting HRs for all three exergames (p<0.01). Visual Sweep had significantly lower average exercise HR compared to Double Decision (p<0.05) and Target Tracker (p<0.05), and there was a significant difference in post-exercise RPE between Double Decision and Target Tracker (p<0.05). There was a significant difference between Target Tracker and Double Decision in post-exercise enjoyment ratings (p<0.05). **CONCLUSION:** The newly developed exergames were safe, enjoyable, and light for older adults who are at risk for falls. Future intervention studies are needed to examine the benefits of exergames for this special population.

**A-52** Free Communication/Poster - Exercise Psychology, Neuroscience

**Wednesday, May 30, 2018, 7:30 AM - 12:30 PM**

**Room: CC-Hall B**

**411 Board #252 May 30 11:00 AM - 12:30 PM**

**Acute Dose-response Effects Of Aerobic Exercise On Cerebrovascular Hemodynamics**

Sophy J. Perdoros1, Bethany Barone Gibbs2, John M. Jakicic, FACSM1, Christopher E. Kline1, Jeffrey R. Balzer1. 1University of Kansas Medical Center, Kansas, KS. 2University of Pittsburgh, Pittsburgh, PA. (Sponsor: John M Jakicic, FACSM)

(No relevant relationships reported)

Exercise may influence cerebrovascular hemodynamics. Few studies have evaluated acute effects of aerobic exercise on cerebral blood flow and cerebral pulsatile flow. **PURPOSE:** To evaluate acute effects of aerobic exercise on cerebrovascular hemodynamics following sitting, a 10-minute exercise bout and a 30-minute exercise bout. **METHODS:** Fifteen adults (age = 45 ± 8.9 years) participated in this randomized crossover study comprised of three experimental sessions: 30 minutes of sitting (SIT), 20 minutes of sitting followed by 10-minutes of exercise (EX10), and 30-minutes of exercise (EX30). The exercise consisted of walking on a treadmill at 70-75% of age-predicted maximum heart rate. Cerebrovascular hemodynamics were measured using transcranial Doppler ultrasonography before the experimental session and at 30- and 60-minutes post-session. Beat-to-beat peak systolic, mean systolic and diastolic cerebral blood flow velocities (CBFv) as well as pulsatility index were recorded for 1 min via sonication of the middle cerebral artery (MCA). **RESULTS:** Pulsatility index was 4.7% (P=0.08) higher in EX30 vs. SIT at the 30-minute but not the 60-minute post-session assessment. There was no difference in pulsatility index at the 30 or 60-minute post-session between SIT and EX10 (P=0.33) or EX30 and EX10 (P=0.27). Peak systolic, mean and diastolic CBFv were not different across conditions at either post-session assessment (P>0.10). **CONCLUSIONS:** Exercise that is either 10 or 30 minutes in duration does not improve cerebrovascular hemodynamics in the MCA within one hour of following the exercise session. Research may be necessary to understand affects cerebrovascular dynamics in response to acute and chronic exercise.

**413 Board #254 May 30 11:00 AM - 12:30 PM**

**Impact of High-Intensity Interval Exercise on Executive Function and Brain Derived Neurotrophic Factor**

Charles S. Schwartz, Aaron L. Slusher, Virginia T. Patterson, Edmund O. Acvedo, FACSM. Virginia Commonwealth University, Richmond, VA.

(No relevant relationships reported)

**PURPOSE:** Prefrontal cortex (PFC)-dependent executive function (EF) is enhanced immediately following completion of high-intensity interval exercise (HIIE). Brain-derived neurotrophic factor (BDNF) is a key protein that enhances EF at rest and in the study. The endocannabinoid system (eCB) is down regulated in substance use disorder (SUD) patients. Pharmacologically targeting the eCB system has led to improved SUD treatment outcomes in both preclinical and clinical studies. Exercise is a non-pharmacological method of augmenting the eCB system in healthy adults, but it is unknown whether exercise can activate the eCB system in SUD patients. **PURPOSE:** To examine eCB responses to acute and chronic aerobic exercise in SUD patients. **METHODS:** Twenty-one SUD patients (35 ± 9 yrs) were recruited from local intensive outpatient treatment programs. Participants were randomized to either treatment-as-usual (TAU, at their outpatient clinic) or TAU plus aerobic exercise training (EX). EX participants engaged in supervised, moderate-intensity exercise sessions 3 x/wk for 6 wks. TAU participants came into the laboratory once per week for assessments and a quiet rest session. At 0- (baseline), 3- (mid), and 6- (post) wks, participants provided blood samples before and after exercise or quiet rest to assess plasma eCB concentrations (anandamide [AEA] and 2-arachidonoylglycerol [2-AG]). Data were analyzed using mixed model ANOVAs and Cohen’s d effect size calculations. **RESULTS:** There was a significant group X time interaction for AEA (p < 0.001). Simple effects indicated that AEA increased acutely after exercise in the EX group (p < 0.001) but did not change after quiet rest in the TAU group (p = 0.39). There were no group differences or significant changes in 2-AG (p > 0.05). Effect size calculations indicated that AEA changes were small to moderate increases in AEA (d = 0.36) and 2-AG (d = 0.37) concentrations from 0 to 6 weeks in the EX group but small to moderate decreases in AEA (d = -0.42) and 2-AG (d = -0.40) concentrations in the TAU group, though these changes were not statistically significant. **CONCLUSION:** These results indicate that aerobic exercise is able to activate the eCB system in SUD patients, which may contribute to improved treatment outcomes. Exercise may also increase basal eCB concentrations over time, suggesting that exercise could be one method to restore eCB function in SUD patients. Additional investigations with larger sample sizes and longer exercise program durations are warranted. Supported by NIH R36DA040140 and the UW Virginia Horne Henry Fund.
co-workers to acute exercise. However, no studies have examined the possible utility of plasma and/or serum BDNF as a biomarker of improved EF in response to a single session of HIIE.

METHODS: Thirty-nine subjects performed the Wisconsin Card Sorting Task (WCST) to assess EF immediately following a 5 min seated rest and participation in a HIIE (10 x 20 s bouts of maximal cycling against 5.5% of the subject’s body weight). Whole blood was collected prior to and immediately following HIIE and the WCST to assess plasma and serum BDNF concentrations.

RESULTS: HIIE increased the number of correct responses (p = 0.048) and reduced the number of total and non-preservative errors (p = 0.048; p = 0.027, respectively) on the WCST compared to the seated rest. Elevated plasma and serum BDNF concentrations prior to exercise were also associated with enhanced WCST performance during the seated rest, and in response to HIIE, BDNF concentrations in plasma, and to a lesser extent in serum, predicted a faster and more accurate performance on the WCST. However, while plasma BDNF concentrations were unaltered and serum BDNF concentrations increased in response to HIIE (F[2,48] = 6.759, p = 0.003), these responses were not associated with improved WCST performance.

CONCLUSIONS: These data provide evidence supporting circulating BDNF in plasma, and to a lesser extent in serum, as a biomarker of enhanced PFC-dependent EF at rest and in response to HIIE.

414 Board #255 May 30 11:00 AM - 12:30 PM
Effect Of A Single Session Of High-intensity, Resistance Or Combination Exercise Training On Neurotrophic Factors In Overweight Collegiate Men: The Brainfit Study

Maria Andrea Domínguez-Sánchez1, Gina Paola Velasco-Oriuella1, Andrea del Pilar Quintero2, Jorge Enrique Correa-Bautista2,2, Antonio García-Hermoso2, Rosa Helená Bustos-Cruz2, Carlos Andrés Peña-Guzmán3, Luis Andrés Téllez-T1, Robinson Ramírez-Vélez1, Universidad de La Sabana, Chia, Colombia. 2Universidad del Rosario, Bogotá D.C, Colombia. 3Universidad de Santiago de Chile, USACH, Santiago de Chile, Chile. 4Universidad Santo Tomás, Bogotá D.C, Colombia.

(Please respond to authors directly if interested in their work.)

PURPOSE: To compare the neurotrophic factor response following one session of high-intensity exercise, resistance training or both in a cohort of physically inactive overweight adults aged 18-30 years old.

METHODS: A randomized, parallel-group clinical trial of fifty-one men (23.6±3.5 years; 83.5±7.8 kg; 28.0±1.9 kg/m²) who are physically inactive (i.e., <150 min of moderate-intensity exercise per week for greater than 6 months) and are either abdominally obese (waist circumference ≥ 90 cm) or have a body mass index ≥ 25 and 1.3 ng/mL [95% CI, 0.3 to 2.3; d = 0.14], 39.6 ng/mL [95% CI, 2.5 to 76.6; d = 0.19], and 1.3 ng/mL [95% CI, 0.3 to 2.3; d = 0.17], respectively). Additionally, combined exercise training results in favorable effects on both BDNF (22.0, 95% CI, 2.6 to 41.5; d = 0.19) and NT-3 (32.9, 95% CI, 12.4 to 53.4; d = 0.25). In the per-protocol analyses, the combined training group but not the other interventions showed greater changes in BDNF (99.7, 95% CI, 22.4 to 176.7; d = 1.01), NT-3 (89.9, 95% CI, 2.2 to 172.1; d = 0.79), and NT-4 (7.5, 95% CI, 1.7 to 13.3; d = 0.10) compared to the control group.

CONCLUSIONS: The findings indicate that acute resistance and combined exercise increased neurotrophic factors in physically inactive overweight adults. Further studies are required to determine the biological importance of changes in neurotrophic responses in overweight men and chronic effects of these exercise protocols.

415 Board #256 May 30 11:00 AM - 12:30 PM
Effects Of Prior Endurance And Resistance Training On PD: Role Of Autophagy And Apoptosis

Ning Jiang1, Zhe Wang1, Zhen Xu1, Zhe Wang1, Yong Zhang1, Li Li Ji, FACSM1,2, Zhe Wang1, Zhen Xu1, Zhe Wang1, Yong Zhang1, Li Li Ji, FACSM1,2, Tianjin Key Laboratory of Exercise Physiological Sports Medicine, Tianjin University of Sport, TIAN-JIN, China. 1School of Kinesiology, University of Minnesota, MN, MN.

(Please respond to authors directly if interested in their work.)

PURPOSE: To determine the relationship between autophagy and apoptosis in midbrain striatum in PD model mice and to investigate whether prior endurance and resistance training can intervene the pathogenesis.

METHODS: Male C57BL/6J mice aged 12 months were randomly divided into 3 groups: control (C), endurance training (E), or resistance training (R). E were exercised on a treadmill for 12 weeks. R was subjected to ladder training for 12 weeks. After training, each group was randomly administered with either MPTP (2*30mg/kg×2), i. p., 16 hr apart, M or saline (S). Mitochondrial function, proteins in autophagy and apoptosis were measured in the midbrain striatum.

RESULTS: Compared with C, M suppressed midbrain striatum state 3 respiratory activity (42%, p < 0.01), respiratory control ratio (RRC, 44%, p < 0.01) and ATP synthesis activity (40%, p < 0.01). Additionally, Beclin1 (35%, p < 0.05), LC3-II (26%, p < 0.05), BCAII (41%, p < 0.01), and BAX (21%, p < 0.05) protein levels p < 0.05). Both ME and MR significantly elevated midbrain striatum state 3 (72%, p < 0.01), RRC (47%, p < 0.01), and ATP synthesis activity (42%, p < 0.01), and elevated Beclin1 (28%, p < 0.05), LC3-II (30%, p < 0.05), BCAII (23%, p < 0.01) and BAX (30%, p < 0.01) protein levels. MR increased midbrain striatum state 3 respiratory activity (16%, p < 0.05), RRC (34%, p < 0.01), ATP synthesis (14%, p < 0.05), Beclin1 (23%, p < 0.01), LC3-II (7%, p < 0.05), BCAII (12%, p < 0.05) protein levels compared to ME.

CONCLUSIONS: MPTP can damage mitochondrial respiratory function in the midbrain and striatum possibly related to an up-regulation of autophagy and apoptosis. Prior training increases autophagy and apoptotic tendency in PD mice. Resistant training appears more effective in ameliorating autophagy and apoptosis and mitochondrial function. (Supported by NSF No.31000523 and 31370821).

416 Board #257 May 30 11:00 AM - 12:30 PM
Impacts of Cerebellar tDCS During a Dual-Task: Sustained Balance Improvement

Kira G. Oberle, Caroline J. Ketcham. Elon University, Elon, NC. (Sponsor: Dr. Eric Hall, FACSM)

(Please respond to authors directly if interested in their work.)

The importance of accurate cognitive performance during a complex motor task is essential for professions including athletes, police and military personnel. Cerebellar transcranial direct current stimulation (tDCS) has been used as a low-cost, non-invasive technique to enhance performance of individuals with a variety of isolated motor and cognitive tasks but not in a dual-task. PURPOSE: The purpose of this study was to examine the effect of cerebellar tDCS during a dual task. METHODS: Twenty healthy college-age individuals completed this study. A baseline dual-task was conducted with participants completing four cognitive tasks: Reaction Time (simple, choice) and Working Memory (Stroop and N-Back) while simultaneously maintaining balance on an unstable BioDex Balance platform. Each participant received anodal (n=10) or sham (n=10) cerebellar tDCS at 1mA for a total of 40mA (~45mins). During this time, participants completed cognitive and balance training. Participants repeated the dual-task testing immediately following training, and again one week later. RESULTS: Results showed no differences in cognitive performance between the iDCS and sham groups (p > 0.05). Balance continued to show improvements during the simple cognitive tasks in the iDCS group one week later (p < 0.05). DISCUSSION: Overall there were limited dual-task performance improvements of cerebellar tDCS in a 45-minute training session. It is possible the dual-task was too complex and the training session too short for this population. There is potential of cerebellar tDCS in an athletic population who rely on peak performance in both cognitive and motor skills simultaneously.

417 Board #258 May 30 11:00 AM - 12:30 PM
Aerobic Exercise Training Effects on Nrf2 and the Antioxidant Defense System

Lauren S. Vervaecke, Allan H. Goldfarb, FACSM, Laurie Wideman, FACSM, Joseph Starnes, FACSM, Keith Erikson. University of North Carolina Greensboro, Greensboro, NC. (Please respond to authors directly if interested in their work.)

Nuclear factor erythroid 2 related factor 2 (Nrf2), an essential transcription factor and master regulator of the antioxidant defense system aiding in cellular protection and survival. PURPOSE: To determine the effect of chronic aerobic exercise on Nrf2 and antioxidant factors in individual brain regions. METHODS: Male Sprague Dawley

WEDNESDAY, MAY 30, 2018
S80 Vol. 49 No. 5 Supplement
Minneapolis, Minnesota
Psychosocial factors were assessed with these scales: Beck Depression Inventory (BDI), Disfunctional Attitudes Scale (DAS), Daily Stress Inventory (DSI), Perceived Stress (PSS), Brief Resilience Counseling Scale (BRCS), Profile of Mood States (POMS), Eating Disorder Inventory (EDI-3), and Three-Factor Eating Questionnaire (TFEQ).

Differences between groups were assessed using ANOVA and Mann-Whitney tests.

RESULTS: Participants did not differ with respect to weight, lean body mass, and fat free mass; however, amenorrheic women had significantly lower body mass index (p=0.010), percent body fat (p=0.017), and fat mass (p=0.018). Amenorrheic women also had significantly lower serum T4 (p=0.008), T3 (p<0.001), leptin (p=0.001), and ratio of measured to predicted RMR (p=0.011) as well as elevated PYY (p=0.000) and scores for drive for thinness (p=0.016), cognitive restraint (p=0.001) subscales.

CONCLUSIONS: FHA in exercising women is associated with energy deficiency but only mild indications of psychosocial factors known to be associated with the suppression of reproductive function. FHA in women may vary in its etiology depending on the population studied.
The endocannabinoid (eCB) system has emerged as a promising target for enhancing fear extinction, which has therapeutic implications for the treatment of stress disorders. Although previous investigations have used pharmacological approaches to enhance fear extinction, there is a strong rationale to investigate the efficacy of non-pharmacological approaches (e.g., exercise) shown to activate the eCB system. 

**PURPOSE:** To examine the effects of exercise on the extinction of conditioned fear, anxiety-like behaviors, and eCB adaptations in cortico-limbic regions.

**METHODS:** ICR/CD1 male mice (N = 26) completed a series of behavioral tests prior to and following a fear-conditioning (day 1; FC) and fear-extinction (days 2-5; FEXT) protocol. Following FC, mice were randomly assigned to caging containing either an unlocked (EX) or locked (CON) running wheel, with unlimited access until 24 hours following the last FEXT session. Mice were sacrificed 48 hours after the last behavioral test in order to examine central eCB tissue content. Data were analyzed using a series of one-way and mixed model ANOVAs, Pearson correlations, and Cohen’s d effect sizes. 

**RESULTS:** EX mice exhibited a significant reduction in anxiety-like behaviors from pre to post compared to the CON mice (p < 0.05). Although both groups experienced less freezing over time, EX mice exhibited significantly less freezing on days 2 (Δ = 0.39), 3 (Δ = 0.50), 4 (Δ = 1.16), and 5 (Δ = 0.89) compared to CON mice (p < 0.05). Additionally, moderate to strong negative correlations were found between wheel running revolutions and freezing time on days 2 through 5, indicating that mice who ran more in between extinction sessions tended to freeze less during subsequent sessions. Lastly, EX mice exhibited significantly greater amygdalar eCB content and significantly less hippocampal eCB content compared to CON mice (p < 0.05). 

**CONCLUSION:** These preliminary results suggest that voluntary exercise enhances fear-extinction and reduces anxiety-like behaviors in mice, possibly due to eCB system adaptations in brain regions involved in regulating fear and anxiety responses.

Supported by the W.Virginia Horne Henry Fund and the Advancing a Healthier Wisconsin Endowment at the Medical College of Wisconsin.

**REFERENCES:**

and Chi square tests. A binary multivariable logistic regression model was used to assess the association between back pain in the past 12 months, flexibility, and participant characteristics. A composite measure of anterior trunk, posterior trunk, anterior and posterior thigh, and anterior and posterior lower leg was used. A whole body scan using DXA was used to estimate %BF. IBM SPSS Statistics 24 was used to analyze the data. For multicollinearity assumption, variables with a variance inflation factor (VIF) = 10 were excluded from analysis. Stepwise multiple linear regression analysis was used to develop prediction equations. Bland-Altman analysis was used to validate the prediction equations. RESULTS: Variables included in the stepwise linear regression analysis were height, sex, and all fat thicknesses. Age and weight were not significantly correlated with %BF (p=0.05). The prediction equation for %BF was the following: %BF = 27.075 + (3.284*Anterior Trunk) + (4.916*Posterior upper arm) + (2.166*Sex) - (0.099*Height) where males = 1 and females = 2. The adjusted r-square of the prediction equation was 0.701 with a standard error of the estimate of 4.1%. Bland-Altman plots revealed a mean bias of 0.266 ± 7.9772 (95% confidence intervals). A significant correlation (r = 0.245, p=0.002) between the difference in %BF (measured - predicted) and the average %BF ([measured + predicted %BF]/2) suggests some systematic error in the prediction equation.

CONCLUSIONS: Ultrasound imaging can be used to predict %BF in older adults; however, there is some systematic error in the prediction equation.

Female athletes may experience an elevated risk of iron deficiency as iron status may decline during physical training. Further, the interaction between hormones involved in regulating the menstrual cycle and its effect on iron status still remains unclear. PURPOSE: To study the influence of the menstrual cycle phases on iron-related parameters in women after endurance exercise. METHODS: Thirty healthy eumenorrheic endurance-training women (34.9 ± 4.2 years; 163 ± 9.1 cm; 58 ± 4.15 kg; peak oxygen consumption (VO2peak) 47.9 ± 7.3 ml min⁻¹ kg⁻¹) participated in the study. Each participant performed 40 min running at the speed corresponding to the 75% of VO2peak. Exercise was completed on a treadmill and was performed in three different phases of menstrual cycle randomly assigned: early follicular (EFP, mid-follicular (MFP) and luteal phase (LP)). Blood samples were obtained at baseline and immediately (Post0h) and 3 hours (Post3h) after exercise and analyzed for serum iron, ferritin and transferrin. Mixed linear models were conducted to analyze the data. RESULTS: Serum iron (µg/dL) was not different across menstrual cycle phases (EFP: 59.7 ± 36.1; MFP: 80.2 ± 39.6; LP: 83.6 ± 58.2; p=0.101), although we observed lower values at EFP. Time was not significant on serum iron (Baseline: 69.9 ± 45.4; Post15h: 76.6 ± 49.3; Post3h: 77.05 ± 45.6; p=0.247). Ferritin (ng/mL) values were similar across menstrual cycle phases (EFP: 27.9 ± 21.7; MFP: 31.8 ± 25.2; LP: 32.0 ± 27.4; p=0.451); however there was a significant effect for time (p=0.017) with higher values at Post0h (33.1 ± 27.0) compared to baseline (28.8 ± 25.1). We observed similar values of transferrin (mg/dL) across menstrual cycle phases (EFP: 300.6 ± 84.0; MFP: 298.6 ± 44.6; LP: 300.5 ± 47.2; p=0.902). Time was significant on transferrin (p=0.001) with higher values at Post0h (307.7 ± 47.8) compared to baseline (293.7 ± 41.5) and Post3h (298.5 ± 41.8). No significant menstrual cycle phases × time interactions were found for any of these variables. CONCLUSION: Based on the preliminary results from this pilot study, iron-status markers are not influenced by the menstrual cycle, although serum iron values seem to be lower at EFP. Ferritin and transferrin values were increased after exercise along the menstrual cycle. Funding: DEP2016-75387-P (Spanish National Plan 2013-2016)

428 Board #269 May 30 11:00 AM - 12:30 PM

Menstrual Cycle Influence on Iron-Status Markers in Female Athletes. IronFEMME Pilot Study


(NO relevant relationships reported)

Female athletes may experience an elevated risk of iron deficiency as iron status may decline during physical training. Further, the interaction between hormones involved in regulating the menstrual cycle and its effect on iron status still remains unclear. PURPOSE: To study the influence of the menstrual cycle phases on iron-related parameters in women after endurance exercise. METHODS: Thirty healthy eumenorrheic endurance-training women (34.9 ± 4.2 years; 163 ± 9.1 cm; 58 ± 4.15 kg; peak oxygen consumption (VO2peak) 47.9 ± 7.3 ml min⁻¹ kg⁻¹) participated in the study. Each participant performed 40 min running at the speed corresponding to the 75% of VO2peak. Exercise was completed on a treadmill and was performed in three different phases of menstrual cycle randomly assigned: early follicular (EFP, mid-follicular (MFP) and luteal phase (LP)). Blood samples were obtained at baseline and immediately (Post0h) and 3 hours (Post3h) after exercise and analyzed for serum iron, ferritin and transferrin. Mixed linear models were conducted to analyze the data. RESULTS: Serum iron (µg/dL) was not different across menstrual cycle phases (EFP: 59.7 ± 36.1; MFP: 80.2 ± 39.6; LP: 83.6 ± 58.2; p=0.101), although we observed lower values at EFP. Time was not significant on serum iron (Baseline: 69.9 ± 45.4; Post15h: 76.6 ± 49.3; Post3h: 77.05 ± 45.6; p=0.247). Ferritin (ng/mL) values were similar across menstrual cycle phases (EFP: 27.9 ± 21.7; MFP: 31.8 ± 25.2; LP: 32.0 ± 27.4; p=0.451); however there was a significant effect for time (p=0.017) with higher values at Post0h (33.1 ± 27.0) compared to baseline (28.8 ± 25.1). We observed similar values of transferrin (mg/dL) across menstrual cycle phases (EFP: 300.6 ± 84.0; MFP: 298.6 ± 44.6; LP: 300.5 ± 47.2; p=0.902). Time was significant on transferrin (p=0.001) with higher values at Post0h (307.7 ± 47.8) compared to baseline (293.7 ± 41.5) and Post3h (298.5 ± 41.8). No significant menstrual cycle phases × time interactions were found for any of these variables. CONCLUSION: Based on the preliminary results from this pilot study, iron-status markers are not influenced by the menstrual cycle, although serum iron values seem to be lower at EFP. Ferritin and transferrin values were increased after exercise along the menstrual cycle. Funding: DEP2016-75387-P (Spanish National Plan 2013-2016)
and hepcidin along menstrual cycle is still unknown. PURPOSE: To elucidate the effect of hormonal fluctuations during menstrual cycle on inflammatory and hepcidin responses after endurance exercise. METHODS: Thirteen healthy eumenorrheic endurance-trained women (34.9 ± 4.2 years; 163.9 ± 6.1 cm; 58.4 ± 5.5 kg; peak oxygen consumption \(\text{VO}_{2}\text{peak} \) 49.7 ± 13.1 mL·min\(^{-1}\)·kg\(^{-1}\) ) participated in the study. Subjects performed 40 min running on a treadmill at the speed corresponding to the 75% of \(\text{VO}_{2}\text{peak} \). Exercise was performed in three different moments: during early follicular (EF), mid-follicular (MF) and luteal phase (LP). Blood samples were obtained at baseline and immediately (Post0h) and 3 hours (Post3h) after exercise and were analyzed for interleukin-6 (IL-6), C-reactive protein (CRP) and hepcidin. Mixed linear models were conducted to analyze the data. RESULTS: Hepcidin (ng/mL) was not different across menstrual cycle phases (EF: 76.5 ± 25.3; MF: 78.4 ± 19.5; LP: 78.0 ± 23.4; \(p = 0.762\)). Time was significant (\(p < 0.001\)) on Hepcidin with higher values at Post0h (81.9 ± 21.5) compared to Baseline (74.8 ± 21.4) and Post3h (76.8 ± 21.9). IL-6 (pg/mL) levels were not different across menstrual cycle (EF: 3.5 ± 10.3; MF: 3.0 ± 1.5; LP: 5.4 ± 6.6; \(p = 0.079\)). However, time was significant (\(p < 0.001\)) at Post3h (5.4 ± 6.6) levels showed significant higher values compared to Baseline (2.6 ± 2.1) and Post0h (3.9 ± 3.2). We found an interaction between menstrual cycle and time (\(p = 0.006\)). CONCLUSION: In our preliminary results, inflammatory responses seem to be influenced by menstrual cycle even though hepcidin levels may not be affected by hormonal fluctuations. Hepcidin and IL-6 peak levels were found Post0h and Post3h after exercise respectively. CRP levels did not show an increase after exercise at any phase. Funding: DEP2016-75387-P (Spanish National Plan 2013-2016)

**Multiple sclerosis (MS) patients exhibit a decreased peak oxygen uptake (\(\text{VO}_{2}\text{peak} \)) compared to age-matched peers, and therefore have the potential for increased relative gains in \(\text{VO}_{2}\text{peak} \) in response to chronic exercise training. Individualized exercise prescriptions and monitoring improvement both rely on accurate assessment of \(\text{VO}_{2}\text{peak} \); however, expired gas analysis is not always available. Therefore, prediction equations have been established to estimate \(\text{VO}_{2}\text{peak} \) for both treadmill (TM) and cycle ergometry (CE) tests. Whether or not these equations are appropriate for MS patients has yet to be investigated. PURPOSE: To compare \(\text{VO}_{2}\text{peak} \) obtained via TM and CE maximal exercise tests to previously established cardiometabolic prediction equations. METHODS: MS patients (44 ± 11 yrs, 28.1 ± 8.0 kg/m\(^2\), 11 ± 10 yrs since dx) performed a maximal graded exercise test on both a TM and CE. Twenty-five minutes were completed at a constant, self-selected pace, with a 2% increase in grade per stage. CE tests increased by 15 Watts/min. \(\text{VO}_{2}\text{peak} \) was compared to previously established mode-specific cardiometabolic prediction equations using paired samples t-tests and further examined with Bland-Altman plots. RESULTS: \(\text{VO}_{2}\text{peak} \) was higher than measured values for both TM and CE (\(p < 0.05\)). The TM had a mean bias, upper limit of agreement (LOA), and lower LOA of -2.35, 6.63, and -11.32 mL/kg/min, respectively. The CE had a mean bias, upper LOA, and lower LOA of +2.0, 3.31, and +7.72 mL/kg/min, respectively. CONCLUSION: Cardiometabolic prediction equations resulted in higher \(\text{VO}_{2}\text{peak} \) estimates for both TM and CE in MS patients. The wide limits of agreement (Bland-Altman plots) suggest the accuracy in predicting individual \(\text{VO}_{2}\text{peak} \) values is compromised among individuals with MS.**

**Multiple sclerosis (MS) is one of the most common progressive neurological diseases in young adults and is characterized by neurologic disruption within the brain.**
central nervous system. Previous research has shown strength asymmetry (SA) in the quadriceps of MS patients to be correlated with a decrease in functional walking performance (FWP). Due to limited ankle mobility in MS patients during walking, an investigation of the relationship between dorsiflexion SA and walking ability is necessary to better understand the impact on quality of life in MS patients.

**Purpose:** To investigate SA during isometric/isokinetic dorsiflexion in MS patients compared to healthy individuals (Non-MS), and investigate the relationship between SA and FWP in both groups. **Methods:** 26 individuals participated in the study (MS: 13, Age: 50.3 ± 9.1 years; Non-MS: 13, Age: 50.8 ± 8.5 years). Visit 1 consisted of test familiarization. Visit 2 consisted of maximal isometric (MVC) and isokinetic (MVIC) dorsiflexion contractions performed at 60° in both legs. SA ratio was calculated from the peak torque achieved. On visit 3, subjects performed three tests of FWP: 25 Foot Walk Test (25FW), Timed Up-and-Go Test (TUG), and 6-Minute Walk Test (6MW).

**Results:** The mean expanded disability status score (EDSS) for the MS patients was 3.5 ± 1.8, indicating mild-moderate disability. There was a significant difference in MVC SA between groups (MS vs NON-MS = 13.7 ± 18.1 vs. 3.3 ± 2.6, p = 0.03) however no difference was observed in MVIC SA between groups (p = 0.05). Differences were observed between groups for all three FWP tests and gait speed (p < 0.05). There was a significant negative relationship between MVC SA and two FWP variables (25FW: r = 0.76, p = 0.002; TUG: r = 0.61, p = 0.03) and a significant relationship between MVC SA and all four FWP variables (25FW: r = 0.93, p < 0.001; gait speed: r = 0.76, p = 0.002; TUG: r = 0.81, p < 0.001; MVIC: r = 0.67, p = 0.001). There was no significant relationship between MVC or MVIC SA and the FWP tests in the Non-MS group (p > 0.10). There was no significant relationship between MVC SA or MVICSA and EDSS in the MS patients (p > 0.05).

**Conclusion:** SA differed between groups, and dorsiflexion SA appears to be related to impaired walking performance in MS patients. This relationship may be independent of disease severity based on EDSS.

**Board #275**
**May 30 11:00 AM - 12:30 PM**
**Relation ship between Soleus H Reflex and Balance Metrics in People with Multiple Sclerosis**
Greg Cantrell1, David Lantzi2, Mike Bemben, FACSM3, Chris Black, FACSM3, Dan Larson1, Rebecca Larson1. 1Northern State University, Aberdeen, SD. 2St. Ambrose, Davenport, IA. 3University of Oklahoma, Norman, OK.

No relevant relationships reported

Multiple Sclerosis (MS) is a disease of the central nervous system with poor balance as one of the most reported symptoms. Previous research has shown limb differences in a number of physiological measures (e.g., leg strength). One measure yet to be evaluated between limbs in MS patients is the soleus Hoffmann (H) reflex, which is regarded as the electrical analogue to the stretch reflex. **Purpose:** The intent of this study was to 1) quantify the soleus H reflex in both legs to determine whether asymmetry was present and 2) correlate H reflex asymmetry to balance performance. **Methods:** The study consisted of six visits. The first visit consisted of paperwork and familiarization. The soleus H reflex was measured twice in both legs over four visits (V2 - V5) to assess bilateral differences in 17 participants (MS:9, Age:49.3±11.3 years; Non-MS:8, Age:48.6±11.3 years). Balance testing was conducted on the final visit, and consisted of a sensory organization test (SOT) and limits of stability (LOS) test. **Results:** One MS participant was unable to complete balance testing, leaving 16 participants in the balance analyses. The mean expanded disability status score for the MS participants was 3.4±2.2 (range=1 to 6; median=2), indicating mild-to-moderate disability. There was a significant difference in MVC SA between groups (MS vs NON-MS = 13.7 ± 18.1 vs. 3.3 ± 2.6, p < 0.05). A significant negative relationship (r=0.518) was observed between AS and reaction time in the sagittal plane during LOS testing. A significant positive relationship was observed between AS and excursion (EPE) and maximum excursion (ME) were significantly less in the MS group (EPE: MS=36.8±9.2, Non-MS=85.8±2.9, p < 0.05). Sagittal plane endpoint excursion (EPE) and maximum excursion (ME) were significantly less in the MS group (EPE: MS=36.8±9.2, Non-MS=85.8±2.9, p < 0.05). There was no significant relationship between MVC SA or MVICSA and EDSS in the MS patients (p > 0.05).

**Conclusion:** SA differed between groups, and dorsiflexion SA appears to be related to impaired walking performance in MS patients. This relationship may be independent of disease severity based on EDSS.

**Board #276**
**May 30 11:00 AM -12:30 PM**
**Body Temperature Regulation In Ms Patients Performing Physical Activity In The Heat**
Georgia Chaseling1, Davide Filingeri2, Scott Davis, FACSM3, Ollie Jay, FACSM1. 1University of Sydney, Sydney, Australia. 2University of Loughborough, Loughborough, United Kingdom. 3Southern Methodist University, Dallas, TX. (Sponsor: Dr Ollie Jay, FACSM)

No relevant relationships reported

**Purpose:** The impact of heat intolerance and associated fatigue among people with multiple sclerosis (MS) is well documented, particularly during physical activity in the heat. However to date it is unclear whether an impaired thermoregulatory capacity is evident in people with MS. It is also unknown whether any such impairment is manifested in the sudomotor (sweating) system or vasomotor (skin blood flow) system. Therefore the aim of this study was to determine whether thermoregulatory responses are independently altered in MS patients relative to healthy controls during physical activity in a warm/hot environment. **Methods:** Sixteen participants with relapsing-remitting MS (EDSS 2.8±0.9; 47±8 y; 77.6±14.0 kg; 1.7±0.1 m) and 14 age- and mass-matched healthy controls (43±11 y; 78.6±17.0 kg; 1.7±0.1 m) cycled at a fixed metabolic heat production of 4 W·kg⁻¹ on a semi-recumbent ergometer for a maximum of 40 minutes in a 30°C, 30%RH environment. A subset of 8 MS (EDSS: 2.6±0.5; 44±8 y; 82±13 kg; 1.7±0.1 m) and 8 healthy controls (44±12 y; 82±21 kg; 1.7±0.1 m) also completed the same exercise protocol in a 35°C, 30%RH environment. In both trials, rectal temperature (T_r), mean skin temperature (T_s), local sweat rate (LSR) and cutaneous vascular conductance (CVC) on the upper back was measured throughout. **Results:** At 30°C, end-exercise T_r (MS:37.2±0.3, CON:37.3±0.4°C; P=0.31), T_s (MS:34.5±0.5, CON:34.6±0.5°C; P=0.43), LSR (MS:0.44±0.22, CON:0.47±0.21 mg·cm⁻²·min⁻¹; P=0.71), and CVC (MS:344±256, CON:266±157% of baseline; P=0.35) were similar between groups. Likewise, at 35°C, end-exercise T_r (MS:37.2±0.4, CON:37.3±0.3°C; P=0.70), T_s (MS:35.5±0.5, CON:35.5±0.5°C; P=0.87), LSR (MS:1.26±0.44, CON:1.34±0.38 mg·cm⁻²·min⁻¹; P=0.61), and CVC (MS:425±163, CON:378±236% of baseline; P=0.68) were not different.

**Conclusions:** Individuals with relapsing-remitting MS do not demonstrate any clear impairments of sweating or skin blood flow control during moderate levels of physical activity at air temperatures as high as 35°C.

**Board #277**
**May 30 11:00 AM -12:30 PM**
**Physical Activity is Associated with Walking Capacity in Persons with Multiple Sclerosis**
Brooks A. Hibner1, Garet Giffith1, Elizabeth C. Schroeder1, Alexander J. Rosenberg1, Rachel E. Bollaert1, Robert W. Motl1, Abraham Murua Kick1, Tracy Baynard, FACSM2, Bo Fernhall, FACSM1. 1Integrative Physiology Laboratory, University of Illinois at Chicago, Chicago, IL. 2Beckman Institute for Advance Science and Technology University of Illinois Urbana-Champaign, Champaign, IL. 3UAB/Lakeshore Research Collaborative, University of Alabama at Birmingham, Birmingham, AL.

No relevant relationships reported

Multiple sclerosis (MS) is a chronic inflammatory disease of the central nervous system which affects 1 in 1000 persons in the United States. MS results in functional limitations, including impairments in walking capacity, balance, and increases in overall fatigue, leading to decreased physical activity. However, the potential associations between physical activity, walking ability and functional capacity are not clear in this population. **Purpose:** To evaluate the association between physical activity, walking ability and functional capacity in individuals with MS. **Methods:** Fifty-eight individuals with MS between the ages of 18-70 (Male = 15, 47 ± 12 years, BMI = 28.8 ± 6.5, EDSS = 0-4) performed a maximal incremental cycle test to assess peak aerobic capacity (VO2 peak). Subjects completed a timed 25-foot walk test (T25FW), 6 minute walk test (6MW), and wore an accelerometer for one week to determine physical activity. Moderate / vigorous physical activity (MVPA) was defined as ≥1722 counts per minute. **Results:** MVPA was correlated with 6MW, T25FW and VO2 peak (p<0.05, Table 1). In stepwise regression analyses, MVPA was a stronger predictor of T25FW (β: -0.44, p<0.01) and 6MW (β: -0.48, p<0.01) than VO2 peak (β: -0.29, p=0.03; β: 0.32, p<0.01). **Conclusion:** Although both MVPA and VO2 peak provide unique contributions to the prediction of 6MW and T25FW, MVPA is a stronger predictor. These results suggest that improving both physical activity and cardiovascular fitness may improve walking ability in persons with MS.
Multiple sclerosis (MS) is an inflammatory disease of the central nervous system characterized by a variety of symptoms including reduced physical and cognitive function. Cannabis is known to improve spasticity and pain in its effects on physical function are unknown. PURPOSE: The purpose of this study was to compare physical/cognitive function and overall quality of life in cannabis users and non-users with MS.

METHODS: Twenty-two people with relapsing-remitting MS (Users, N = 13, age: 51.0 (14.2); Non-users, N = 9, age: 53.4 (14.7)) completed the following evaluations: 25th mile walking test, timed up and go, 9-hole peg test with a metronome, chair stand test, 5-time sit-to-stand test, 2-minute stepping test, 5-minute cycle test, 6-minute walking test, and the Paced Auditory Serial Addition Test (PASAT). The MS Quality of Life-54, Patient Determined Disease Steps (disability status), Activities of Balance Confidence, Numerical Rating Scale of Spasticity, and Fatigue Severity Scale questionnaires were also completed by all participants. Cannabis use status was confirmed via urinalysis. Comparisons between the groups were made using independent T-Tests.

RESULTS: Cannabis users and non-users were similar in all measures of physical function and overall quality of life (P > 0.12). Cannabis users scored significantly lower on cognitive function than non-users (PASAT, Users 32.4 ± 9.9 vs. Non-users 32.8 ± 9.8, P = 0.02).

CONCLUSIONS: People with MS currently using cannabis perform similarly on physical tasks as non-users. However, the performance of the cannabis users during abstinence from the drug is not known. These results suggest that cannabis may not have an impact on physical function and overall quality of life in people with MS, although cannabis likely has negative effects on cognitive function, which is consistent with findings from healthy individuals. Longitudinal and/or interventional studies with on/off drug testing are needed to better quantify the positive and negative effects of cannabis in MS.

**Table 1**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Users</th>
<th>Non-users</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>6MW</td>
<td>19.7 (1.13)</td>
<td>16.9 (1.73)</td>
<td>0.02</td>
</tr>
<tr>
<td>T25FW</td>
<td>-0.580*</td>
<td>-0.504*</td>
<td></td>
</tr>
<tr>
<td>VO_peak</td>
<td>0.588*</td>
<td>0.568*</td>
<td></td>
</tr>
<tr>
<td>MVPA</td>
<td>0.630*</td>
<td>0.630*</td>
<td></td>
</tr>
</tbody>
</table>

*Significant correlation, p < 0.05
resulting from dynamic denervation/renervation cycling) along with increased expression of indices of neuromuscular junction instability, and some signs of reversal with high intensity exercise training. The purpose of this study is to further investigate PD skeletal muscle pathology, examine the role of muscle inflammation, and explore the impact of exercise reversal.

METHODS: Vastus lateralis skeletal muscle biopsies were obtained from three cohorts of individuals: PD patients (n=30, 67±7 y, Hoehn & Yahr stage 2-3), age-matched older adults (OA) and young adults (YA). To assess the effects of exercise training, a subset of PD patients (n=16) underwent 16wk high intensity training. Markers of denervation (e.g., neuronal cell adhesion molecule (NCAM) and sodium channel (Na,1.5) and inflammation (e.g., IL-1β), TNF-α, and TNF-like weak inducer of apoptosis (TWEAK)) are being assessed across the three groups and within the PD group pre- and post-training.

RESULTS AND CONCLUSION: We expect the study findings to aid in differentiating the effects of primary aging vs. aging with PD in skeletal muscle. Further, we anticipate high intensity exercise training will improve the inflammatory profile of PD muscle. Complete results will be available for presentation at the 2018 ACSM national meeting.

Exercise is Medicine®/Poster - ELM: Cognitive and Mental Function

Wednesday, May 30, 2018, 7:30 AM - 12:30 PM
Room: CC-Hall B

Purpose: The purpose of this cross-sectional study was to assess the continued activity tracker (AT) usage of a convenience sample of 165 university faculty and staff, determine the prevalence of various behaviors that comprise AT usage, and elucidate the relationship between usage and number of steps per day.

Methods: Participants were recruited by email from five cohorts of faculty/staff in the Ready-to-Move (RTM) coaching program during 2014-2016; all had been previously trained to use ATs as part of the program. In the summer of 2016, an online Qualtrics survey was utilized to discern usage patterns and steps/day; various quantitative analyses were performed using SPSS.

Results: In a sample of 165 trained users (mean age: 47.6 years; 84.8% female), a pattern variable frequency analysis showed that a total of 61.2% of previously trained users continued to do some, or all, of three usage behaviors (wearing, looking, and adjusting) on the day prior to data collection. There was a significant difference in the number of self-reported steps between those who did all 3 usage behaviors yesterday (M = 9032.4) and those who did not (M = 6459.2); p<0.05.

Conclusion: Results showed that about half of trained-users from a physical activity program continued to use their trackers for months or even years after an initial period of coaching, depending on the cohort. This finding contrasts with findings from other studies where AT owners’ usage dropped off more dramatically. We also found that those who consistently performed wearing, looking, and adjusting behaviors took significantly more steps than those who did not. The findings from this study indicate that AT use can be sustained in trained users and that the application of three usage behaviors can lead to an increased number of steps/day.

The Influence of Long-Term Transcranial Direct Current Stimulation on Gait Function in Parkinson’s Disease

Lidio Lima de Albuquerque, Irwin Munoz, Ashley Mangahas, Merrill Landers, Brach Poston. University of Nevada, Las Vegas, NV

Purpose: Long-term tDCS applied to the motor cortex does not seem to elicit improvements in gait function in Parkinson’s disease (PD). Therefore, tDCS may not be as effective for improving complex, whole body movements compared to upper limb movements involving fine motor control. The first author is a CAPES PhD student grantee (BEX 13509/13-6).

This research was supported by an internal research grant to Brach Poston.
salivary samples were again taken to determine post-treatment cortisol levels. The CogState Brief Battery Assessment was administered a second time. RESULTS: Changes in Speed of Performance (SOP) for working memory (WM) was found to be significantly quicker in post cognitive assessments for both resting and exercise trials. Differences were not seen in the AOP for VL between the two trials. Subsequent analysis showed that there was no significant interaction between cortisol and the cognitive tests (p > 0.05). CONCLUSION: An acute bout of moderate intensity exercise was found to significantly improve the SOP of VL. The SOP during the WM assessment was significantly improved after both the resting and exercise trials. Supported by Georgia College and State University Faculty Grant, 2016.

445 Board #286 May 30 11:00 AM - 12:30 PM The Effects of Pilates on Mental Health Outcomes: A Meta-Analysis of Controlled Trials Karl M. Fleming, Matthew P. Herring. University of Limerick, Limerick, Ireland.

(popular relationships reported)

Population-based and experimental evidence supports the mental health benefits of exercise among otherwise healthy adults, chronically-ill patients and adults with anxiety and depression. However, there has been a lack of research investigating the potential benefits of traditional modes of exercise, including aerobic exercise training. However, the mental health benefits of non-traditional modes of exercise such as yoga, tai chi, and qigong remain understudied. Pilates, an alternative form of exercise, is posited to provide a valuable tool for every individual, regardless of age, gender, capacity, or ability to utilise traditional exercise, due to both physiological and emotional states. PURPOSE: This meta-analysis estimated the population effect size for Pilates effects on mental health outcomes. METHODS: Articles published prior to August 2017 were located with searches of PubMed, Medline, Cinahl, SportDiscus, Science Direct, PsychINFO, Web of Science, and Cochrane Controlled Trial Register using combinations of: Pilates, Pilates method, mental health, anxiety, and depression. Eight English-language peer-reviewed articles that included both allocation to a Pilates intervention or non-active control condition that lacked exercise training and a validated measure of depressive and/or anxiety symptoms assessed at baseline and after the Pilates intervention were selected. Extracted data included participant and intervention characteristics, anxiety and depression outcomes, and other relevant mental health outcomes, including feelings of energy and fatigue and quality of life. Hodges’ d effect sizes were computed, study quality was assessed, and random effects models were used to estimate sampling error and population variance for the observed effects. RESULTS: Pilates resulted in significant, large, heterogeneous improvements in depressive (Δ = 1.27, 95%CI: 0.44, 2.09; z = 2.33, p = 0.02), and feelings of energy (Δ = 1.49, 95%CI: 0.67, 2.30; z = 3.57, p < 0.001) and fatigue (Δ = 0.93, 95%CI: 0.21, 1.66; z = 2.52, p = 0.012). Though statistically non-significant, a large increase was also found for quality of life (Δ = 0.79, 95%CI: −0.04, 1.61; z = 1.87, P = 0.06). CONCLUSIONS: The available evidence supports that Pilates improves mental health outcomes.

446 Board #287 May 30 11:00 AM - 12:30 PM Sleep Quality Moderates the Association Between Physical Activity Frequency and Feelings of Energy and Fatigue in Adolescents Matthew P. Herring,1 Derek C. Monroe,2 Christopher E. Kline,2 Patrick J. O’Connor, FACSM3, Ciaran MacDonncha1. 1University of Limerick, Limerick, Ireland. 2University of California Irvine, Irvine, CA. 3University of Pittsburgh, Pittsburgh, PA. 4University of Georgia, Athens, GA.

(popular relationships reported)

Physical activity (PA) can improve sleep quality, low energy, and fatigue. Though poor sleep quality may induce feelings of low energy and fatigue, the potential moderating effect of sleep quality on associations between PA and feelings of energy and fatigue among adolescents is unknown. PURPOSE: This study examined the moderating effect of sleep quality on associations between PA frequency and feelings of energy and fatigue among adolescents. METHODS: Mental health and sleep quality were measured using the Profile of Mood States - Brief, and Pittsburgh Sleep Quality Index, respectively. RESULTS: Sleep quality significantly moderated the association between PA frequency and feelings of energy and fatigue among adolescents with good sleep quality, fatigue scores were invariant across PA frequency categories. However, a dose-response relationship was suggested among adolescents with poor sleep quality, with less fatigue symptoms with greater PA frequency among adolescents with poor sleep quality.

447 Board #288 May 30 11:00 AM - 12:30 PM Exercise Referral for Major Depressive Disorder Chad Rethorst. UT Southwestern Medical Center, Dallas, TX.

Reported Relationships: C. Rethorst: Contracted Research - Including Principle Investigator; NIH.

PURPOSE: Despite its proven efficacy in research trials, exercise is rarely used as a treatment for Major Depressive Disorder (MDD) in real-world clinical settings. Clinicians cite a lack of training in exercise prescription as a barrier, and indicate a preference for referral to community resources. The purpose of this project was to assess the feasibility and preliminary efficacy of referral from primary care to a research-tested exercise program in the treatment of MDD. METHODS: Patients diagnosed with MDD in a primary care clinic were provided a written Exercise Is Medicine prescription by their provider and referred to a research-tested exercise program. Patients met weekly for 12 weeks with an exercise specialist at a community recreation center. In addition, patients received access to the recreation center for 6 months and a Fitbit Charge HR to monitor their activity. Depressive symptoms were assessed on a weekly basis. RESULTS: To date, 24 patients have been referred to the program and 17 patients (70.8%) have been enrolled. Patients have attended 73.75% of supervised exercise sessions. Based on Fitbit data, patients have engaged in a mean of 150.66 minutes of moderate-vigorous physical activity per week (“Very Active” minutes + “Fairly Active” minutes). Depressive symptoms, as assessed by the PHQ-9, reduced from 9.06 at baseline to 4.76 at last observation (p < 0.01). CONCLUSIONS: Patient activation data indicates exercise referral is a feasible intervention in patients with MDD. Furthermore, patients experienced a significant reduction in depressive symptoms demonstrating the potential of referral to exercise as a viable treatment option.

448 Board #289 May 30 11:00 AM - 12:30 PM Factors Influencing Firefighters’ Perceptions of Worksite Exercise Charrity L. Lane, O’Dane Brady, Thomas Janus, John M. Mayer, FACSM. University of South Florida, Tampa, FL.

(popular relationships reported)

PURPOSE: Firefighters have physically demanding jobs resulting in high rates of cardiovascular disorders, musculoskeletal injuries, and disabilities. Many fire service stakeholders advocate worksite exercise to counteract the impact of these disorders in firefighters. However, implementation of worksite exercise is fragmented in this population, and barriers and facilitators have not been fully explored. The purpose of this study was to assess factors influencing firefighters’ perceptions about implementation of worksite exercise. METHODS: A cross-sectional study was conducted in career firefighters (n = 181; 23 F, 158 M; age 35.3 +/- 8.6 yr) from 3 fire departments in the Tampa Bay region of Florida. The participants completed a 45-item implementation questionnaire after a 12-week worksite exercise interventionIQUE. The questionnaire was about implementation outcomes, such as uptake, adherence, access, resources, and stakeholder engagement. Relationships were assessed between items responses and independent variables, including department, age, BMI, physical activity, and low back pain history. RESULTS: Significant departmental differences were noted for perceptions in leadership support for exercise (p = 0.03), fitness personnel availability (p = 0.001), and regular off-duty exercise (p = 0.03) and gym memberships (p < 0.01). Respondents with lower BMI values were more likely to report that regular exercise was important (p = 0.003) and to report sufficient fitness personnel availability (p = 0.01). Respondents without low back pain history were more likely to exercise off-duty (p = 0.05). No significant relationships were observed between questionnaire responses and physical activity. CONCLUSIONS: Intrapersonal, interpersonal, and institutional factors influence firefighters’ perceptions about the implementation of worksite exercise. Stakeholder engagement (leadership support) and available resources vary across departments and
impact implementation. Potential barriers related to these factors need be addressed to successfully implement worksite exercise programs to reduce the adverse effects of injuries, illnesses, and subsequent disabilities in firefighters.
Anterior cruciate ligament injury prevention programs (ACL-IPP) are generally successful at reducing injury rates; however, these ACL-IPP are more effective with women’s (soccer) than basketball (BB) athletes. Purpose: To compare the biomechanical profiles and responses to an ACL-IPP in women’s BB and SOC players. Methods: 87 single-sport athletes (38 BB, 49 SOC) were cluster randomized into intervention (6-week ACL-IPP) and control groups. 3D biomechanical analyses of drop vertical jump (DVJ), double- (SAG-DL) and single-leg (SAG-SL) sagittal, and double- (FRONT-DL) and single-leg (FRONT-SL) frontal plane jump landing tasks were tested before and after the intervention. Baseline peak angles, excursions, and joint moments were analyzed using repeated measures MANOVA, while delta (△) scores of the same biomechanical measures were analyzed using two-way MANCOVAs controlling for pre-test scores. Results: At baseline, BB players landed with less hip and/or knee excursion during all tasks (p<0.05) except for the SAG-SL task. The FRONT-SL task elicited the most distinct differences, including decreased hip adduction angles (mean difference: 5.0±1.3°, p<0.001), increased hip internal rotation excursion (mean difference: 2.8±0.9°, p=0.003), and lower hip adduction moments (mean difference: 0.15±0.05 Nm/kg·m, p=0.001) in basketball players. After completing the ACL-IPP, the basketball intervention group exhibited a lower reduction in peak knee abduction angles (A=−0.9±3.5°), compared to the control basketball group (A=−2.6±3.5°, p=0.004) and soccer intervention group (A=−1.5±3.4°, p=0.01) during the SAG-SL. During FRONT-SL, the basketball intervention group exhibited greater knee flexion excursion (A=−1.5±4.5°) after training than the control group (A=−3.8±5.5°, p=0.01). Conclusion: Soccer players exhibit a more protective landing strategy than basketball players, yet women’s soccer and basketball players largely exhibit similar biomechanical adaptations to ACL-IPP. These data indicate that ACL-IPP may need to account for sport-specific biomechanics, including technique training that emphasizes soft landings during basketball-specific frontal plane and single-leg jumping activities.
Vestibular impairment following concussion is associated with higher symptom burden, worse cognitive performance, and longer recovery. However, the role of persistent vestibular symptoms and impairment on these outcomes among adolescents is unknown. PURPOSE: Determine the role of persistent vestibular symptoms and impairment following concussion on recovery time and clinical outcomes among adolescents. METHODS: 50 (F:22/M:28) aged 12-20 years completed the Vestibular/Ocular Motor Screening tool (VOMS), Immediate Post-concussion Assessment and Cognitive Testing (ImPACT), and Post-concussion Symptom Scale (PCSS) at 0-10 and 11-21 days after concussion. Participants were grouped into: 1) persistent vestibular (PV), 2) vestibular improvement (VI), and 3) no vestibular (NoV). A 3 (group) X 2 (time) ANOVA with Bonferroni correction was performed for cognitive and symptom scores, and one-way ANOVA was performed for recovery time. RESULTS: Participants included 17 (35%) PV, 12 (25%) VI, and 20 (40%) NoV with one being excluded based on outlier analyses. Results supported group differences on PCSS at 11-21 days (p<0.005), with PV (29.0±24.9) reporting higher symptoms than VI (13.0±15.5; p<0.045) and NoV (5.45±10.0; p<0.005). The PV group took longer to recover (34.9±11.6 days, p<0.03) than the NoV (22.9±14.9 days) group. There were no significant group by time interactions for cognitive scores. However, all groups improved on verbal (p<0.007) and visual (p<0.02) memory, visual motor speed (p<0.02), and reaction time (p<0.03) from 10-20 days-likely more than males to be in the PV versus NoV group (p<0.02, 95% CI=1.3-24.6). CONCLUSION: Persistent vestibular symptoms and impairment following concussion may play a role in higher symptom burden and prolonged recovery that warrants attention from clinicians. Females may be more likely to experience these persistent vestibular symptoms and impairment.

Funding

This research was supported in part by a grant to the University of Pittsburgh from the National Institute on Deafness and Other Communication Disorders (1K01DC012332-01A1) to Dr Kontos.

Researchers report that a history of motion sensitivity is associated with vestibular/ oculomotor impairment and symptoms in non-concussive collegiate athletes. However, previous research did not include other commonly used baseline concussion assessments (e.g., neurocognitive, symptoms) or adolescent athletes. PURPOSE: To examine the effects of motion sensitivity on baseline neurocognitive, symptom, and vestibular/oculomotor scores in high school athletes (HS). METHODS: A total of 423 HS athletes (15.0±1.24 years; 97 females-24% completed the Motion Sickness Sensitivity Questionnaire (MISSQ)), the Immediate Post-concussion Assessment and Cognitive Testing (ImPACT), Post-concussion Symptom Scale (PCSS), and Vestibular/Ocular Motor Screening tool (VOMS) at baseline. Athletes were categorized into three groups: 1) NONE- MISSQ score=0 (33%, 142/421), 2) LOW-MISSQ score >0<7.07 (34%, 144/421) or 3) HIGH- MISSQ score >7.20 (32%, 135/421) based on median split of MISSQ scores. A series of ANOVAs were performed to examine between group differences on VOMS item scores, near-point convergence (NPC) distance, cognitive testing, and symptoms. A series of chi-square analyses with odds ratios (ORs) were used to analyze the association of motion sensitivity to clinical cutoffs on VOMS (i.e., >2 on any item) and NPC distance (<5 cm). RESULTS: A total of 34% (144/421) and 95% (401/421) of athletes had scores >2 on one VOMS item and NPC distance, respectively. Total PCSS scores were greater for the HIGH compared to the NONE group (p<0.003). There were no differences between motion sensitivity groups on cognitive performance (p>0.05). The HIGH group had higher total VOMS scores than the NONE group for horizontal saccades, horizontal vestibulo-ocular reflex (VOR), vertical VOR, and visual motion sensitivity (p<0.01). The HIGH group was 2.94x (p<.001) more likely than the NONE group to exceed clinical cutoffs on VOMS. CONCLUSION: Motion sensitivity was associated with scores above clinical cutoffs on VOMS. Sports medicine professionals should assess motion sensitivity in athletes at baseline to inform better SRC care.

PURPOSE: Our aim was to evaluate a quantitative and multifaceted approach for determination of concussion recovery among youth athletes across different functional domains. METHODS: Youth athletes 8-18 years of age and diagnosed with a concussion were tested 3 times: within 10 days of injury (T1), approximately 3 weeks post-injury (T2), and after clinical recovery, defined as symptom resolution and return to sport clearance (T3). Control participants completed the protocol in similar temporal increments as concussion participants. All participants completed a multifaceted protocol that included an symptom inventory (PCSS), a dual-task gait evaluation, an electroencephalography (EEG)-based auditory oddball task, and objective eye tracking. Repeated measures ANCOVAs were used to evaluate between group differences with sex, age, and prior concussions as covariates. We also examined if the rate of change across time for each outcome variable was different between groups using analysis of response profiles for longitudinal data. RESULTS: Sixty-3 athletes participated: 36 post-concussion (age=14.0±2.6 years; 44% female) and 31 controls (age=14.6±2.2 years; 39% female). Concussion symptoms were significantly higher for the concussion group compared to controls at T1 (PCSS=31.7±18.8 vs. 19.2±2.9; p<0.001) and T2 (PCSS=10.8±11.2 vs. 1.8±3.6; p<0.001), but resolved by T3 (PCSS=1.7±3.6 vs. 2.0±3.8; p=0.46). The concussion group walked slower significantly slower during the dual-task gait than controls at each of the three tests (0.83±0.19 vs. 0.95±0.15 m/s; p<0.049). We found no significant differences between groups for the EEG oddball task or objective eye tracking measures. The EEG auditory oddball connectivity recovery trajectory differed significantly between groups, where the concussion group scores decreased and the control group scores increased across the testing timeline (p<.001). CONCLUSIONS: Despite symptom resolution, athletes with concussion displayed altered dual-task gait speeds at their final visit and their auditory oddball connectivity scores worsened throughout the test timeline. A multimodal and objective approach to concussion monitoring may support clinicians in the detection of brain function deficits that are undetectable with standard clinical assessments.

PURPOSE: To determine if there is an association between reported sleep quality and concussion symptoms in pediatric athletes. METHODS: A review of prospectively collected data from subjects diagnosed with a sports-related concussion between October 2015 and June 2017, and enrolled in the North Texas Concussion Network Prospective Registry (Con-Tex), was performed. Subjects were treated at one of four outpatient clinics, in North Texas, specializing in concussions. Records were reviewed for sleep quality, indicated by composite scores on the Pittsburg Sleep Quality Index (PSQI). According to PSQI guidelines, good sleep quality (GOOD SLEEP group) is indicated by a composite score of ≤5 (possible total=21), and poor sleep quality (POOR SLEEP group) by a score >5. Demographics, symptoms, and total symptom score, as assessed by the Sports Concussion Assessment Tool 3 (SCAT3) at initial visit and 3-month follow-up, were compared between groups. RESULTS: Of 356 eligible subjects, 180 (50.6%) were girls and 176 (49.4%) were boys, with a mean age of 14.58 years (7-18). 261 subjects had a PSQI composite score of ≤5 at their initial visit (GOOD SLEEP) or the initial visit on the SCAT3 (POOR SLEEP). At initial visit, the POOR SLEEP group had a higher mean PSQI composite score (8.7) and total symptom score on SCAT3 (39.2) compared to the GOOD SLEEP group (2.6 and 20.4, respectively, p<.0001). The POOR SLEEP group also had a higher mean PSQI composite score (5.7) and total symptom score (12.2) at 3 months compared to the GOOD SLEEP group (3.0 and 4.2 months, respectively, p<.0001), although both groups had poor sleep quality. Additionally, subjects in the POOR SLEEP group reported more fatigue, drowsiness, and trouble falling asleep on the SCAT3 at both the initial visit and 3-month follow-up when compared to the GOOD SLEEP group (p<.005). Gender was also significantly different between the two sleep groups with more girls included in the POOR SLEEP
group than boys (61.1% vs 38.9%, respectively, p=0.017). CONCLUSIONS: Poor sleep was strongly associated with increased symptom burden within pediatric athletes both at initial visit and 3-month follow-up post-concussion. Clinicians should include an evaluation of sleep quality in young athletes treated for a sports-related concussion.

491 Board #6 May 30 1:00 PM - 3:00 PM
Functional Near Infrared Spectroscopy Identifies Changes in Cognitive Workload Following Pediatric Concussion
christina lin master1, Eileen Storey1, Lei Wang2, Olivia Podolak1, Matthew Grady1, Andrew Mayer1, Hasan Ayaz2. 1The Children’s Hospital of Philadelphia, Philadelphia, PA. 2Drexel University, Philadelphia, PA. 3Mind Research Network, Albuquerque, NM. (No relevant relationships reported)

PURPOSE: To determine if functional near infrared spectroscopy (fNIRS), a noninvasive imaging modality detecting oxygenation changes reflective of cognitive workload, distinguishes physiologic differences between concussion subjects and healthy controls during King-Devick (KD) testing, a rapid number naming task

METHODS: We recruited 57 cases, ages 7 to 21 years, 51% female, and 17 controls, ages 10-21 years, 47% female from a subspecialty referral concussion program for this prospective case control study where the subjects performed the KD test while wearing a fNIRS device consisting of a headband which records anterior prefrontal cortex oxygenation changes with 4 optodes at a 4Hz sampling rate. The main outcome measures were KD times, symptom provocation and oxygenation change during KD testing.

RESULTS: Concussion subjects demonstrated longer KD times and greater oxygenation change on fNIRS compared to healthy controls. However, within the group of concussion subjects, KD times did not distinguish between those with and without symptom provocation upon testing. In contrast, fNIRS was able to detect oxygenation change differences between these two subgroups, with the symptomatic group exhibiting greater oxygenation change with testing.

CONCLUSIONS: Based on our data, the prolongation of KD times observed following concussion has physiologic correlates with increased cognitive workload. Among subjects with concussion, KD times did not distinguish between those with and those without symptom provocation upon testing. In contrast, fNIRS was able to differentiate between these two subgroups of concussion, with symptomatic subjects exhibiting a pattern of greater cognitive workload compared to asymptomatic. fNIRS has utility in detecting subclinical differences in cognitive workload in concussion. In addition, our data supports the concept that the physiologic basis for symptom provocation in concussion may be related to cognitive overload.

fNIRS with Symptom Provocation on KD testing

492 Board #7 May 30 1:00 PM - 3:00 PM
The Effect of Anxiety on Baseline Concussion Assessment in Adolescent Females
Christopher F. Tomczyk1, Jody Langdon, George Shaver, Tamerah Hunt, FACSM, Georgia Southern University, Statesboro, GA. (Sponsor: Tamerah Hunt, FACSM) (No relevant relationships reported)

Anxiety occurs in approximately 15-20% of adolescent females. The potential for the interaction between anxiety and impaired cognition commonly assessed by concussion batteries require clinicians and researchers to examine the effect of anxiety on baseline concussion test scores. PURPOSE: Examine the effects of trait anxiety on concussion baseline testing in adolescent female athletes. METHODS: Prior to their competitive season, 35 adolescent female athletes ranging from 13-18 years of age (mean age: 15.66 ± 1.28) were administered the Immediate Post-Concussion Assessment and Cognitive Test (ImPACT) and the State Trait Anxiety Inventory during baseline testing. Participants were divided into groups, based off a previously validated T-Anxiety cutoff score of 35, which was derived from the literature (low n=18, high n=17). ImPACT composite scores served as dependent variables. Multiple one-way ANOVAs were calculated to examine group differences on ImPACT composite scores. All statistical analyses were conducted using SPSS 23.0 (IBM, Armonk, NY). Significance level was set a priori at 0.05 with a Bonferroni correction (p<0.008).

RESULTS: Significant differences were found between high and low trait anxiety groups for total symptom score (F(1,34)= 9.58, p=0.004; High: 12.30 ± 4.96, Low: 40.31 ± 8.21). Athletes with high trait anxiety reported more symptoms and performed slower on visual motor speed. No statistical differences existed for composite: verbal memory, visual memory, reaction time and impulse control (p=0.05).

CONCLUSION: This study provides preliminary evidence that adolescent females with high trait anxiety during baseline concussion assessment present with higher symptoms and slower visual motor speed. In order to subscribe to a holistic approach of concussion management, anxiety needs to be incorporated into the clinical decision process. Without examining adolescent levels of anxiety the clinician may be vulnerable to making inaccurate interpretations of baseline test scores.

493 Board #8 May 30 1:00 PM - 3:00 PM
Concussion Recovery in Adolescents: The Influence Of Race And Sex On Neurocognition
Seema S. Aggarwal, Summer D. Ott, Nikhil S. Padhye. The University of Texas Houston Health Science Center, Houston, TX. (No relevant relationships reported)

An estimated 500,000 to 800,000 concussions occur annually among U.S. high school athletes. However, the association of sex and race/ethnicity with recovery remains unclear. PURPOSE: The aim of this study was to examine influence of sex and race/ethnicity on the Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) in adolescents. METHODS: This was a retrospective cohort study of adolescents, 13-19 years old, evaluated for an acute concussion ≤10 days from injury at a university-based concussion clinic. General linear models (GLM) were used to examine race and sex interaction on post-concussion ImPACT composite scores on verbal memory, visual memory, visual motor, reaction time, and symptoms. RESULTS: A total of 277 charts that met inclusion criteria. There were no differences in the distributions of age and sex. The sample (N = 227) was primarily male (75%), and the median age was 15 years. Minorities (Blacks and Hispanics) constituted 46% of the sample. White females had the longest recovery time (median 27.5 days) and minority males had the shortest recovery time (median 11 days). Univariate tests indicated that the interaction of sex and race was statistically significant for visual memory (F(3,223) = 3.83, p = 0.011, t2 = 0.049), reaction time (F(3,223) = 2.87, p = 0.037, t2 = 0.037), and symptoms (F(3,223) = 9.46, p < 0.001, t2 = 0.113). On these ImPACT subscales, White females had the poorest performance, and minority males had the best performance. Compared to the scores for minority males, ImPACT scores for White females on these subscales were as follows: visual memory (70.67±14.1 vs. 69.95±14.5), reaction time (67.5±17 vs. 76.1±19), and symptom scores (12.19±4.5 vs. 28.29±22.04). Multivariate tests for the main effect of the interaction of race and sex (F(15,663) = 3.00, p = 0.001, t2 = 0.06) were statistically significant. CONCLUSION: This study found that both race and sex appear to influence concussion recovery. White females took longest to recover and had worse ImPACT visual memory, reaction time, and symptoms scores than White males, minority females, and minority males. In contrast, minority males had shorter recovery times and better ImPACT scores on these subscales than all other race-sex categories.

B-09 Thematic Poster - Exercise Psychology-Stress
Wednesday, May 30, 2018, 1:00 PM - 3:00 PM
Room: CC-Lower level L100E

494 Chair: Steven J. Petruzzello, FACSM. University of Illinois at Urbana-Champaign, Urbana, IL. (No relevant relationships reported)

495 Board #1 May 30 1:00 PM - 3:00 PM
Multidimensional Stress Influencing Mental Health of Chinese Professionals and the Health Promotion of Physical Activity
Chunmei Zheng. Shandong University, Jinan, China. (No relevant relationships reported)

Social and economic changes in China have seriously influenced the mental health of citizens. Although work stress has been studied by scholars within China and...
abroad. Little is known about multidimensionality of stress factors and their effects among various populations. PURPOSE: The purpose of this study was to examine the influence of multidimensional stressors on the mental health in Chinese adults and identify the impact of physical exercise on mental health. METHODS: Participants for the survey were randomly recruited from Jinan institutions, parks, squares and streets. A total of 1000 questionnaires were distributed, of which 819 questionnaires were returned (response rate 81.9%). 110 invalid excluded. A total of 709 valid questionnaires were used for the data analysis. Using SPSS version 16.0, descriptive statistics, T-test, Multivariate Analysis of Variance (MANOVA) and hierarchical regression analysis were used to analyze the data. RESULTS: Analysis of variance (F = 0.046 < 0.05) indicated that the stress levels of professionals across the ranks are significantly different. Descriptive Statistic Analysis showed that the main sources of stress across different occupational groups are work (35.8%), education (36.1%), and health (18.1%). MANOVA (WilksLamba Criterion = 0.86) showed that satisfaction, emotional balance, self-awareness, and interpersonal relationship are significantly different among different occupations (p < 0.01, respectively). T-test indicated that there was significant differences in life satisfaction, emotional balance, self-awareness, and interpersonal relationships between physical activity and non-physical activity group (all p = 0.05). CONCLUSION: It can be concluded that China has distinct social classes, whose mental health conditions vary; The stress levels of professionals across the ranks are significantly different; Work, education, and healthcare were identified as main sources of stress among working professionals; Respondents who regularly engaged in physical activity far better in terms of mental health compared to the non-exercise group. Supported by the China Scholarship Council; Shandong Soft Science. [2015RKE27016]; National science and technology basic work.

Despite knowing the factors that increase stress levels in collegiate freshmen, there is limited research that compares the stress levels and coping mechanisms between collegiate, freshmen athletes and freshmen non-athletes. PURPOSE: To investigate differences in perceived stress levels and coping mechanisms in collegiate freshmen athletes and non-athletes. METHODS: One hundred and forty-seven NCAA Division II freshmen (n Slavin = 68, n Vetroczky = 69, n Rebellon = 86, n Jochum = 49) completed three self-report questionnaires: Perceived Stress Scale (PSS-10), Brief COPE, and demographic information questionnaire. The 10-item PSS-10 was used to measure the degree to which an individual appraises his/her situation as stressful. The 28-item Brief COPE was used to measure frequency of positive, neutral and negative coping mechanisms on fourteen different scales. An alpha level of p ≤ .05 was set for statistical significance. An independent t-test was conducted to compare mean scores of the PSS-10, and Mann-Whitney U tests were used to compare Brief COPE scales. A Spearman’s rho correlation was used to determine relationships between perceived stress and coping mechanisms. RESULTS: Analysis revealed no statistical difference between athletes and non-athletes on perceived stress or coping mechanisms. All participants rated a high level of perceived stress on the PSS-10, females (SD = 27) males (SD = 26) out of 40 possible points, yielding a statistical difference between genders, r(133) = 3.117, p = 0.002. Of the 14 coping strategies measured, four were found to be statistically significant for females: emotional support (r = 0.001), instrumental support (r = 0.03), venting (r = 0.06), and self-blame (r = 0.05). A positive correlation exists between increased stress levels and eight coping mechanisms. The two highest correlations were disengagement r = 0.422, p = 0.001 and self-blame r = 0.523, p = 0.001. CONCLUSION: No difference was observed in perceived stress levels between collegiate freshmen athletes and non-athletes, all freshmen perceive high levels of stress. Females perceive higher levels of stress than males, and tend to select negative coping mechanisms. The higher levels of perceived stress, the more likely the person would be to use disengagement and self-blame as coping mechanisms.
of psychiatric diseases. Being physically fit has been associated with improved sleep. However, to date, there has been limited investigation of physiological stress responding as a mediating factor in the relationship between physical fitness and improved sleep, and even fewer which have investigated this relationship in women while experimentally controlling for the influence of the ovarian cycle on the physiological stress response. This study aimed to investigate relationships among physical fitness, sleep disturbances, and physiological responses to psychosocial stress in women. METHODS: Following a two-tiered screening process, 30 healthy women (18-45y) who were medication-free and had regular menstrual cycles completed: (1) enrollment visit, including (mood and sleep assessment and assessment of cardiorespiratory fitness via maximal oxygen consumption during exercise); (2) one-week sleep monitoring period (objective and subjective measures of sleep wake behavior); and (3) psychosocial stressor protocol for the collection of heart rate (HR) and cortisol stress responses. Psychosocial stress testing sessions occurred during the follicular phase of the menstrual cycle to control for hormone fluctuations which have been shown to influence the physiological response to stress. RESULTS: Higher levels of physical fitness were significantly associated with reduced objectively measured wake after sleep onset (WASO) duration (r = -0.38, p = 0.04), higher self-reported sleep quality (higher scores reflect poorer sleep quality; r = -0.37, p = 0.05), and lower HR during the psychosocial stressor (r = -0.39, p = 0.04). Consequently, lower self-reported sleep quality was significantly associated with a higher HR during the psychosocial stressor (r = -0.41, p = 0.02), and increased WASO duration was significantly associated with blunted cortisol responses to the psychosocial stressor (r = -0.41, p = 0.04, n=26). CONCLUSIONS: Results suggest that, in women, physical fitness may be protective against the deleterious effects of stress via improved sleep-wake behavior.

499

Board #5

May 30 1:00 PM - 3:00 PM
Correlations Between Serum Biomarkers Of Stress And Subjective Measures Of Well-being In Collegiate Swimmers

Conor A. Kuremsky,1 Wang Haoyan,2 Neil M. Johannsen,3 Jack Marucci,1 Shelly Mullenix,1 Brian A. Irving,4 Rick L. Sharp, FACSM4, Brian Harrell,1 Guillaume Spielmann,1 Louisiana State University, Baton Rouge, LA. 2Iowa State University, Ames, IA. 3Baton Rouge General Sports Medicine, Baton Rouge, LA. (Sponsor: Rick Sharp, FACSM)

(No relevant relationships reported)

Collegiate student-athletes experience prolonged physical, psychological and academic stressors, putting them at risk for impaired athletic performance and overall well-being. Practical feasibility undermines the use of objective physiological measures of stress, such as serum cortisol, alternatively favoring subjective measures of well-being by using self-reported questionnaires. Purpose: To determine the relationship between serum cortisol and various subjective measures of well-being in NCAA D1 swimmers over a 6-month training method. Methods: Early morning resting serum samples were collected from sixteen NCAA Division 1 swimmers (8 M, 8 F; 19.81 ± 0.65 yrs) at 2 timepoints (early season and immediate post-season), and an additional mid off-season timepoint was collected in a subset of 10 swimmers. Self-reported subjective measures of well-being were collected at each timepoint by using questionnaires for overtraining (DALDA), sleep quality (PSQI) and mood state (ADACL). The gold-standard physiological biomarker of stress, serum cortisol, was measured using commercially-available ELISA kits (R&D Systems). Pearson’s correlation coefficients determined linear correlations between serum cortisol concentration and questionnaire responses (r=0.05). Results: At the pre-season timepoint, higher serum cortisol concentrations (138.99 ± 33.9 ng/mL) were observed in swimmers reporting less calmness (r = 0.79, p = 0.006), while this association disappeared at the early season timepoint (p = 0.935). At the post-season timepoint, serum cortisol concentrations (123.3 ± 76.7 ng/mL) were negatively correlated with calmness (r = -0.46, p = 0.035) and tension (r = -0.45, p = 0.041). Surprisingly, however, swimmers reporting greater symptoms of overtraining at the post-season timepoint had reduced cortisol concentration (r = -0.44, p = 0.046). Discussion: Subjective questionnaires have been used as a surrogate to objective biomarkers of stress, such as serum cortisol concentration. Although the results obtained from self-reported questionnaires were highly correlated with serum cortisol levels during periods of high academic and athletic stress (post-season), the correlation between cortisol concentration and mood states did not remain consistent throughout the competitive season.

500

Board #6

May 30 1:00 PM - 3:00 PM
Resting Heart Rate Variability Moderates A Relationship Between Attentional Bias and Stress Response

Derek C. Monroe1, Zachary Rader2, Matthew P. Herrig1, Jonathan Golden1. 1University of California--Irvine, Irvine, CA. 2Georgia College & State University, Milledgeville, GA. 3University of Limerick, Limerick, Ireland. (No relevant relationships reported)

University students report greater symptoms of psychological distress compared to age-matched controls, which plausibly contribute to a greater incidence of anxiety and depressive disorders. Maladaptive responses to, and recovery from, stress may be partially explained by cognitive (e.g., threat bias) and physiological (e.g., poor autonomic balance) correlates of effective dysfunction that may be modifiable through exercise training. Thus, elucidating interactions among psychological and physiological predictors of stress has implications for better understanding the mental health benefits of exercise training.

Purpose: To quantify the moderating effect of heart rate variability on a relationship between threat bias and perceived stress during exam week in healthy, undergraduate students.

Methods: 45 undergraduate students completed a Spielbergers Trait Anxiety Inventory, a computerized Dot-Probe Task, and a 5-minute assessment of resting heart rate variability (HRT). Threat bias was operationalized as a positive bias score (discordant vs. concordant trials), and HRT was computed as a ratio of power density in the high frequency spectrum (15–40 Hz) to power density in the entire spectrum (0.4–40 Hz). The Perceived Stress Scale was completed online during exam week 4-8 weeks later. Bivariate correlations were computed between trait anxiety and threat bias and HRT. Moderation was tested using hierarchical linear regression with interaction effects.

Results: Trait anxiety was inversely associated with HRT (r = -0.35, p = 0.01) and positively associated with bias scores (r = -0.34, p = 0.01). The relationship between threat bias and perceived stress during exam week was moderated by HRT, F(1,26)=26.04, p = 0.001, ABp=.2605. Lower stress was only predicted by a lack of attentional bias among participants who also had the highest resting HRT, b = 6.60, SE = 1.43, p = 0.001. There was no association between trait anxiety and perceived stress.

Conclusion: Findings suggest that in young, healthy individuals the protective effects of high parasympathetic tone are only revealed among those who do not exhibit threat biases. Cognitive and physiological correlates of affective dysfunction should be measured when determining the efficacy of exercise training programs designed to improve mental health outcomes.

501

Board #7

May 30 1:00 PM - 3:00 PM
Appraisals Significantly Influence Endurance Performance and Psychophysiological Response: Stress Appraisals, Emotions, and Cortisol Responses

Mark A. Thompson, John Toner, John L. Perry, Rachel Burke, Adam R. Nicholls. University of Hull, Hull, United Kingdom. (No relevant relationships reported)

Athlete stress appraisals have been associated with athletic performance, which is purported to be mediated by emotions and coping behaviours. However, our understanding of how these psychological mechanisms underpin endurance performance is equivocal. Purpose: To assess the causal psychophysiological and performance impact of past (e.g., harm/loss and benefit) and future-oriented (e.g., challenge and threat) stress appraisals on performance. Methods: Thirty trained and gender-matched athletes were randomly engendered with one of five stress appraisal (challenge, threat, benefit, harm/loss, or control) and completed three 16.1km cycling time trials on a SRM cycle ergometer. Salivary cortisol concentration was measured via an ELISA to assess neuroendocrine response, whilst psychometrics measuring appraisals, emotions, and coping behaviours were also completed. Results: Penalized Multinomial Logistic Regression analyses of performance change revealed that temporal orientation of appraisal was a causal influence upon performance, with benefit (β = 5.13, 95% CI = 1.90, 10.39, p < 0.001, OR = 169.00) and harm/loss (β = 3.15, 95% CI = -0.46, 8.18, p = 0.019, OR = 23.40) groupings significantly facilitating and inhibiting performance respectively. Threat appraisals lead to a performance dichotomy, with both significant improvement (β = -3.41, 95% CI = 0.72, 8.54, p = 0.018) and significant deterioration (β = 3.08, 95% CI = 0.06, 8.23, p = 0.046) more likely to occur than a non-significant change (OR = 30.33 and 21.67 respectively). Variation across temporal orientation also translated into neuroendocrine response, with cortisol spikes found in threat (p = 0.49, compared to a decrease in harm/loss (p = 0.74). Conclusion: Stress appraisals significantly influence psychophysiological response and performance, with past-oriented appraisals as autonomous and influential as future-oriented appraisals. Spikes in cortisol levels in
the future-oriented stress appraisal threat, compared to a decline in the past-oriented harm-loss, suggest that the fear of defeat may be physiologically more stressful than losing itself. Practitioners are advised to engender benefit stress appraisals in order to facilitate both psychophysiological well-being and subsequent performance proficiency among their athletes.

B-10 Basic Science World Congress - Thematic Poster - Moderating Skeletal Muscle I

Wednesday, May 30, 2018, 1:00 PM - 3:00 PM
Room: CC-Mezzanine M100C

502 Chair: Troy Hornberger, University of Wisconsin-Madison, Madison, WI.

(No relevant relationships reported)

503 Board #1 May 30 1:00 PM - 3:00 PM
No Effect Of Hmb Or α-hica On Training-induced Changes In Performance Or Body Composition

Filipe J. Teixeira1, Catarina N. Mattas2, Cristina P. Monteiro2, Maria J. Valamatos3, Joana F. Reis4, Francisco Tavares5, Christopher Domingos1, Francisco B. Alves4, Ana R. Batista1, Luis B. Sardinha4, Stuart M. Phillips, FACSM6. 1Faculty of Human Kinetics, University of Lisbon, Lisbon, Portugal. 2CIPER, Faculty of Human Kinetics, University of Lisbon, Lisbon, Portugal. 3Universidade Europeia, Laureate International Universities, Lisbon, Portugal. 4Wakato University, Hamilton, New Zealand. 5McMaster University, Hamilton, ON, Canada.

(No relevant relationships reported)

Some leucine metabolites like β-hydroxy-β-methylbutyrate (calcium: HMB-Ca and free acid: HMB-FA) and α-hydroxy-isocaproic acid (α-HICA or leucic acid) have been suggested to augment training-induced adaptations in body composition and performance. PURPOSE: To compare the effects of commercially available supplements, HMB-Ca, HMB-FA and α-HICA, on resistance training-induced changes in fat mass and fat-free mass (FFM) and performance. METHODS: Forty men were block-randomized (based on handgrip strength, age, and fat-free mass (FFMJ)) to one of four groups: HMB-FA (n=11, age 30 ± 2.4 y, FFM 62.7 ± 10.5 kg), HMB-Ca (n=9, age 34 ± 1.5 y, FFM 65.6 ± 10.1 kg), α-HICA group (n=10, age 31 ± 2.7 y FFM 62.0 ± 7.1 kg), and placebo (PLA) group (n=10, age 31 ± 2.1 y FFM 64.2 ± 5.7 kg). The training program consisted of whole body thrice weekly training for 8wk (7 exercises/session, 3-4 sets per session, 70-80% 1RM). Whole body fat and FFM were assessed by DXA, and performance measures (vertical jump, 1RM for bench press, squat and Wingate test) were all assessed at baseline and at the end of weeks 4 and 8. Participants were instructed to consume at least 45 kcal/kg FFM/d and 1.6 g protein/kg body weight/d.

RESULTS: Time-dependent changes were observed for 1RM bench press (p = 0.001), 1RM Squat (p = 0.001), vertical jump height (p = 0.028) and vertical jump power (p = 0.006). No significant between-group or time-group interactions were observed for body weight, Wingate peak and average power, handgrip, whole body fat or whole body FFM (A changes: HMB-FA 0.1 ± 5.0 kg; PLA 0.6 ± 0.8 kg; α-HICA 0.1 ± 1.0 kg; HMB-Ca 0.6 ± 2.0 kg) CONCLUSION: When consuming sufficient protein while in an estimated positive energy balance, none of the leucine metabolites studied resulted in any ergogenic effects on any outcome variable. We do not recommend leucine metabolites as a supplement strategy to augment training-induced gains in performance or body composition.

504 Board #2 May 30 1:00 PM - 3:00 PM
Human Skeletal Muscle Lipid Mediator Responses to Resistance Exercise and Anti-inflammatory Drugs

Tommy R. Lundberg1, Mats Lilja2, Mirko Mandić2, Krishna Rao Maddipati1, Thomas Gustafsson3, Eric Rullman1. 1Karolinska Institutet, Stockholm, Sweden. 2Wayne State University, Detroit, MI.

(No relevant relationships reported)

Exercise has been found to induce bioactive lipid mediators which possess both pro- and anti-inflammatory activity, yet the role of these mediators in the muscle adaptive response to resistance exercise (RE) remains to be explored. PURPOSE: The present study aimed to characterize the presence of polysaturated fatty acid-related bioactive lipids in human skeletal muscle. Specifically, we hypothesized that high doses of anti-inflammatory drugs (NSAIDs) would hinder the action of both pro-inflammatory and pro-resolving lipid mediators in response to acute RE, thereby providing a mechanistic link to the negative effect of high (compared with low) doses of NSAIDs on the muscle hypertrophic response to RE reported by us. METHODS: Thirty-one men and women (18-35 years old) performed 8 weeks of RE with consumption of either a high dose of ibuprofen (IBU; 1200 mg) or a low dose of aspirin (ASA; 75 mg). Muscle biopsies were obtained before the training/treatment period and 3 h after an acute RE bout at week 4 of the intervention. We used a targeted lipidomics approach (High-Performance Liquid Chromatography with Tandem Mass Spectrometry) to compare the response of over 140 pro- and anti-inflammatory lipid mediators in IBU and ASA as well as in relation to untreated controls (CON). RESULTS: We could reliably detect 71 lipid metabolites in skeletal muscle, where 12/71 belonged to the cyclooxygenase pathway but the majority of the mediators were from the lipoxygenase and epoxygenase pathways. Overall, both the pro-inflammatory and the pro-resolving lipid mediator signature was decreased in both IBU and ASA, yet remained unchanged with exercise in CON. Pathway analysis revealed significant differences between drug treatments in the lipoxygenase pathway, specifically in mediators derived from the 5-LOX and 15-LOX enzymes, where levels after exercise were significantly lower in ASA compared with IBU. Specific metabolites driving these differences were 5-HETE, 13-OSOXDE and 17-HDoHE. CONCLUSIONS: The results show that both high and low doses of NSAIDs markedly affect the skeletal muscle lipid mediator response to RE. We put forth the idea that lipid mediators from the lipoxygenase pathway may have a role in explaining the differential muscle hypertrophic response to RE noted with different doses of NSAID treatment.

505 Board #3 May 30 1:00 PM - 3:00 PM
Hyperbaric-oxygen Reduces Inflammation And Regenerates Rats Skeletal Muscle Via Macrophage And Satellite Cell Activation

Takuya Oyaizu, Mitsuhiko Enomoto, Naoki Yamamoto, Masaki Horie, Atsushi Okawa, Kazuyoshi Yagishita. Tokyo Medical and Dental University, Tokyo, Japan.

(No relevant relationships reported)

Muscle contusion injury is the most common sport-related injury. Hyperbaric oxygen treatment (HBO) promotes rapid recovery from soft tissue injuries. PURPOSE: Uncover a potential mechanism of the restorative effect of HBO on injured muscle. METHODS: A muscle contusion injury was performed by the drop-mass method on the rat calf muscle. Rats were divided into non-treated (NT) and HBO-treated (HBO). HBO consisted of 2.5ATA 100% oxygen for 120 minutes once per day. Circulating CD11b, CD68 positive cells were measured with flow cytometry. Injured muscles were homogenized and interleukin-6 (IL-6) and signal transducer and activator of transcription 3 (STAT3) were measured with enzyme-linked immunosorbent assay (ELISA). Calf muscles sections were immunostained with CD68 and CD163 (macrophage markers), Pax7 and MyoD (satellite cell markers). RESULTS: Expression of IL-6 (NT vs. HBO: 995±144 vs. 1964 ± 396 pg/mg, p=0.05) and the ratio of phosphorylated to total STAT3 (42.05 ± 0.01 vs. 1.17 ± 0.07, p<0.01) are increased at 3hrs in HBO. The percentages of circulating CD11b-positive cells 6hrs (NT vs. HBO: 65.5 ± 4.6 vs. 42.2 ± 4.1%, p<0.01) and 24hrs (45.6 ± 6.1 vs. 21.9 ± 1.1%, p<0.001) were deceased in HBO. In the injured muscle, peak infiltration of CD68-positive cells occurred 2 days earlier in HBO. CD163-positive cells were higher at 3 days (NT vs. HBO: 9.3 ± 0.75 vs. 12.7 ± 0.83/HPF, p<0.05), 5 days (13.3 ± 0.63 vs. 17.2 ± 0.89/HPF, p<0.01) and 7 days (11.9 ± 0.80 vs. 17.3 ± 1.70/HPF, p<0.05) after injury. In muscle tissue, the number of Pax7+MyoD+ cells was higher at 3 days (NT vs. HBO: 8.7 ± 0.75 vs. 17.2 ± 0.99/HPF, p<0.01) and 5 days (14.73 ± 2.24 vs. 24.9 ± 2.2/HPF, p<0.05) after injury. The number of Pax7+MyoD+ cells was higher at 1 day (NT vs. HBO: 9.9 ± 1.4 vs. 15.4 ± 0.48/HPF, p<0.01) and 3 days (12.6 ± 1.5 vs. 21.96 ± 1.4/HPF, p<0.05) and the number of Pax7-MyoD+ cells higher at 1 day (NT vs. HBO: 4.4 ± 0.21 vs. 8.2 ± 1.0/HPF, p<0.05), 3 days (6.9 ± 1.1 vs. 15.5 ± 2.6/HPF, p<0.05) and 5 days (13.0 ± 1.4 vs. 23.4 ± 1.4/HPF, p<0.01). CONCLUSIONS: HBO increased levels of a tissue inflammatory cytokine, reduces circulating inflammatory cells and induces a rapid macrophage response. These early-onset inflammatory responses appear to enhance satellite cell proliferation and differentiation, leading to rapid recovery of injured skeletal muscle.

506 Board #4 May 30 1:00 PM - 3:00 PM
Muscle Fiber Type Adaptations To Exercise Differ In Obese And Non-obese Volunteers

Maxime Morellon, Yannick Morard, Nicholas T. Broskey, Sonia Conde Alonso, Cyril Besson, Francesca Amati, FACSM. University of Lauasanne, Lausanne, Switzerland.

(No relevant relationships reported)

Human skeletal muscle is composed of slow fibers (type I), fast fibers (Ila and IIx), and a continuum of hybrid fibers co-expressing different myosin heavy chains. Cellular responses to exercise involve changes in fiber type proportions and cross sectional area (CSA). To our knowledge, the impact of obesity on these responses is not yet known. PURPOSE: To determine if obesity impacts changes in fiber type proportions and CSA in response to endurance exercise in a sedentary population. Abstracts were prepared by the authors and printed as submitted.
B-11 Thematic Poster - Muscle Basic Science Applications

507 Board #5 May 30 1:00 PM - 3:00 PM

2000 Steps/Day Does Not Prevent Muscle Atrophy or Strength Loss During Bed Rest

Arentson-Lantz, Eliejo Galvan, Sheena Nagamia, Adam Wachera, Christopher Fry, Doug Paddon-Jones, FACSM.

Emory University Medical Center, Atlanta, GA.

Supported by NIH Grant R01AR052966 (No relevant relationships reported)

PURPOSE: To determine if 2000 steps/day can protect key markers of skeletal muscle health during 7 days of bed rest.

METHODS: Healthy, community-dwelling older adults (N=17, 11M/6F; 68 ± 2 y; 72.5 ± 3.2 kg; 169.4 ± 2.4 kg) were subjected to 7-days bed rest, with and without a 2000 steps/day intervention. This model mimics the physical inactivity experienced during hospitalization, while isolating the intrinsic catabolic effects of skeletal muscle disease.

RESULTS: Performing 2000 steps/day during 7 days of bed rest corresponded to 155 minutes/week of walking at a moderate intensity (50% heart rate reserve: 102 ± 5 bpm). The intervention partially preserved lean mass (Δ STEP: -609 ± 129 vs. Δ CON: -1035 ± 159 g), glucose tolerance; OGTT AUC (Δ STEP: -0.5 ± 6.3 vs. CON: 1.5 ± 7.2), and aerobic capacity (Δ STEP: 0.3 ± 1.1 vs. CON: 1.2 ± 0.1 mL/kg/min).

CONCLUSIONS: Performing 2000 steps/day is broadly consistent with cardiovascular fitness guidelines, but in isolation does not fully counter the negative effects of bed rest in healthy older adults.

Supported by NIH Grant R01NR012973 and NIH/NIA grant #2R01AG037762

508 Board #6 May 30 1:00 PM - 3:00 PM

Muscle Size and Strengths and Their Associations with Sports Participation among Young Adults


1University of Central Florida, Orlando, FL. 2Baylor University, Waco, TX. 3University of Miami, Coral Gables, FL. 4University of South Florida, Tampa, FL. 5University of the Pacific, Stockton, CA. 6Children’s National Medical Center, Washington, DC. 7Children’s National Medical Center, Washington, DC. 8Harvard University, Cambridge, MA. 9University of Connecticut, Storrs, CT. (Sponsor: Linda Pescatello, FACSM)

Supported by NIH Grant R01AR052966 (No relevant relationships reported)

PURPOSE: A decision to participate in physical activity is heavily influenced by one’s self-efficacy related to exercise capacity, but it is not clear if muscle size and strength influence one’s decision to engage in sports and recreation. We examined this relationship and hypothesized that those with stronger and larger muscle would engage in more sports and recreation.

METHODS: Subjects were young (23.4 ± 5.6 y), normal weight (24.4 ± 4.6 kg/m2) European-American women (n=227) and men (n=192). The Pennsylvania Physical Activity Questionnaire assessed self-reported weekly Kcal expended in sport and recreational physical activity. We obtained muscle size and strength on the dominant arm and leg, and muscle size and strength on the nondominant arm.

RESULTS: On average, men spent about 1568.7±2397.5 kcal/wk and women spent 1732.2±2184.8 kcal/wk in sports and recreation. Among men, a one-unit increase in dominant arm MVC and MVC was associated with 16.9% (95% CI: 5.0-31.1%) and 2.3% (95% CI: 0.6-4.2%) higher odds of engaging in sports and recreation, respectively. Among women, a one-unit increase in dominant arm MVC was associated with 5.3% (95% CI: 2.2-8.7%) higher odds of engaging in sports and recreation, while a one-unit increase in nondominant arm CSA was associated with 19.8% (95% CI: 8.9-30.0%) lower odds of engaging in sports and recreation.

CONCLUSIONS: As hypothesized, greater MVC predicted engaging in more sport and recreation for both men and women, but greater 1RM predicted engaging in more sport and recreation among men only. Contrary to our hypothesis, greater CSA (i.e., muscle size) predicted engaging in less sports and recreation among women only. The interactions among putative psychosocial mediators, muscle capacity, and sport and recreation participation warrants future investigation.

510 Board #1 May 30 1:00 PM - 3:00 PM

Aerobic Exercise Training Alters The Lipopolysaccharide-induced Cytokine Secretory Profile Of Skeletal Muscle In Mice

Alex J. Mattingly, Orlando Laitano, Thomas L. Clanton.

University of Florida, Gainesville, FL.

(Sponsor: Linda Pescatello, FACSM)

Supported by NIH Grant R01GM088895-01

PURPOSE: Aerobic exercise training alters the cytokine secretory profile from skeletal muscle tissue in response to lipopolysaccharide (LPS) challenge. However, it is unknown if exercise-induced cytokine secretion is the same for skeletal muscle from sedentary and trained mice.

METHODS: 12-week-old male mice were randomly assigned to sedentary (S) or exercise (EX) groups. Sedentary mice were housed in standard vivaria and ad libitum food and water. EX mice were given 24-hour access to running wheels for 69 days (EX). Daily running distance was recorded. Mice were killed 16 hours after running, and muscles were biopsied for cytokine analysis.

RESULTS: Mean daily running distance was higher in EX mice compared to S mice (p=0.020). All other measured cytokines (MIP-1β, IL-13, TNFα) were reduced in EX and S mice compared to CON (p=0.016 for both), but TNFα was elevated (1.99 vs. 1.60pg/ml; p=0.020). All other cytokines (MIP-1β, IL-13, TNFα) were reduced in EX and S mice compared to CON (p=0.016 for both). These changes were observed in the Gastrocnemius, Soleus, Quadriceps, and Semitendinosus muscles.

CONCLUSIONS: Exercise training reduces LPS-induced cytokine production from skeletal muscle. This may be due to decreased NFκB transcription factor signaling. Further studies are needed to determine the mechanisms by which exercise training reduces LPS-induced cytokine production.
Mitochondria are highly dynamic organelles within eukaryotic cells that function primarily to produce energy. Exercise has been known to positively impact mitochondria for over 50 years. Our previous work indicated that one novel factor, dynamin-related protein 1 (Drp1), that is responsible for splitting mitochondria, was impacted by exercise. However, it is not known whether Drp1 is essential for the development of exercise adaptations. Purpose: To determine the impact of reduced Drp1 expression in skeletal muscle on muscle strength, exercise performance, and long-term exercise induced adaptations. Methods: For each protocol, skeletal muscle specific heterozygous (mDrp1+/−) and littermate control mice were used. Animals were sacrificed and tissues harvested at the times indicated. Protocol 1: Treadmill exercise at 15 m/min (5° grade) for 90 minutes for controls and 13 m/min for mdDrp1−/− mice. Protocol 2: Thirty days of cage voluntary wheel running (VWR) after which wheels were locked. Animals were sacrificed 30 hours later. Exercise effects were statistically assessed with two-way ANOVA or t-test (P=0.05 established a priori; values presented as mean ± SEM). Results: Muscle strength was reduced in mdDrp1−/− mice resulting in a reduction in protocol 1 exercise speed but not relative intensity. Following protocol 1, signaling molecules and cellular factors regulating mitochondrial life cycle were not different between mdDrp1−/−and control exercised mice. Additional metabolites including plasma lactate and triglyceride and muscle glycogen levels post exercise were not different between groups. In untrained mice, endurance exercise capacity was not different between groups; however, following VWR, mdDrp1−/− mice had a reduced increase in exercise capacity when compared to control trained mice. Several cellular factors and signaling molecules regulating mitochondrial life cycle showed similar expression changes in Drp1−/−animals compared to control exercised animals. Conclusions: Our results indicate that Drp1 is particularly important for muscle strength in untrained mice and may play a role in the improvement of exercise capacity.

**Background:** Ribosomal biogenesis and protein translation are finely coordinated with essential for cell growth, proliferation, differentiation, and muscle development. Furthermore, there is a significant positive correlation between the fold change in total muscle RNA content from pre- to post- resistance training and the increase in muscle fiber cross sectional area. Our previous findings in vitro indicate de novo ribosome biogenesis is necessary for myotube hypertrophy. Because chronic muscle hypertrophy appears to impair myofiber hypertrophy in vivo, we hypothesize this inhibitory influence of inflammation may manifest by disrupting ribosome biogenesis. Purpose: The aim of the present study was to determine if inflammation inhibits myotube hypertrophy by interfering with ribosome biogenesis in human primary myogenic cells. Methods: Skeletal muscle satellite cells were isolated from untrained older (69±4 years) adults percutaneous needle biopsy of the vastus lateralis. Cells were grown in DMEM containing 20% FBS, 5 μg/ml fibroblast growth factor, 100 μ/ml streptomycin, and 100 U/ml penicillin until they reached ~70% confluence. They were then placed in different media (DMEM containing 2% horse serum, 100 μ/ml streptomycin, and 100 U/ml penicillin) for seven days to induce formation of multinucleated myotubes. Myotubes were then treated for 48 hours with 20% FBS, TNFa (5ng/mL), 20% FBS + TNFa (5ng/mL), or control (differentiation) media. Cells were subsequently harvested for analysis of mRNA, muscle protein synthesis, ribosomal (rRNA) and constituent ribosomal proteins, myotube size and myofusion index. Results: Myotubes treated with FBS increased myotube diameter by 20% compared to control. TNFa (5ng/mL) induced 16% atrophy, while a combination of both treatments caused 7% hypertrophy compared to control. Total RNA concentration (ng/ul) increased 32% in FBS treated cells but only 20% in response to the combination of FBS + TNFa. Phase II fusion was decreased in myotubes treated with TNFa or a combination of FBS + TNFa. Conclusions: TNFa-mediated inflammation impairs human myotube hypertrophy, which may be driven by impairments in both ribosome biogenesis and phase II myoblast-myotube fusion.

**Background:** Estrogens influence force generation of skeletal muscle. When estrogen is deficient, post-tetanic potentiation (PTP) of force is low and estradiol treatment can rescue potentiation in ovariectomized mice both in vivo and in vitro. However, it is not known whether this estrogenic influence is through estrogen receptors, and if so, activation of which specific receptor augments PTP is also unknown. Purpose: We hypothesized estrogenic utilize G protein-coupled estrogen receptor (GPER) to enhance in vivo skeletal muscle PTP in ovariectomized mice. Methods: Adult female C57BL/6J mice (n = 7-12 per treatment) had a nerve cuff surgically implanted on the left common peroneal nerve. Six weeks later mice were ovariectomized (OVX). Four weeks later, PTP of the anterior crural muscles was measured immediately before and 1 hour after treatment with either vehicle (O VX-vehicle), GPER agonist G1 (OVX+G1; 2.4 μM G1) or GPER antagonist G15 (OVX+G15; 27 μM G15) via tail vein injection. PTP was measured and calculated as the percent increase in twitch force from baseline to the highest torque of the post-tetanic twitches. One-way ANOVAs with Holm-Sidak post hoc tests were used for data analysis of PTP. Results are reported as mean ± SE. Results: Peak torques of unpotentiated, baseline twitches were not different among OVX+vehicle, OVX+G1, and OVX+G15 mice (0.51 ± 0.03, 0.48 ± 0.03 and 0.54 ± 0.02 N·mm, respectively; p=0.25). Potentiated twitches generated 15-108% more torque than unpotentiated twitches. However, the extent of PTP depended on the presence of GPER modulator (main effect, p=0.03). PTP of OVX+vehicle and OVX+G15 mice were not significantly different from each other (35 ± 5% and 46 ± 4% increase, respectively; p=0.26). POT of OVX+G1 mice resulted in a 61 ± 7% increase which was significantly greater than that of OVX+vehicle mice (p=0.02), but not different from OVX+G15 mice (p=0.26). Conclusion: Acute treatment with a GPER agonist increased in vivo PTP of the anterior crural muscles in anesthetized mice, supporting our hypothesis that estrogens mediate their effects on skeletal muscle force potentiation through specific estrogen receptors. Supported by NIH grants R01-A031743 and T32-AR050938.
response was an elevation in TNFRSF12A in the trained twin. CONCLUSIONS: At the mRNA-level, differences in expression of some key markers related to muscle fiber type, muscle growth, and the inflammatory training were observed in the trained vs the untrained twin. These data highlight the adaptability of skeletal muscle at the molecular level with decades of divergent physical activity patterns.

Long stays in space can have deleterious effects on the body homeostasis. Significant adverse effects of long-term weightlessness include loss of skeletal muscle mass, strength and endurance that can lead to fatigue and poor performance of astronauts during space missions and put them at high risk of injury when they return to earth. Bed rest studies have been proven to be a reliable model to study the effect of spaceflight on muscle. PURPOSE: To characterize the vastus lateralis (VL) gene and microRNA (miR) responses to 70-day bed rest with and without countermeasures to mitigate the negative consequences of weightlessness. METHODS: 22 healthy young adults participated in a NASA 70 day bed rest study with and without 2 different modes of exercise interventions (6 participants bed rest only; 8 bed rest & flywheel exercise; 8 bed rest). RNA extracted from the VL was hybridized to Agilent Human Gene (V3) and miR (V2) microarrays. Data was analyzed using GeneSpring 14.5 and differential gene and miR expression was determined using ANOVA, (FDR<0.05, Fold Change>2 for GE, >1.1 for miR). Kegg pathway was used to classify the genes into pathways (EASE<0.05). RESULTS: 70 day bed rest significantly altered the level of 268 VL genes and 83 miRs. 16 oxidative phosphorylation pathway genes (e.g., ATP5G1, ATP5G3, ATP7, NDUFS1, COXTA2, SDHB and UQCR10) and 37/40 metabolic pathway genes (e.g., HMGCS2, NDUF8, ACY1 and FH) that were significantly altered had reduced expression in all 3 conditions. All genes in the oxidative phosphorylation pathway and 31 out of 40 genes in the metabolic pathway had attenuated expression when exercise was introduced with no significant difference between the two different modes of exercise. Five let-7 family miRgs were significantly upregulated and miR-1 and miR-133a were downregulated (30 and 50% respectively in the bed rest only group), all of which known to be linked to muscle atrophy. Both exercise modes mitigated the miRgs response. CONCLUSION: 70-day bed-rest altered the expression of genes and miRgs that could affect muscle metabolism and promote muscle atrophy. Introducing exercise as countermeasures mitigated the expression of almost all bed rest altered genes and miRgs, with no significant difference in the 2 modes of exercise. Supported: NSHBI MA02801 & PERC Systems Biology Fund

Obesity is a significant health problem and is associated with numerous changes in skeletal muscle. Obesity increases muscle mass and muscle fiber cross sectional area (FCSA) of type I and II fibers. Resistance exercise (RE) promotes muscle fiber hypertrophy. Activation of the IFG-I/Akt/mTOR pathway is critical for muscle mass maintenance and muscle hypertrophy. PURPOSE: To investigate: 1) if obesity alters basal muscle IGF-I/Akt/mTOR pathway expression; and 2) if obesity alters the muscle response to acute RE. METHODS: Vastus lateralis biopsies were obtained to investigate mRNA, miRNA, and protein expression between lean (LN) and obese (OB) sedentary subjects at rest, and 15 min and 3 hr post-acute RE. RESULTS: Type II FCSA in OB was larger than FCSA of type I in OB and type II and LN (Type 1: LN = 4804.53 μm² vs. OB = 6044.78 μm²; Type II: LN = 4690.71 μm² vs. OB = 8114.34 μm²). Skeletal muscle expression was lower in OB for IGF-I mRNA (Pre: LN = 0.82 vs. OB = 0.56 pg/μg; 15 min: LN = 3.98 vs. OB = 2.19 pg/μg; 3 hr: LN = 4.98 vs. OB = 2.91 pg/μg). The expression of miR-206, a post-translational inhibitor of IGF-I expression, was higher in OB (Pre: LN = 1.00 vs. OB = 0.54 AU; 15 min: LN = 0.95 vs. OB = 0.54 AU; 3 hr: LN = 1.04 vs. OB = 1.20 AU). A negative relationship was observed between miR-206 and IGF-I mRNA at rest (r = -0.54 consistent with miR-206 regulating IGF-1 expression. CONCLUSIONS: In spite of greater muscle FCSA, obesity decreases muscle IGF-I expression suggesting a negative feedback mechanism may be limiting muscle mass expansion in obesity.

Several design features of running shoes such as decreased mass, appropriate midsole cushioning, and increased longitudinal bending stiffness are associated with improved running economy (RE). While increased longitudinal bending stiffness has been achieved through the use of carbon fiber plates inserted into shoe middles, there are some limitations and questions associated with this construction method. An alternative way to increase longitudinal bending stiffness in running shoes is to utilize a carbon fiber shoe insole (CFI) tuned for optimal mechanical efficiency of the athlete-footwear system. PURPOSE: To determine if a carbon fiber shoe insole (VK Performance Insole; VKTRY Gear; Milford, CT) can improve running economy in highly-trained trial runners. METHODS: Ten highly-trained male trial runners (24.7 ± 6.8 years, height: 177.9 ± 5.59 cm, mass: 67.7 ± 5.7 kg) participated in this study. To measure RE, participants ran for 6 min at 16 km·hr⁻¹ for the following three conditions: 1) control footwear (no CFI), 2) medium flex CFI (VK Pro 4), and 3) stiff flex CFI (VK Pro 5). Indirect calorimetry was used to measure oxygen consumption (VO₂). The first 4 min were to allow the athlete to reach a steady state and metabolic data from the last 2 min were used to determine submaximal VO₂. The shoe insole conditions were presented in random order; each RE test was separated by a period of 6 min to minimize the effects of fatigue. A repeated-measures ANOVA was used to determine the effects of shoe insole condition on RE. RESULTS: The submaximal VO₂ for each of the shoe insole conditions were as follows: 1) control (no CFI): 49.8 ± 3.0 ml·kg⁻¹·min⁻¹; 2) medium flex CFI (VK Pro 4): 50.2 ± 3.5 ml·kg⁻¹·min⁻¹; and, 3) stiff flex CFI (VK Pro 5): 51.3 ± 3.1 ml·kg⁻¹·min⁻¹. Based on these submaximal VO₂ values, there was no difference in RE between the three different shoe insole conditions [F(2,8) = 0.97, p = 0.44]. CONCLUSIONS: Previous studies have shown that increased longitudinal bending stiffness achieved through the use of carbon fiber plates inserted into shoe middles can significantly improve RE by 1-4%. However, the use of a CFI did not result in similar improvements in RE. Further design work and testing of the CFI is required to determine the optimal longitudinal bending stiffness for improved RE at submaximal velocities.
minute) was significantly lower while wearing compression socks, which indicated a reduction in cardiovascular stress. Compression socks have a positive effect on running performance and heart rate responses associated with maximal aerobic exercise for moderately fit college aged individuals. It is hypothesized that this change is brought about as the compression applied decreases venous pooling in the lower leg, assisting in venous return. The applied compression allows for a more efficient circulation path back to the heart, promoting increased clearance rates of muscle metabolites while also lowering the workload on the heart.

PURPOSE: To determine the effects of training load on salivary amylase and testosterone levels and their association with race performance in Female Division I cross-country athletes. METHODS: 18 female athletes (18.9 ± 0.86 yrs old) were monitored during the 2015 cross-country season. VO$_2$ max, and baseline salivary amylase and testosterone levels were assessed during the pre-season. Participants also underwent weekly data collection sessions in which saliva samples were collected. Salivary levels of amylase and testosterone were analyzed using ELISA kits from Salimetrics (State College, PA) according to the manufacturers instructions. Athletes utilized a GPS/HR monitor seven days prior to running two minutes (t=2 min) active recovery. The potential effects of this testing sequence (ie. 2min active recovery) on VO$_2$ max values had an immediate return to the ending VO$_2$ max speed and grade and exercised (ie. a following 2min of active recovery at the conclusion of a treadmill GXT to volitional exhaustion) a second time (MX2). MX1 and MX2 values had an immediate return to the ending MX1 speed and grade and exercised (ie. a following 2min of active recovery at the conclusion of a treadmill GXT to volitional exhaustion). However, prior research with averagely fit females and males as well as older adults have suggested VO$_2$ max values to be achieved by fit ultramarathon runners during a max treadmill GXT, yet 37.9% of the subjects increased their VO$_2$ max during the “booster VO$_2$ max test” treadmill protocol. Future research may examine if fitness level, training experience, age, ultramarathon distance specialty, or other variables might affect this exercise testing protocol.

**RESULTS:** Mean results (±SD): Post-training change in VO$_2$ max for all athletes was 7.0 ml/kg/min. The mean change from MX1 to MX2 was 6.0 ml/kg/min which was significantly different (p=0.009). Athletes, who had a high weekly training load, expressed lower levels of testosterone for that week. While controlling for salivary amylase levels however, testosterone were associated with optimal training and improved race performance. However, the higher the weekly salivary testosterone level, the better the athletes performed (p=0.002). CONCLUSION: In this study, higher levels of weekly salivary testosterone were associated with optimal training and improved race performance. While higher levels of salivary amylase, were associated with a decline in race performance. Periodic measurements of salivary amylase and testosterone could be an important diagnostic marker for monitoring overtraining and predicting performance in collegiate athletes. Funding was provided by the School of Health Science Faculty Grant.

**Table 1. Pre- versus post-training changes in Running Economy (RE)**

<table>
<thead>
<tr>
<th>Running Speed (m/s)</th>
<th>Running Economy (m/kg·min$^{-1}$)</th>
<th>Pre-training</th>
<th>Post-training</th>
<th>P</th>
<th>ES</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.24</td>
<td>0.71 ± 0.08</td>
<td>0.67 ± 0.08</td>
<td>0.002*</td>
<td>0.91</td>
<td></td>
</tr>
<tr>
<td>2.68</td>
<td>0.65 ± 0.04</td>
<td>0.63 ± 0.04</td>
<td>0.085</td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td>3.13</td>
<td>0.66 ± 0.04</td>
<td>0.63 ± 0.04</td>
<td>0.153</td>
<td>0.20</td>
<td></td>
</tr>
</tbody>
</table>

*Significantly different compared to pre-training (P<0.05).

**Support:** The US Army Research Laboratory (W911NF-14-1-0471), the US Army Medical Research and Materiel Command, The University of Connecticut Endowment Fund, and Project CREST (World Anti-Doping Agency). This research is also supported by the Department of Defense, grant # W81XWH-17-1-0400.

**CONCLUSIONS:** In this study we have demonstrated that VO$_2$ max is significantly improved while running at 2.24m/s (P=0.002, ES=0.91; Table 1). There were significant effects of training load on VO$_2$ max values in fit ultramarathon runners, following 2min active recovery at the conclusion of a treadmill GXT to volitional exhaustion. However, prior research with averagely fit females and males as well as older adults have suggested VO$_2$ max values to be achieved by fit ultramarathon runners during a max treadmill GXT, yet 37.9% of the subjects increased their VO$_2$ max during the “booster VO$_2$ max test” treadmill protocol. Future research may examine if fitness level, training experience, age, ultramarathon distance specialty, or other variables might affect this exercise testing protocol.
DhamaSport™ bands: 1) both bands were off (off/off), 2) one band on (off/on), 3) both bands on (on/on). Heart rate (HR), core temperature ($T_{core}$), running speed (RS), rating of perceived exertion (RPE) and thermal sensations (TS) were recorded at baseline, during the 10km TT, and during recovery. To understand potential impacts on recovery and fatigue post-exercise, heart rate variability (root mean square of successive differences; RMSSD, and standard deviation of N-N intervals; SDNN), mean arterial pressure (MAP), and visual analog scale (VAS) for fatigue were measured. Due to safety constraints, trials were terminated if $T_{core}$ ≥39.2°C, in which average speed was used to estimate 10km time. RESULTS: Use of the cooling bands had no effect ($p>0.05$) on resting $T_{core}$, MAP, TS, VAS, RPE, RMSSD, or SDNN, but modestly increased ($p<0.05$) HR (A3-5 beats/min). During exercise, use of the bands significantly ($p<0.05$) increased RS ($0.25$ Am/s), HR (5 $\Delta$beats/min), but had no significant effects on $T_{core}$ (60.3°C), RPE, or TS were observed over time. The increased RS with the use of the bands, tended to reduce projected 10km time ($-10$-30s). Use of the cooling bands did not impact RMSSD, SDNN, MAP, or fatigue post-exercise ($p>0.05$). CONCLUSION: Our data demonstrate that use of the cooling bands improves running speed, decreasing projected 10km time. This modest improvement in performance comes at a cost of increased HR; although, interestingly, sensations of effort and thermal comfort were not impacted, despite the faster speed and higher HR. Taken together, use of the cooling bands has the potential to improve exercise performance in the heat perhaps due to altered thermal sensation. Support: DhamaSport.

524 Board #7 May 30 1:00 PM - 3:00 PM
The Influence of AlterG Treadmill Training on Lower Extremity Muscle Performance in Cross Country Runners
Tracy A. Dierks1, Vincent C. Nittoli2, Todd W. Arnold2, Jason Pociask2, Jacquelyn Fletcher1. Indiana University, Indianapolis, IN. "St. Vincent Sports Performance, Indianapolis, IN. "Community Health Network, Indianapolis, IN.

Running on an AlterG® Treadmill (AGT) at reduced bodyweight requires speed to be increased if heart rate response is to match overground running. This can be beneficial as one can run at faster speeds for longer durations, without increasing impact forces or heart rate intensity beyond typical training, all while increasing lower extremity muscle demands. However, it is unknown if AGT training influences lower extremity muscle performance. PURPOSE: Investigate the effect of an AGT training program on lower extremity muscle performance. METHODS: As an offseason supplement, 19 uninjured high school boys cross country runners replaced 2 overground running sessions/week with AGT runs for 6 weeks. AGT runs were 80-85% of bodyweight with speed increased to elicit a heart rate intensity and distance/time consistent with each runner’s mile pace for that day. Bilateral isokinetic muscle performance testing was completed at baseline and post program; 10 concentric/eccentric contractions at a speed of 180°/s for sagittal motions at the hip, knee, and ankle. A 2-way ANOVA (side x time) was used to assess pre-post changes (torque, work, power) and side-to-side symmetry ($p>0.05$). RESULTS: Significant interactions were found for almost all hip variables for pre-post and side-to-side comparisons, while both the knee and ankle generally showed no differences. At the hip, the right generally improved pre-post for all variables, while the left decreased. This resulted in side-to-side asymmetries at pre, but improved to mostly symmetric at post. CONCLUSION: The AGT program seemed to primarily influence hip musculature, possibly related to pre-existing asymmetry. However, after training in the AGT environment for 6-weeks, both sides were generally symmetric post-program, mostly due to right side improvements. Thus, AGT training appears to be associated with improved symmetry of hip muscle performance, which may be significant when considering the role of the hip in overuse injuries.

No relevant relationships reported

525 Board #8 May 30 1:00 PM - 3:00 PM
Nocturnal Heart Rate Variability and Morning Orthostatic Test as Tools to Monitor Training Load
Ville Vesterinen, Ari Nummela. KIHU - Research Institute for Olympic Sports, Jyväskylä, Finland.

Both the nocturnal heart rate variability (HRV) and the morning Orthostatic Test are widely used to monitor training load and recovery status of athletes. Both measurements have been observed to be associated with cardiac autonomic regulation. But less is known whether the measurements show similar responses to training load. PURPOSE: This study investigated the effects of easy and hard training days on the nocturnal HRV and the Orthostatic Test. In addition, the aim was to investigate relationships between nocturnal and morning HRV variables. METHODS: Thirty-four recreational endurance runners performed nocturnal R-R interval recordings and the morning Orthostatic test (5 min supine + 3 min standing) after an easy and a hard training day (moderate- or high-intensity endurance training). Nocturnal HRV was analyzed as four-hour period starting 30 min after going to bed for sleep. Morning HRV was analyzed over 4 min supine (00:30-04:30) and 2 min standing position (06:00-08:00). In addition, peak HR after stand-up and Orthostatic heart rate (HR) (HRstanding - HRsupine) were analyzed. RESULTS: Training load (session RPE) of hard training day (638 ± 638) was significantly (P < 0.001) greater compared to easy training day (50 ± 100). Nocturnal HR was lower (52 ± 6 vs. 57 ± 9, P < 0.001) and all nocturnal HRV variables were higher (Total power: 8.86 ± 0.63 vs. 8.41 ± 0.79, P < 0.001) after easy training day. HR in supine position was lower (53 ± 7 vs. 56 ± 7, P = 0.011) and high frequency power in supine position was higher (8.06 ± 0.89 vs. 7.74 ± 0.93, P = 0.027) after easy day. Other Orthostatic test variables were not different between easy and hard training days. Nocturnal HR and HRV variables showed moderate correlations (r = 0.62 - 0.78, P < 0.001) to the morning supine variables, but trivial and small correlations (0.19 - 0.39) to standing variables. CONCLUSIONS: Different training load after easy and hard training days can be observed in both nocturnal HRV and Orthostatic Test. However, the differences are greater in nocturnal HRV recordings compared the morning Orthostatic Test. In addition, it seems that standing variables are not able to evaluate the training load of the previous day. The results suggest that both nocturnal HRV and selected, supine variables of the Orthostatic test can be used in monitoring training load.
Cardiovascular drift (CV drift) has been shown to be related to reduced maximal oxygen uptake ($\dot{V}O_{2max}$) during heat stress. At a given relative metabolic intensity ($\%V_{O2max}$), individuals with higher fitness levels would be expected to experience greater CV drift, and thereby greater decrements in $\dot{V}O_{2max}$ because of a greater metabolic heat production resulting from exercising at a higher absolute intensity. However, this has not been directly investigated. PURPOSE: To test the hypothesis that individuals with a higher initial $\dot{V}O_{2max}$ (i.e., fitness level) will experience a greater magnitude of CV drift and accompanying decrement in $\dot{V}O_{2max}$ compared to those with a lower initial $\dot{V}O_{2max}$ during prolonged, moderate-intensity exercise in the heat. METHODS: Data from 7 studies (n = 62) were used to assess the relationships between fitness level and 1) CV drift (change in heart rate and stroke volume) and 2) $\dot{V}O_{2max}$. CV drift and $\dot{V}O_{2max}$ were assessed between 15 and 45 min or between 15 and 60 min of cycling at 60% $\dot{V}O_{2max}$, 35°C ± 3°C, 35°C ± 3°C, 0.4°C to 38.2°C, and decrease in $\dot{V}O_{2max}$ (r=-0.14, p=0.28). CONCLUSION: Contrary to our hypothesis, fitness level was unrelated to the magnitude of CV drift or decrement in $\dot{V}O_{2max}$ during prolonged submaximal exercise in the heat. However, these findings support the results of previous studies in that the greater the magnitude of CV drift—regardless of fitness level—the greater the decrement in $\dot{V}O_{2max}$ during constant-rate, moderate-intensity exercise in the heat.

Due to anti-inflammatory effects and anti-inflammatory drugs (NSAIDs) are theorized to blunt core temperature (Tc) rise during exercise. On the other hand, the adverse events from NSAID use (eg, gastrointestinal and renal damage) can cause an inflammatory response. Existing literature examining NSAIDs on Tc during exercise in the heat is limited and conflicting. PURPOSE: To determine the effects of naproxen on Tc and interleukin-6 (IL-6) in hydrated, exercising humans. METHODS: We utilized a double-blind, randomized and counterbalanced, cross-over design. Independent variables were a 24 hr naproxen dose (220 mg naproxen/dose) or placebo (10 mg naproxen/dose) and an ambient (22.7 ± 1.8°C, 52.4 ± 5.5% humidity) or hot (35.7 ± 1.3°C, 53.2 ± 3.2% humidity) environment. Participants (n = 11, 6 male, 5 female; age = 27.8 ± 6.5 yr, weight = 79.1 ± 17.9 kg, height = 177 ± 9.5 cm) completed 4 conditions: 1) placebo and ambient (Control); 2) placebo and heat (Heat); 3) naproxen and ambient (Npx); and 4) naproxen and heat (NpxHeat). Participants cycled 80 min at a heart rate corresponding to 70% $\dot{V}O_{2max}$ followed by a 10 min time trial for maximum distance. Participants then rested 3 hrs in an ambient environment. Tc and IL-6 were assessed pre-, during-, post-, and 3 hrs post-cycling. RESULTS: Tc significantly increased pre-to post-cycling (37.1 ± 0.4°C to 38.2 ± 0.3°C, P < 0.001) and decreased during rest (P < 0.001), reaching baseline by 75 min post-cycling. Rate of Tc change and maximum Tc were not significantly different between conditions. IL-6 increased pre- to post-exercise (0.54 ± 0.06 pg/ml to 2.46 ± 0.28 pg/ml, P < 0.001) and remained significantly higher than pre- at 3 hrs post-exercise (1.17 ± 0.14 pg/ml, P = 0.001). No significant IL-6 differences were found between conditions.

CONCLUSION: A 24 hr over the counter naproxen dose did not significantly affect Tc or IL-6 among hydrated males and females cycling at moderate intensity in hot or ambient conditions. These results are important for physically active individuals and those working with persons who may be taking naproxen. Future research should examine stronger naproxen doses, longer usage, and more intense exercise to determine potential effects on the thermoregulatory and inflammatory systems. Supported by the ACSM Foundation Carl V. Gisolfi Memorial Fund.
in the heated muscle we found significant increases in the phosphorylation of AMPK (32 ± 16% p = 0.0365) and ERK1/2 (205 ± 77%, p = 0.0246). There were no changes in the phosphorylation of either p38 or JNK. Conclusion: The altered phosphorylation status of HSP27, together with the increased phosphorylation of AMPK and ERK1/2, suggest that a single, 2-hr heating session is capable of eliciting a significant cellular stress response, which may influence metabolic adaptive processes.

Cardiac dysfunction has been documented after exertional heat stroke (EHS), but little is known about the metabolic (mal)adaptations occurring in the heart after exposure to EHS. Purpose: To identify metabolic biomarkers in a preclinical model of EHS that could indicate long-term cardiometabolic complications or adaptations to EHS. Methods: 56 male mice ran on an incremental forced running wheel while exposed to 37.5°C/~40% humidity to induce EHS. Mice ran 124 ± 7.2 min, reaching a core temperature of 42.2 ± 0.07°C at the time of collapse. Animals lost 7.5 ± 0.9% body weight. Plasma and heart ventricular tissue were obtained at 0.5, 3, and 24 h after running and at 4, 9, and 14 days post EHS and compared to exercise-matched controls at 4 days post-exercise. Metabolites were extracted from biospecimens and analyzed by mass spectrometry. Ions were matched to a library of standards for identification and quantification. Results: At 0–5 hr after EHS, there was a marked loss in carbohydrate availability (1.6–15-fold reduction in plasma glucose, pyruvate, and lactate). During the immediate post-EHS period there was also evidence for mobilization of a variety of amino acids. Elevations in acetylated amino acids were also observed. Elevated nucleic acid breakdown products were evident until 24 h post EHS, then recovered. By 3 h, 1.4–12.1-fold increases in acyl carnitine and ketone bodies were evident in the plasma. In cardiac muscle, most species of acyl carnitines were 2.2–25.0-fold lower than control at 0.5 h, suggesting rapid intracellular turnover of available free fatty acids (FFA). Interestingly, in the heart, carnitine FAMA remained 2.0–16.7-fold lower than control through 14 d. Conclusion: Our results are consistent with an acute “energy crisis” following EHS that resolves within 3–24 hours, primarily via a sustained, persistent (>14 day) shift toward fatty acid metabolism in the heart. Other metabolic changes reflect responses to injury, inflammation or wound repair during the recovery phase. The opinions or assertions contained herein are the private views of the author(s) and are not to be construed as official or reflecting the opinions of the Army or the DoD.

Heat tolerance testing (HTT) has been used in clinical settings to determine readiness to return to activity after exertional heat stroke. However, published HTT data are mostly limited to a walking protocol (5km·h⁻¹ at 2% grade) in a climatic chamber set at 40°C and 40% relative humidity (RH), which may limit application in determining one’s ability to achieve thermoregulatory equilibrium during exercise. Purpose: To investigate factors that are associated with differences in temperature response during a modified HTT (mHTT). Methods: Thirty-two participants completed mHTT on a treadmill set at 60% of the velocity at VO₂max in a climatic chamber set at 27 ± 3°C and 51 ± 1% RH. Within this cohort, we identified three pairs of participants (A, B, C) who had the same treadmill speed respectively, with body mass (BM) and body surface area (BSA) difference <5% but exhibited rectal temperature (TREC) difference ≥0.75°C at the end of mHTT. Pooled data of participants with lower end TREC were compared using a two-way ANOVA. Results: BM and BSA difference in pairs A, B, C were 3.8%, 4.8%, 10% and 3.4%, 3.5%, 1%, respectively. Starting TREC difference was largest in pair A (HIGH-LOW: A, 201%, C, 163%). Overall RR was greater in high in all pairs but the difference observed in pair A was negligible (0.001°C·min⁻¹). Conclusions: Fluid was not replaced during mHTT, which may have served as the limiting factor for high sweaters in pairs A and C to sustain thermoregulatory equilibrium and contributed in the greater slope, SR, and overall RR. In designing a HTT that accounts for physical demands greater than walking, SR should be recorded to understand the influence from dehydration. Starting TREC may have also affected the negligible difference observed in RR in pair A. Future studies should investigate the normative values for TREC response during mHTT under a setting where the treadmill speed, BM, BSA, and body mass loss are controlled.
Age: 65±9 years, height=168.5±9.3 cm, weight=70.8±12.8 kg, BMI=24.7±2.6 kg/m²) participated in the study. PB was determined by the presence of a distinct peak in the 0.003-0.06 Hz frequency band of the LFVEF. HS subjects with PB had blood volumes that were nearly doubled compared to healthy and HS subjects without PB. This relationship persisted when blood volumes were normalized to body surface area (Volumes reported as ml·m⁻²).

**Experimental Manipulating Mechanical Ventilatory Constraint During Exercise Does Not Influence Dyspnea in Older Men and Women**

Yannick Molgot-Seon¹, Andrew H. Ramsook¹, Carli M. Peters¹, Michele R. Schaeffer², Paolo B. Dominielli³, Lee M. Romer, FACSM, Jeremy D. Road³, Jordan A. Guenette³, A. William Sheel, FACSM.¹University of British Columbia, Vancouver, BC, Canada. 2Mayo Clinic, Rochester, MN. 3Brunel University London, Uxbridge, United Kingdom. (Sponsor: Bill Sheel, FACSM)

(No relevant relationships reported)

During exercise at a standardized metabolic work load, the perception of dyspnea is higher in older women than men, which is thought to be related to sex-differences in mechanical ventilatory constraint; however, this hypothesis has yet to be experimentally tested. **PURPOSE:** To determine the effect of manipulating the magnitude of mechanical ventilatory constraint during submaximal exercise on dyspnea in older men and women.

**METHODS:** Thirteen healthy subjects (60-80 y; n=7 women) completed two days of testing. On Day 1, subjects performed pulmonary functional testing and incremental cycle exercise test. On Day 2, esophageal pressure (P_E) and diaphragm electromyography (EMG_D) were recorded during three constant load cycle exercise tests (6 min each) at ventilatory threshold (V_E). Constant load exercise tests were performed under three conditions in a single blind, randomized, counterbalanced fashion: i) breathing normoxic helium-oxygen gas (HeO2) to reduce the work of breathing (WOB) and ductile the work of breathing; ii) breathing (EFL); iii) inspiratory resistance (RES) of 5 cmH2O·L⁻¹·s to increase WOB; and iii) control (CON) breathing room air. During exercise on Day 2, derived measures of WOB, EFL, and EMG_D were assessed.

**RESULTS:** During the HeO2 condition, there was a significant decrease in WOB (men=-20.4%, women=-16.5% and EFL (men=-11.7%, women=-9.7%) relative to CON (both p<0.01). Moreover, if EFL was present during the CON condition (n=3 men, n=5 women), it was alleviated during the HeO2. Conversely, during the RES condition, there was a significant increase in WOB (men=34.1%, women=50.12%) and EMG_D (men=32.15%, women=23.12%) relative to CON (both p<0.01). The effect of condition on WOB and EMG_D was not significantly different between the sexes (both p>0.05). Across conditions, women reported significantly higher levels of dyspnea than men (3.3±0.4 vs. 1.9±0.4 Borg units, p<0.05). However, despite significant differences in the degree of mechanical ventilatory constraint between conditions, there was no effect of condition on the perception of dyspnea intensity, regardless of sex (p=0.46).

**CONCLUSION:** Our results suggest that during short bouts of exercise at V_E, sex-differences in dyspnea in older adults are not related to sex-differences in mechanical ventilatory constraint.

**Alterations In Pulmonary And Respiratory Muscle Function In Response To 10 Marathons In 10 Days**

Nick B. Tiller¹, Louise A. Turner¹, Bryan J. Taylor². ¹Sheffield Hallam University, Sheffield, United Kingdom. ²University of Leeds, Leeds, United Kingdom. (No relevant relationships reported)

**BACKGROUND:** Marathon and ultramarathon running are sufficient to induce pulmonary dysfunction and respiratory muscle fatigue. However, it is unknown how the respiratory system responds to multiple, consecutive days of endurance exercise.

**METHODS:** Eleven well-trained endurance runners (8 male, 3 female) contested an ultra-endurance challenge comprising 10 marathons in 10 consecutive days. Lung function (FVC, FEV₁; FVC, PEF) and maximal static inspiratory and expiratory mouth pressures (MIP and MEP) were measured before and after marathon 1, 4, 7, and 10. Perceptual ratings of breathlessness ( Borg CR10), respiratory muscle soreness (Visual Analogue Scale), and symptoms of upper-respiratory tract infection (URTI) were also recorded.

**RESULTS:** Group mean time for the 10 marathons was 276±35 min, and post-marathon breathlessness was 2.6±0.3 (range 1.0 to 3.0). Relative to pre-challenge baseline (159±32 cmH₂O), MEP was reduced after marathon 1 (136±41 cmH₂O, p=0.017), marathon 7 (138±42 cmH₂O, p=0.035) and marathon 10 (130±41 cmH₂O, p=0.008), but there were no consistent reductions in baseline (pre-marathon) MEP. There were no changes in FVC, FEV₁, PEF, PEF, MEP, perception of breathlessness or respiratory muscle soreness throughout the challenge (p>0.05).

Moreover, there was no change in symptoms of URTI during and up to 2-weeks following the challenge (p>0.05). **CONCLUSIONS:** Ten days of marathon running did not induce a chronic reduction in respiratory or pulmonary muscle function, despite acute pre-to-post-marathon reductions in maximal exercise muscle strength. These data underscore the robustness of the healthy respiratory system.
lowering the Wb decreases MSNA during whole-body cycle exercise. METHODS: Healthy active subjects (n=12, 3 female) performed semi-recumbent cycling to exhaustion (VO_{2peak} = 45±2 ml kg^{-1} min^{-1} means ± SE). During eight consecutive experimental days (CON) completed ten days of spirometry, but no hyperpnea training. Outcome variables included peak expiratory flow (PEF), forced vital capacity (FVC), forced expiratory volume 1.0 second (FEV1) and MVV.

RESULTS: In both HYP and CON subjects, PEF, FVC, and FEV1 did not change during the ten experimental days. In CON subjects, MVV did not change during the ten experimental days. In HYP subjects, MVV decreased gradually over time during the ten experimental sessions, reaching its nadir during the final day of training (MV10-MVV1, -14 ± 2 L/min; ±7 ± 14%); however, the decrease was not statistically significant (P=0.07).

CONCLUSIONS: These findings suggest that repeated bouts of high airflow hyperpnea do not compromise airway function in healthy adults. In the absence of any change in the maximal forced exhalations, we speculate that the decreased MVV in HYP subjects may be due to respiratory muscle fatigue.

B-15 Clinical Case Slide - Cardiovascular I

Wednesday, May 30, 2018, 1:00 PM - 3:00 PM
Room: CC-200E

543 Chair: Aaron L. Baggish, FACSM. Massachusetts General Hospital, Boston, MA. (No relevant relationships reported)

544 Discussant: Sourav Poddar. University of Colorado Health Sciences Center, Denver, CO. (No relevant relationships reported)

545 Discussant: Mats Börjesson. Sahlgrenska University Hospital, Gothenburg, Sweden. (No relevant relationships reported)

546 May 30 1:00 PM - 1:20 PM
Exercise Induced Electrocardiogram Abnormalities In Elite Swimmer

Dalya Navot-Mintzer¹, Naama W. Constantini, FACSM², Wingeate Institute and Clalit Health Services, Netanya, Israel. ²Shaare Zedek Medical Center, Jerusalem, Israel. (No relevant relationships reported)

HISTORY: A 17-year-old male national team swimmer came for an intake examination at The Academy for Sports Excellence at Wingate Institute. He reported being a non-symptomatic carrier of familial long QT mutation of the LQT2 type (KCNH2 mutation (R744X)) which was diagnosed through a family screening examination. He is taking Bisoprolol 2.5 milligrams once daily since he was 10 years old. Three other family members were diagnosed with the same long QT mutation (brother, mother and maternal grandfather). None of the family members have ever developed cardiac symptoms or arrhythmia, except for the grandfather who had one event of Torsade de Points at an old age, following acute MI. The whole family was screened following this event.

PHYSICAL EXAMINATION: PE revealed no pathological finding, including normal cardiac examination. Resting ECG at supine position was within normal limits (Heart rate (HR) = 49/min, QTc=415 msec). QT interval became elongated (HR=88/min, QTc=550 msec) at the first minute on the treadmill stress test. During the stress test the swimmer was asymptomatic, had a normal blood pressure response and reached maximal oxygen consumption of 65ml/min/Kg. Exercise ECG showed two patterns of wide premature beats with few bigeminis that started at a HR of 95/min.DIFFERENTIAL DIAGNOSIS: 1- Benign ventricular pre-mature hyperpnea exercise:2- Electrical myocardial instability, due to channelopathy:3- Co-existence of CPVT in the family:TESTS AND RESULTS: 1- Repeated resting ECG, normal:2- Echo-cardiography, normal:3- Repeated family history and family ECG examination. No evidence of any cardiac symptoms except for the index event of the maternal grandfather:4- Repeated 24h holter, normal: 5- Expert consultation.

EXPECTED DIAGNOSIS: Asymptomatic elite swimmer. A carrier of benign familial LQT2 type mutation. No evidence of QT elongation on resting ECG and therefore does not meet QTc elongation criteria. Exercise induced ventricular pre-mature beats should be evaluated separately. Channelopathy expert physicians concluded that there is no justification for disqualification.TREATMENT AND OUTCOME: Cleeared for swimming with no limitations. Repeated stress test and switching to a non-selective beta-blocker drug was reconneced.

ACSM May 29 – June 2, 2018
Minneapolis, Minnesota
547 May 30 1:20 PM - 1:40 PM  
Cardiac Rehabilitation: A Gateway to the Senior Olympics  
Kirk D. Hendrickson, Beaumont Health, Royal Oak, MI.  
(Sponsor: Barry A. Franklin, FACSM)  
(No relevant relationships reported)

**HISTORY:** An 81 year old male with a history of hypertension in 2012 initially underwent graded exercise testing (GXT) followed by cardiac catheterization that revealed severe multivessel coronary artery disease (CAD). He underwent urgent coronary artery bypass surgery (CABG x 4) and enrolled in an exercise-based cardiac rehabilitation program (CR).

**PHYSICAL EXAM:** (1/2012): Total cholesterol (TC), HDL-C, LDL-C, and triglycerides (TG) were 118, 25, 56, and 186 mg/dL, respectively. Resting heart rate (HR) and blood pressure (BP): 59 bpm and 102/80 mmHg; body mass index (BMI), 29.2 kg/m².

**DIFFERENTIAL DIAGNOSIS: CAD**

**TEST AND RESULTS:**

- Baseline GXT with myocardial perfusion imaging (MPI): patient achieved 94% HRmax and 4.8 METs; no symptoms or diagnostic ST segment depression were noted. However, MPI revealed a transient infero posterior wall and a fixed posterior wall perfusion defect. Peak HR and BP: 136 bpm and 192/110 mmHg. Resting ejection fraction (EF) = 55%.
- CABG x 1/13/2012: Left anterior descending coronary artery (LAD) had 70-80% stenoses in the proximal and distal LAD. There were multiple 80-95% lesions in the left circumflex coronary artery (LCx), obtuse marginal artery (OM), and right coronary artery (RCA). EF = 55%.
- Most recent GXT 2/18/2015: 8.3 METs; negative for symptoms or ischemic ST segment shifts. MPI showed mild reversible defects in the anterior and lateral wall.
- Follow-up coronary computed tomography angiography was unremarkable. Lipid values (9/2017) were largely unchanged from his 2012 profile, except for an increased HDL-C, 41 vs 25 mg/dL; formerly. His BMI also decreased, 27.1 vs 29.2 kg/m² at baseline.

**FINAL WORKING DIAGNOSIS:** CAD; previous CABG

**TREATMENT AND OUTCOMES:** Patient initiated CR in 2012, follows a plant-based diet, is currently taking a beta-blocker, ACE inhibitor, aspirin, and statin and enrolled in an exercise-based cardiac rehabilitation program (CR).

548 May 30 1:40 PM - 2:00 PM  
Painful Arm Mass-Weight Lifting  
Jenna Crowder, Franklin Sease, FACSM, Irfan Asif, Vicki R. Nelson. Greenville Health System, Greenville, SC. (Sponsor: Franklin Sease, FACSM)  
(No relevant relationships reported)

**HISTORY:** A 15-year-old female HS lacrosse player presented for episodes of chest pain and palpitations, initially at rest for minutes and then became exertional with SOB. She denied nausea, HA, and syncope. Family history was negative for congenital heart disease and sudden cardiac death, but her mother had atrial fibrillation and MGF died before age 60 from an MI.

**PHYSICAL EXAMINATION:**

- T 97.7°F, HR 56, BP 116/68, RR 20, SpO₂ 98% RA, BMI 20.7
- Well appearing with clear breath sounds. Cardiac exam: regular rhythm, normal S1 and S2, no S3 or S4, and a 2/6 low frequency systolic murmur best heard at the left upper sternal border. 2+ pulses. No peripheral edema, cyanosis, or hepatomegaly.

**DIFFERENTIAL DIAGNOSIS:**

- Left arm: 1.5 cm aneurysm proximal to the antecubital fossa. Right mid vertebral artery aneurysm (1.4 cm); prior coil embolization of the left vertebral artery.
- Lower extremity pulses are symmetric and equal. Cervical spine motion is normal. Spurling’s test is negative bilaterally.

**FINAL WORKING DIAGNOSIS:**  
Superficial phlebitis

**TEST AND RESULTS:**

- Bilateral extremity angiogram - Right arm: multiple aneurysmal disease of unknown origin  
- Right vertebral artery aneurysm (1.4 cm); prior coil embolization of the left vertebral artery.
- Intramuscular hemorrhage  
- Neoplasms (vascular, sarcoma, nerve sheath)
- Brachial artery aneurysm or pseudoeuaneurysm

549 May 30 2:00 PM - 2:20 PM  
Cardiovascular Disease—Ice Hockey  
Bradley Changstrom¹, Robert Quaife², Matt Sokolowski², Nicholas Edwards¹, Gregory Coe³, William Cornwell².  
¹University of Colorado Hospital, Denver, CO. ²Colorado Avalanche Hockey Club, Denver, CO. ³University of Colorado Denver- Anschutz Medical Campus, Denver, CO.  
(No relevant relationships reported)

**HISTORY:**

- An 18 year-old healthy male semi-professional ice hockey player presented with a chief complaint of dizziness during a graded oxidation and lactate bike test. During the episode, he exhibited fluctuating levels of consciousness, gagging and cough. Following this episode, he denied chest pain, dyspnea, dizziness, or syncope. Physical Examination: On examination following the episode, he was responsive to verbal commands but appeared dizzy and confused. He was frequently coughing and appeared dyspneic. Blood pressure 120/70. Heart rate was in the 120s. Pulse oximetry was 93%. Heart was regular rhythm without murmurs, rubs or gallops. 

- Painful Arm Mass-Weight Lifting

- Brachial and radial pulses are symmetric and equal. Cervical spine motion is normal. Spurling’s test is negative bilaterally.

**Differential Diagnosis:**

- Superficial phlebitis

**TEST AND RESULTS:** Bilateral extremity angiogram - Right arm: multiple aneurysms proximal to the antecubital fossa, the largest measures over 1.5 cm. Aneurysms at the origin of the ulnar and radial arteries without distal abnormality. 

- Left arm: 1.5 cm aneurysm proximal to the antecubital fossa. Right mid vertebral artery aneurysm (1.4 cm), prior coil embolization of the left vertebral artery. Lower extremities: 33 discrete aneurysms. Pseudoeuaneurysm at the proximal anastomosis of the aorto-iliac graft that measures 4 cm proximally and 2.2 cm on the right iliac limb.

**FINAL WORKING DIAGNOSIS:** Multiple aneurysmal disease of unknown origin

**TREATMENT AND OUTCOMES:**

- Increased intravascular pressure related to physical activity recommendations. Increased intravascular pressure related to heavy resistance likely accelerates disease progression, and as such, the athlete was advised to refrain from weightlifting. Vascular surgery was consulted for evaluation of abdominal aortic pseudoeuaneurysm and right vertebral artery aneurysm.
Differential Diagnosis:
1. Cardiac arrhythmia
2. Structural heart disease
3. Seizure disorder
4. Hypoglycemia
5. Exercise induced asthma

Test and Results:
An electrocardiogram was normal. A complete blood count, comprehensive metabolic panel, cardiac troponin and brain natriuretic peptid were normal. A chest radiograph was normal. The patient was discharged with follow up.

The following day, a transthoracic echocardiogram was normal. A stress echocardiogram on a bike was performed under the same graded exercise protocol as the provoking bike test. At similar sub-maximal effort for heart rate and lactate levels, the patient developed recurrent symptoms. A continuous EKG did not demonstrate arrhythmia; however, the stress echocardiogram demonstrated a hyperdynamic left ventricular contractility. At the same time, a cerebral perfusion monitor demonstrated a decrease in cerebral blood flow. No left ventricular outflow tract gradient was noted.

A cardiac magnetic resonance imaging (MRI) was normal. A dobutamine stress echocardiogram was performed which confirmed an abnormal cardioinhibitory reflex response.

Final Diagnosis:
Bezold-Jarisch (Cardioinhibitory) response to exercise due to a hyperdynamic left ventricle.

Treatment and Outcomes:
1) He was cleared for full athletic participation.
2) He has returned to hockey activities without issues.

551 May 30 2:40 PM - 3:00 PM
Palpitations, Diaphoresis, Left-sided Chest, And Shoulder Pain – Football
James N. Cornwell, David Wilhelm. LECOM Health Sports Medicine, Erie, PA
(Sponsor: Patrick F. Leary, DO FACSM, FACSM)
(No relevant relationships reported)

Palpitations, Diaphoresis, Left-sided Chest and Shoulder pain – Football
James N. Cornwell, LECOM Health Sports Medicine, Erie, PA
 e-mail: james.cornwell@med.lecom.edu

HISTORY:
An otherwise healthy 24 year old female volleyball player presented to the sports medicine clinic with a two week history of atraumatic severe left ankle pain and swelling. She localized the pain to her tibialtalar area. She described a sensation of “tightness” in the ankle. She denied any numbness or tingling or mechanical features to her pain, and she denied focal weakness. She did not endorse any other swollen or painful joints. She denied any history of autoimmune disease, inflammatory arthritis, or exposure to ticks. She had tried Ibuprofen and Tylenol with no significant relief.

PHYSICAL EXAMINATION:
She had diffuse ankle pain to palpation. There was limited range of motion with anterior drawer test. External rotation stress test was not painful. No pain was produced with resisted ankle motion in all planes. Neurologic exam did not reveal any focal strength or sensory changes in the lower extremities. Distal pulses and capillary refill were symmetric.

DIFFERENTIAL DIAGNOSIS:
1. Septic arthritis
2. Inflammatory arthritis/synovitis
3. Crystalline polyarthritis
4. Lyme arthritis
5. Internal derangement
6. Occult fracture
7. Pigmented villonodular synovitis
8. Synovial chondromatosis

TEST AND RESULTS:
Laboratory testing showed normal white blood cell count. Sedimentation rate and C-reactive protein were slightly elevated. Lyme disease ELISA, rheumatoid factor, and CCP were all negative.

X-ray showed left ankle effusion but no fractures. Attempted ultrasound guided aspiration showed extensive tibialtalar synovitis but did not produce any fluid for analysis. MRI of the left ankle showed extensive nodular synovial thickening of the anterior compartment consistent with Diffuse PVNS.

FINAL WORKING DIAGNOSIS:
Diffuse Pigmented Villonodular Synovitis(PVNS)

TREATMENT AND OUTCOMES:
1. Modest improvement of pain with activity reduction
2. Orthopedic Foot and Ankle Surgery consult for planned arthroscopic nodule excision and synovectomy
Rare Cause of Second Webspace Interdigital Neuritis Diagnosed with Ultrasound

Marissa L. Dombovy-Johnson1, Brennan J. Boettcher2, Jonathan T. Finnoff, FACSM1, 3

1Mayo Clinic, Rochester, MN; 2Mayo Clinic Sports Medicine Center, Minneapolis, MN. (Sponsor: Jonathan T. Finnoff, FACSM)

(No relevant relationships reported)

HISTORY: A 68 year-old male with history of right second metatarsal Weil osteotomy, third webspace interdigital neuroma removal and third hammertoe correction presented with non-traumatic, burning pain in his second webspace that radiated into his second and third toes over the last four years. His pain was present at rest and worsened with activity.

PHYSICAL EXAMINATION: He had full, symmetric, and painless ankle and subtalar joint range of motion. Strength and sensation to light touch were full and normal. There was tenderness to palpation in right second webspace but no tenderness over the second and third MTP joints. No pain or click was elicited on Mulder’s test. He walked without a limp.

DIFFERENTIAL DIAGNOSIS:
- Interdigital neuroma
- Intermetatarsal bursitis
- Metatarsophalangeal joint instability
- Metatarsalgia
- Metatarsal stress fracture

TEST AND RESULTS:
Foot Radiographs:
- Healed osteotomy right 2nd metatarsal neck with screw fixation
- Post-operative changes right 2nd and 3rd PIP joints

Diagnostice Ultrasound:
- No neuroma or intermetatarsal bursitis was noted

- Third digit flexor tendons were dislocated medially between the second and third metatarsal heads compressing the adjacent neurovascular structures

Foot MRI:
- Confirmed US findings of medial dislocation of the third flexor digitorum longus and brevis tendons in between the second and third metatarsal heads

FINAL/WORKING DIAGNOSIS:
- Interdigital neuroma

TREATMENT AND OUTCOMES:
- Definitive treatment with an interdigital neurectomy was planned
- An ultrasound-guided second webspace corticosteroid injection along the interdigital nerve provided immediate relief of all patient’s symptoms, however the pain and subluxation persisted.
- It was felt that relocation of the tendons was not a technically feasible surgery
- Medial dislocation of third flexor digitorum longus and brevis tendons likely causing mass effect on the interdigital nerve in the second interspace

TREATMENT AND OUTCOMES:
- It was felt that relocation of the tendons was not a technically feasible surgery
- Medial dislocation of third flexor digitorum longus and brevis tendons in between the second and third metatarsal heads likely causing mass effect on the interdigital nerve in the second interspace

TREATMENT AND OUTCOMES:
- Medial dislocation of third flexor digitorum longus and brevis tendons in between the second and third metatarsal heads likely causing mass effect on the interdigital nerve in the second interspace

TREATMENT AND OUTCOMES:
- Medial dislocation of third flexor digitorum longus and brevis tendons in between the second and third metatarsal heads likely causing mass effect on the interdigital nerve in the second interspace

1. Lumbar
2. Stress Fracture
3. Hamstring/TIB Syndrome
4. Psychosomatic
5. Spondylarthropathy

TEST AND RESULTS:
Lumbar Xray (obtained via fax from PCP visit in New York): There is mild lumbar spondylosis. There is narrowing of all intervertebral disc spaces from T12-L5. Schmorl node endplate deformities and discogenic changes are present. No fracture or subluxation. Facet joints and SI joints are normal.

MRI Lumbar: Degenerative changes greater than expected for age and multiple Schmorl’s nodes. No spondylolisthesis or spondylolysis. Consider ordering thoracic MRI as concern exists for Scheuermann’s disease. There is subchondral sclerosis along the iliac sides of bilateral sacroiliac joints.

MRI Thoracic: Scattered endplate irregularities and small Schmorl’s nodes with disc space narrowing throughout the thoracic spine with associated endplate change.

LABS:
- HLA B-27: negative
- CRP: 7.4
- ESR: 4
- Quantiferon Gold TB: negative
- ANA: positive

FINAL WORKING DIAGNOSIS:
Scheuermann’s Disease and HLA-B27 seronegative Axial Spondyloarthropathy

TREATMENT AND OUTCOMES:
Patient is doing well in medical school and currently being managed on naproxen 500mg twice a day with no gastrointestinal side effects.

No relevant relationships reported

Rib Injury in a Professional Baseball Player

Christopher Trinh, Brian Coleman, James Barrett.
University of Oklahoma Health Science Center, Oklahoma City, OK.

HISTORY: A 24 year old previously healthy left handed male professional baseball pitcher was warming up on the mound before a game when he suddenly felt a vague pain in his lower left anterior-lateral rib cage region but denied hearing a pop. Pain was a localized deep ache on the lower anterior rib cage. Although he felt discomfort the player was able to complete his warm up regimen and start the game. During the game he was only able to throw four pitches prior to unbearable pain during the acceleration phase of pitching causing him to be pulled from the game and seek medical attention.

PHYSICAL EXAM:
- Pain was not affected by inhalation or exhalation. On exam, he was neurologically and symmetrically normal.
- Bilateral shoulder exams were within normal limits and pain was not affected by inhalation or exhalation. On exam, he was neurologically and symmetrically normal.
- He walked without a limp.
- Point tenderness to palpation
- An ultrasound-guided second webspace corticosteroid injection along the interdigital nerve provided immediate relief of all patient’s symptoms, however the pain and subluxation persisted.
- Medial dislocation of third flexor digitorum longus and brevis tendons in between the second and third metatarsal heads likely causing mass effect on the interdigital nerve in the second interspace
- Medial dislocation of third flexor digitorum longus and brevis tendons in between the second and third metatarsal heads likely causing mass effect on the interdigital nerve in the second interspace
- Medial dislocation of third flexor digitorum longus and brevis tendons in between the second and third metatarsal heads likely causing mass effect on the interdigital nerve in the second interspace

DIFFERENTIAL DIAGNOSIS:
- Oblique muscle strain
- Rib stress fracture
- Costochondral junction avulsion fracture
- Serratus anterior avulsion fracture
- Intercostal muscle strain

Test and Results:
Thoracic MRI findings suggested either a fracture or stress injury of the costochondral cartilage along the left anterior-inferior aspect of the ribcage. There was extensive edema present along the region that measured 8x10 cm but there was no evidence of rib fractures.

Chi-squared test revealed edema around the costochondral junction of ribs 7 and 8 on the left with anterior prominence of the cartilage but no focal displacement or rib fractures.

FINAL WORKING DIAGNOSIS: Based on Imaging, injury most likely to be costochondral junction avulsion fracture of ribs 7 and 8.

TREATMENT AND OUTCOMES:
Patient has followed up with Rheumatologist who recommends naproxen at this time and if symptoms flair will consider initiating an anti-TNF agent with monitoring of CRP values.

No relevant relationships reported

Low Back Pain in a First-Year Medical Student

Michael S. Antonis. MedStar Georgetown University, Washington, DC.

HISTORY:
- A 22-year-old male presents to MedStar Sports Medicine clinic from Student Health physician with complaint of hamstring and back pain for the last year. Patient describes the pain is worse when he rides his bike to school (5 miles) improved with walking to class and through the day, but worsens when he tries to run at night beyond 4 miles.

PHYSICAL EXAMINATION:
The player was initially treated with 6 weeks of activity restriction and rest. Surgery was not warranted due to lack of significant separation of the fragment. Repeat radiographs were obtained at 6 weeks which revealed proper healing. After 6 weeks he began a graduated pitching regimen. Pain improved throughout his rehabilitation with rest and NSAIDS once he began physical activity. He returned to full activity at 8 weeks.

559 May 30 2:20 PM - 2:40 PM  
Acute Lumbar Pain - Football  
(No relevant relationships reported)

HISTORY:  
A freshman collegiate football player presented to the athletic training facility after his first official practice, complaining of worsening, severe pain in his R greater than L lumbar region without radiation or radicular symptoms. He denied any injury during practice. He had previously reported mild low back tightness during summer conditioning workouts that resolved with rest. He and the sports health staff were aware that he has sickle cell trait.

PHYSICAL EXAMINATION:  
Pt in severe distress with diaphoresis, agitation and restlessness Limited lumbar ROM. Tenderness in lumbar paraspinal muscles R greater than L. Non-tender abdomen, symmetric pulses x4 extremities, no neurologic deficits or costa-vertebral tenderness. HR and BP elevated. Afibrile. High-flow oxygen by mask initiated and athlete transported to ED.

DIFFERENTIAL DIAGNOSIS:  
Lumbar muscle/myofascial strain  
Lumbar disc rupture  
Lumbar paraspinal myonecrosis  
Urteral calculus

Renal angiomylipoma

TESTS AND RESULTS:  
CMP Cr 1.7, Ca 10.6, Glu 140; otherwise normal WBC 11.8, Hgb 15.5, Hct 47.5, Pt 178 CK 747 U/L, Urimasly SpecGr 1.010, Pro 30, Small blood, 2 RBC, 4 WBC, myoglobin negative

MRI lumbar spine: T2 hypertense signal in the paraspinous muscles bilaterally, R greater than L. Spine and nervous structures normal. Impression: Multifocal paraspinal muscular edema. Considerations would include strain, acute myonecrosis (given clinical history), or acute blood products.

FINAL DIAGNOSIS:  
Acute lumbar paraspinal myonecrosis in athlete with SCT

TREATMENT AND OUTCOMES:  
1. High-flow oxygen continued  
2. IV fluids initiated and 3L NS bolus given by pressure infusion  
3. IV hydromorphe pron for pain control  
4. Rapid improvement in pain post IV fluid bolus  
5. Inpatient admission, transitioned from IV hydromorphe to PO oxycodone  
6. Peak CK of 10,169 approximately 13 hours post event  
7. Discharged home hospital day 2 with CK down trending at 7,060. Cr 0.98, off all pain meds

8. Cleared for activity at 7 days post event  
9. Completed return to play activities, returned to full practice at 11 days post event  
10. No related medical issues, no visible loss of muscle bulk/tone and continued full team participation as of abstract submission

 HISTORY:  
A 21-year-old female recreational soccer player presented with intermittent right-sided low back pain for two years. She denied any trauma or inciting event. Pain was localized to the right lumbosacral region without radiating leg pain and was described as dull and aching. It was rated on average 5/10 on a numerical rating scale and associated with nausea when pain worsened. Symptoms were worse with prolonged sitting, and several times in the last month she reported worsening of typical pain with alcohol intake. She denied leg weakness, numbness, or bow/rec/ bladder dysfunction. She participated in six weeks of physical therapy, which helped with nausea and pain with sitting, but she continued to have pain with alcohol consumption.


B-17 Clinical Case Slide - Shoulder  
Wednesday, May 30, 2018, 1:00 PM - 1:20 PM  
Room: CC-Mezzanine M100F

Chair: Tracy Ray, FACSM. Duke University, Durham, NC.  
(No relevant relationships reported)

Discussant: C. Mark Chassay, FACSM. IRONMAN Sports Medicine Institute, Houston, TX.  
(No relevant relationships reported)

Discussant: David Olson, FACSIM. University of Minnesota, St. Paul, MN.  
(No relevant relationships reported)

HISTORY:  
41 y/o male RHD sustained an injury to his chest area while performing a heavy bench press. His arm gave out when he was spotted by the injury. He suddenly felt nauseated/lightheadeled, unable to perform any more exercises so he immediately sat down. He was evaluated by a fitness specialist, obtained an MRI study within 2 days, then seen 3 days later in Sports clinic. He does not supplement any usage or take any medications. He was found to have acute blood products. He had a sensation of weakness when using his arm.

PHYSICAL EXAMINATION: Right upper extremity/chest region reveals asymmetry of pectoralis muscle with less fullness/dimpling upon hands on hips” pose; ecchymosis of proximal arm area with loss of axillary fold; tender over medial humerus with difficulty palpating the tendon; weakness with resisted internal rotation/adduction maneuvers.

DIFFERENTIAL DIAGNOSIS:  
1. Right arm contusion/tendon strain  
2. Right partial pectoralis muscle tear  
3. Right pectoralis major tendon rupture

TESTS AND RESULTS:  
Shoulder radiographs: AP, Y and axillary lateral views show no bony avulsion MRI films: reveal “extensive edema around musculotendinous junction of right pectoralis”; “small amount of linear fluid” in area of humeral insertion and “absence of tendon” with “retaction” into chest wall

Final Working Diagnosis: Right pectoralis major tendon rupture

TREATMENT AND OUTCOMES:  
1. Underwent primary open right pectoralis tendon repair/reattachment 6 days post injury  
2. Wore shoulder immobilizer for 6-8 weeks  
3. Participated in formal physical therapy rehabilitation at 1 month post-surgery  
4. Progressed to light weightlifting at 4 months  
5. Experienced transient scar hypersensitivity-resolved with local massage  
6. Discharged himself at 5 months  
7. Follow-up 2 years 9 months later for another complaint-doing well, back to working out (lighter weights/higher reps)

564 May 30 1:00 PM - 1:20 PM  
Pectoralis Muscle Rupture While Lifting Weights  
Mimi Zumwalt, Thomas Githens, Adam Wooldridge. Texas Tech University Health Science Center, Lubbock, TX. (Sponsor: Jacalyn McComb, FACSIM)

(No relevant relationships reported)
Teen With Acute Shoulder Pain Four Years After A Car Accident.

Natalie Ronshaugen, Kyle Nagle. University of Colorado, Aurora, CO. (Sponsor: John Hill, FACSM)

History: 18yo male with sudden onset, severe right shoulder pain occurring while sitting in class 11 days prior to presentation. He had a history of a posterior shoulder dislocation at age 14 in a car accident, requiring relocation under sedation without known complication. He completed PT at that time, however was unable to return to football or overhead throwing activities. At the start of his new onset pain, he suspected re-dislocation of his shoulder and went to the ED. X-rays were abnormal but to football or overhead throwing activities. At the start of his new onset pain, he suspected re-dislocation of his shoulder and went to the ED. X-rays were abnormal but

Physical Examination: 20 degrees forward flexion, 0 degrees external rotation, and internal rotation to T12. Strength: 4/5 empty can, 4/5 internal rotation, 3+/5 external rotation. Neurovascular: Brisk pulses, 2 second capillary refill, intact motor exam, and sensation intact in all dermatomes. Special tests: Neer’s positive pain with no increased ROM, Speed’s test positive, O’Brien’s test positive, cross over test negative, and Hawkin’s positive.

Differential Diagnosis: Recurrent shoulder dislocation/Malignant or benign bony lesion/Pathologic fracture of proximal humerus/Rotator cuff tear/Disruption of suprascapular nerve

Treatment and Outcome:

566 May 30 1:40 PM - 2:00 PM
Back and Shoulder Pain in a Weightlifter with Ehlers Danlos

James Kelley. Wellspan, York, PA. (Sponsor: Mark Lavallee, FACSM)

Back and Shoulder Pain in a Female Weight Lifter with Ehlers Danlos

History: The patient is a 44 yo woman who is a former fitness model, power lifter, and police office. She has a past medical history consisting of, pituitary tumor, Macromastia (C to DDD), and left temporal aneurysm, Bilateral hip subluxation, Chiari Type I herniation – nonoperable and Ehlers Danlos. She is treated for chronic pain and her regimen consists of Tylenol, Tramadol and Oxycodeone based on severity. NSAIDs are contraindicated due to the Xarelto use. In her most recent EDS clinic visit, she was referred to the sports medicine clinic for pain in her back and right shoulder. She was swimming and performing rehab exercises and presented with her 9/10 shoulder pain. The pain is worse with motion and is located on her posterior and lateral shoulder.

Physical Exam:

General: Healthy appearing, Alert and Oriented, no acute distress, mood appropriate, respiratory rate non-labor, hearing intact

Thoracic:

Pallation: Tender over bilateral trapezius, splenius capitis, rhomboids

Examination:

Sensation:

Upper Extremity: intact bilateral, no deficits

Lower Extremity: intact bilateral, no deficits

Strength:

Upper extremity: full strength in all major muscle groups

Lower extremity: full strength in all major muscle groups

Special Tests:

(+) Hawkins right side

(+) Sparling’s away from affected

Differential Diagnosis:


Final Working Diagnosis:

Chronic Rotator Cuff tendinosis from chronic subluxation, and bilateral trapezius, rhomboid and splenius capitis strain, likely from overly active rehab and her Macromastia

Treatment: Subacromial shoulder injection with glucocorticoids and dry needling of her splenius capitus, rhomboids, and trapezius muscles

Outcome: Significant reduction in her pain, reduced narcotic use and continuing with her rehab and swimming. Receiving dry needling on a monthly basis.

567 May 30 2:00 PM - 2:20 PM
Shoulder Pain - Builder with Chronic Calcifications

Lauren Nadkarni, Krystian Bigosinski, Heather Gillespie, FACSM. Maine Medical Center, Portland, ME. (Sponsor: Heather Gillespie, FACSM)

History:

A 48 year old right hand dominant male smoker who works as a builder presents with chronic left shoulder pain. 15 years ago, he dislocated his left shoulder while breaking up a fight. Since then, he has dislocated it several times, most recently 5 years ago, but is able to replace it on his own. Two years ago, he had x-rays at an outside hospital emergency room and was diagnosed with calcium in his shoulder (images were unavailable). Last year, he felt a “squishy mass” and then “felt like something left my shoulder” when he was getting out of his car, and has had pain since then. He feels his shoulder is weaker and has less muscle mass, but denies hand weakness. However, he has had some neck issues and had numbness in his left arm secondary to cervical stenosis at C5-7, spondylosis of C2-3, disc herniation at C4-5, and radiculopathy of C5-6, which improved after physical therapy which was prescribed by a physiatrist.

Phyical Exam:

Office examination of his left shoulder revealed mild pain at terminal motion with overhead movements, full range of motion, 5/5 rotator cuff and distal strength, and negative AC joint testing. Impingement tests (Hawkins and Neer), and instability tests (apprehension and relocation) were positive. Distal neurovasculature was intact. His elbow and contralateral shoulder exam were normal.

Differential Diagnosis:

Rotator cuff tear, shoulder impingement, osteoarthritis, osteochondromatosis, labrum tear, lipoma, ganglion cyst, foreign body, erosive arthritis, pigmented villonodular synovitis, synovial sarcoma, intra-articular fracture fragments, neuropathic joint, and multidirectional instability

Tests and Results:

Abstracts were prepared by the authors and printed as submitted.
Left shoulder x-rays (AP/Outlet/Axillary): "immumerable calcific loose bodies consistent with synovial osteochondromatosis as well as significant osteoarthritis changes at the glenohumeral joint with close to bone-on-bone narrowing seen best on the axillary view. The loose bodies are dispersed throughout the joint capsule and into the bicapital groove."

**Final Working Diagnosis:**
Synovial osteochondromatosis

**Treatments and Outcomes:**
- Continued physical therapy
- Over the counter analgesics, ice/heat as needed
- Referral to orthopedic surgeon for loose body removal vs. shoulder joint replacement

### Shoulder Pain in a Youth Hockey Player

**May 30 2:20 PM - 2:40 PM**

**Brennan J. Boettcher, Jeffrey M. Payne, Jonathan T. Finnoff, FACS.M. Mayo Clinic, Minneapolis, MN. (Sponsor: Jonathan T. Finnoff, FACS.M)**

(No relevant relationships reported)

**HISTORY:** A 14-year-old male hockey player presented for right shoulder pain. He checked an opponent with his left shoulder and developed right shoulder pain immediately. There were no associated neurovascular symptoms. The pain was sharp, and radiated down the lateral shoulder to the mid-arm with abduction. Outside shoulder radiographs were normal.

**PHYSICAL EXAMINATION:** Athletic male resting with his right hand on his abdomen. Asymmetric depression of his right acromion with arms unsupported at his side. Right shoulder range of motion was slightly limited due to pain. He had tenderness just posterior to the distal mid-third of the clavicle diaphysis over the trapezius insertion. Neurologic and strength examination were normal.

**DIFFERENTIAL DIAGNOSIS:** Trapezius strain - Occult clavicle fracture - ACJ separation - Shoulder instability - Brachial plexus injury - Rotator cuff injury - Labral tear

**TEST AND RESULTS:** Diagnostic Ultrasound revealed an avulsion of the deep fibers of the trapezius from the clavicle, with ACJ strain and distal clavicular hypermobility. Repeat radiographs demonstrated subtle periosteal lifting of the inferior clavicle near the avulsion visualized on sonographic evaluation indicative of a clavicular physeal injury.

**FINAL WORKING DIAGNOSIS:** Grade 1 right ACJ separation with trapezius avulsion off of the clavicle and distal clavicular physeal injury.

**TREATMENT AND OUTCOMES:**
The patient was placed in a sling for comfort for 2 weeks. At the 3 week follow-up, he was about 95% of normal, repeat ultrasound demonstrated a small amount of distal clavicular callus formation. He was cleared to resume non-contact aerobic activity (e.g. skating) and gentle, non-painful shoulder isometrics. Re-evaluation at 6 weeks demonstrated full, pain-free shoulder range of motion, normal strength, and distal clavicular callus formation on radiographs. He was released to unrestricted activity.

**RETURN TO SPORTS:**
Returned to full sports 8 weeks following PRP injection. After complete resolution of symptoms, she played volleyball in the following season as a setter.

### OCD: A Zebra In The Glenoid Fossa

**Elizabeth Barchi. New York University, New York, NY.**

(No relevant relationships reported)

**History:** A 19-year-old female Division 1 volleyball player presented with 5 months of right shoulder pain and decreased range of motion. The pain was localized to "inside" the shoulder and aggravated by serving and setting (right hand dominant). 2 months after the onset of symptoms, she noticed an acute increase in pain following a collision that resulted in a cervical strain. The symptoms persisted despite 3 months of physical therapy in the training room and 2 months of post-season rest. She denied neurological or instability symptoms.

**Physical exam:**

**Differential Diagnosis:**
- Impingement Syndrome
- Labral tear
- Rotator cuff tendinopathy
- Osteochondral defect of the glenoid fossa
- Osteochondroma

**Testing and Results:**
MRI Right Shoulder: Large osteochondral defect centered in the posterior superior aspect of the glenoid measuring approximately 1.6 x 1.7 cm. Associated marked irregularity and bone loss of the subchondral plate and subchondral bone, suspicious for an instable osteochondral fragment. Tear of the adjacent posterior superior labrum.

**Final Diagnosis:**
Osteochondral defect of the glenoid fossa

**Treatments/Outcomes:**
- Hyaluronic acid injection into glenohumeral joint with no change in symptoms
- PRP injection into glenohumeral joint with excellent reduction in pain and eventual return to baseline range of motion
- Physical therapy - rotator cuff strengthening, range of motion exercises, joint mobilization, and manual methods
- Returned to full sports 8 weeks following PRP injection. After complete resolution of symptoms, she played volleyball in the following season as a setter.
Prolonged Uninterrupted Sitting Impairs Vascular Function and Increases Biomarkers of Atherosclerotic Risk in Overweight Adults

Megan S. Grace1, Rachel E D Clinic1, Michael Wheeler1, Elisabeth Lambert1, Carolina Iki Sari1, Farzaneh Rezaei1, Hamza Ali1, Gavin Lambert1, Neville Owen1, Daniel J. Green2, Bronwyn A. Kingswell3, David W. Dunstan4. 1Baker Heart and Diabetes Institute, Melbourne, VIC, Australia. 2Swinburne University, Melbourne, VIC, Australia. 3Monash University, Melbourne, VIC, Australia. 4University of Western Australia, Perth, WA, Australia.

Purpose: Prolonged uninterrupted sitting ameliorates postprandial glucose, insulin and lipid responses in overweight/obese adults with or without type 2 diabetes; and, impairs lower limb endothelial-mediated vasodilation in healthy adults. It is unknown whether prolonged sitting impairs vascular function or modulates other vascular inflammatory and pro-atherogenic mechanisms in those at heightened risk of cardiometabolic disease. In overweight/obese adults, we examined the potential pro-atherogenic effects of an acute bout of prolonged sitting, compared to sitting interrupted with brief activity breaks.

Methods: In a randomised crossover trial, following a standardised breakfast meal, 19 (11 Male, 8 Female) overweight/obese participants (BMI 30.6±3.4 kg/m2, age 57±12 years; mean±SD) either: (i) sat uninterrupted for 5h (SIT); or, (ii) interrupted 5h of sitting with 3min light-intensity simple body-weight resistance activities every 30min (SRA). Brachial and femoral artery endothelial-mediated vasodilation were measured using flow mediated dilation (FMD). Circulating levels of vasoactive and pro-atherosclerotic biomarkers (total nitrate+nitrite, ET-1, ICAM-1 and VCAM-1) were measured. Sympathetic nervous activity was also estimated (peroneal microneurography and circulating catecholamines). Data were analysed using generalised linear mixed models controlling for sex, BMI, baseline values and treatment order, and are presented as marginal mean±SEM.

Results: Femoral artery FMD was impaired in the SIT condition, compared to SRA (5.1±0.5% vs 9.0±0.5%, respectively, p<0.05). Significantly higher circulating levels of the potent vasodilator and pro-atherosclerotic mediator ET-1 (1.6±0.1 vs 1.4±0.8 pg/ml) and pro-atherogenic adhesion biomarker VCAM-1 (616±33 vs 564±26 ng/ml) were observed in SIT compared to SRA, respectively (p<0.05). There were no differences between conditions for any other outcomes.

Conclusion: In overweight/obese adults, an acute bout of uninterrupted sitting impaired femoral artery endothelium-mediated vasodilation and increased circulating levels of pro-atherosclerotic biomarkers. Prolonged sitting may have implications for vascular function, leukocyte adhesion and atherosclerosis in those at heightened risk of cardiometabolic disease.
performed at 0.5, 1.5, 2.5, and 3.5 hours post-meal. Glucose, triglycerides, and blood pressure were measured at baseline, 1, 2, 3, and 4 hours post-meal. Pulse wave velocity (PWV) was measured before and following each condition. Linear mixed models evaluated overall condition effects and differences at each hour that was Bonferroni adjusted for multiple comparisons. Cohen’s d estimated the magnitude of effects.

RESULTS: Average glucose across the simulated workday did not differ by condition (β= -0.35 mmol/L, p=0.278, d=0.51). However, pairwise comparisons demonstrated an attenuation of glucose from baseline to 1 hour post-meal (β= -0.69 mmol/L, p=0.004, d=1.02) in REX compared to SIT, but not at the other time points. Blood pressure, triglycerides, and PWV did not differ significantly across conditions (all p ≥ 0.102, d = 0.01 to 0.21) or at any time point. CONCLUSIONS: Disrupting sitting with a brief resistance exercise bout performed at 0.5 hours after consuming a meal may have beneficial effects on 1-hour postprandial glucose. However, this initial benefit does not appear to be sustained beyond that time point. Moreover, these findings do not support an acute benefit of brief resistance exercise bouts compared to sitting on other cardiometabolic outcomes. Additional research is needed to assess optimal strategies for disrupting sedentary behavior that may have cardiometabolic benefits.

purposes of this study was to determine the association between weather condition, ambient temperature and objectively measured sedentary time in Chinese adults. METHODS: 3,426 Chinese (2,116 men and 1,310 women) users of a brand of smart bracelet from July to October in 2015 were recruited in this study. With a novel algorithm, the calendar component of the acceleration signal collected by the activity monitor was extracted from the raw data to identify different types of activities and determine sedentary time. Using the information of GPS and time, the data of ambient temperatures and weather condition were collected from the meteorological data released by China Central Meteorological Observatory. RESULTS: Compared with the days with rain, shower, haze and clouds, Chinese adults spent less time in sedentary behaviors in sunny days. There is no significant difference in sedentary time in rainy days in adults with different weight status. However, obese adults had significant longer sedentary time in non-rainy days than their counterparts with normal weight. Chinese women have shorter daily sedentary time when the mean ambient temperature lower than 20 °C, as compared with 20-24°C, 25-29°C and ≥30°C groups, whereas no difference was found in Chinese men. CONCLUSIONS: Weather condition and ambient temperature are important factors associated with sedentary behaviors. Sedentary time in Chinese adults is longer in rainy days and high ambient temperature as compared with non-rainy days and cool weather. Long sedentary time especially in non-rainy days could be one of the factors contribute to the development of obesity in Chinese adults.

Research indicates prolonged occupational sitting may have detrimental effects on cardiometabolic health. This may suggest that interrupting prolonged sitting with physical activity may have an acute beneficial effect on cardiometabolic health. However, it is unclear if brief resistance exercise bouts would result in these acute benefits.

RESULTS: Based on work time (min/hour), there was a small negative trajectory for sedentary time (β [SE] = -0.31 ± 0.12, p>0.01). Women were less sedentary overall (β [SE] = -2.90 [0.62], p<0.001); however, men had greater decreases in sedentary time over the workday (β [SE] = 0.27 [0.10], p=0.002). Obese individuals were less sedentary than overweight (β [SE] = 4.90 [0.65], p<0.001) and normal weight (β [SE] = 6.61 [0.63], p<0.001) individuals overall; however, overweight individuals (β [SE] = -0.26 [0.10], p=0.006) had greater decreases in sedentary time over the workday relative to obese (whose sedentary time remained stable). These patterns were similar when time was aligned by clock time.

CONCLUSION: Sedentary time was modestly reduced over the work day. This pattern varied by gender and weight status, but not by age or job type. These findings inform potential tailoring strategies by identifying when and for whom to optimally target interventions to reduce sedentary time in the workplace.

PURPOSE: The purpose of this study was to investigate the effects of a worksite sedentary behavior intervention on energy intake and perceived appetite in full-time sedentary office workers over the first three months of intervention.

METHODS: Data were derived from the ongoing study ‘Stand & Move at Work’, a multi-level group randomized trial aimed at reducing employee sedentary time with a socio-ecological approach. Dietary intake was assessed through the online ASA24 multi-level group randomized trial aimed at reducing employee sedentary time with a socio-ecological approach. Dietary intake was assessed through the online ASA24 dietary assessment tool. Dietary intake was assessed through the online ASA24 dietary assessment tool. Dietary intake was assessed through the online ASA24 dietary assessment tool.

RESULTS: Enabling scores ranged from 0 to 3. One hundred and thirty-three reinforcing) were evaluated, with one point recorded for each factor included in the Precede-Proceed Health Promotion Model as a guide. Six factors (three enabling and three reinforcing) were evaluated by two investigators using enabling and reinforcing components of the Precede-Proceed Health Promotion Model as a guide. Six factors (three enabling and three reinforcing) were evaluated by two investigators using enabling and reinforcing components of the Precede-Proceed Health Promotion Model as a guide.
four (87.6%) apps included videos or pictures, while 123 apps (80.4%) included written instructions on how to perform exercises. Thirty-eight apps (24.8%) included the ability to track daily and gaming experience and no statistical difference were found by category. RESULTS: Compared to resting values (4.5±0.6ml/kg/min), VO₂ was higher during TOF, AS, and HP (30.5±7.1, 19.1±5.8, and 24.8±6.6ml/kg/min, respectively; p<0.05). Using %VO₂R, HP had closer values than TOF. Methods were classified as severe exercise from moderate to vigorous, and AS was moderate intensity. Using RPE (95%CI), TOF was classified as moderate, whereas HP and AS were light intensity. CONCLUSIONS: Our data suggests the three VR games examined can elicit at least a moderate exercise intensity based on ACSM guidelines. Participants perceived the physical exertion to be lower during the games than their measured exertion, which might allow participants to continue playing ARVs for longer durations before feeling fatigued. Data on metabolic cost for movement specific games may aid consumers and health/fitness specialists in developing exercise programs with ARVs.

**Board #3 May 30 3:15 PM - 5:15 PM**

### Metabolic Cost and Exercise Intensity during Active Virtual Reality Gaming

Dulce H. Gomez, Nicole Bolter, C. Matthew Lee, James R. Bagley, Marialice Kern, FACSM. San Francisco State University, San Francisco, CA.

**PURPOSE:** Sedentary behavior remains a critical health promotion target because it increases risk of morbidity and mortality. Virtual reality (VR) eXergaming is a new avenue of physical activity that may be preferred over “traditional exercise” in historically inactive populations. Use of active VR games (ARGs) could be an mHealth intervention approach for Hispanic men.

**METHODS:** An mHealth intervention (GCSWLI) for sedentary, overweight/overt Hispanic males suffering disproportionate rates of overweight and obesity compared to other racial/ethnic groups. However, few weight loss interventions have been developed for this high-risk group. Further, use of mobile health (mHealth) technologies to support lifestyle behavior changes in weight loss interventions for Hispanic men are untested. **PURPOSE:** This pilot study examined the feasibility and acceptability of integrating mHealth technology into a 12-week gender- and culturally-sensitive weight loss intervention (GCSWLI) for sedentary, overweight/overt Hispanic males.

**METHODS:** Eighteen Hispanic males (age: 38 ± 11 years; BMI: 34 ± 5 kg/m²; 56% Spanish monolingual) received a CGSWL including weekly in-person individual sessions, a daily calorie goal, and prescription of ≥225 minutes of moderate-to-vigorous physical activity/week. mHealth technology support included tailored text messaging and behavioral weight self-monitoring support using the Fitbit Charge 2, a consumer-wearable physical activity tracker, and a Fitbit Aria Wi-Fi Smart Scale. Participants were encouraged to use the Fitbit tracker during all waking hours and weigh themselves daily using the provided scale. Participants received biweekly SMS customized to address self-reported barriers to behavior change and in response to objective data collected via tracking tools. Changes in weight from baseline to 12-weeks were estimated using a paired t-test. Descriptive analyses characterized use of the Fitbit and the smart scale. **RESULTS:** Sixteen of 18 participants completed 12-week assessments; overall attrition rate was 11.1%. Mean weight loss at week 12 was 4.7 kg (95% CI [1.1, 2.3], p < 0.001). Participants wore the Fitbit 71% of intervention days and logged body weight using the smart scale 30.5% of intervention days. Participants identified barriers for use of the technology, including strenuous work activities prohibiting them from wearing the Fitbit. In addition, reliable internet access was cited as a barrier to using the smart scale. **Conclusions:** While significant weight loss was achieved integrating mHealth technology non-players were examined using a one-way between groups ANCOVA (p=0.001). Patients wore the Fitbit 71% of intervention days and logged body weight using the smart scale 30.5% of intervention days.

Interventions using virtual reality (VR) in three or two-dimensional, multi-sensory, synthetic worlds have been used to enhance rehabilitation and performance (e.g., combat PTSD in military personal, increase motor control in stroke-recovery patients). VR also has potential as a method for rehabilitation from sporting injuries. **PURPOSE:** To assess athletes’ interest in VR as an intervention to enhance performance and injury rehabilitation, and to identify preferred components within a VR world. We also explored gender influences on these preferences. We focused on one collegiate sport, soccer, at three levels (NCAA, NAIA, Junior College). **METHODS:** Sixty-eight collegiate soccer (25 male; 43 female) athletes completed an electronic survey which included demographics, as well as the virtual reality interest survey created to assess VR use, interest and specific uses athletes may find useful in a VR environment.

**RESULTS:** Participants’ responses on a 10-point Likert-type scale from not interested (1) to extremely interested (10), indicated strong interest in using VR, both in recovery from injury (M=7.06, SD=2.67), and to improve sport performance (M=7.89, SD=2.59). Additional items asked about interest in specific forms of VR with the same 10-point scale. Athletes indicated strong interest in viewing sport-specific scenarios (M=7.26, SD=2.66), sport-specific skills (M=6.89, SD=2.73), and physically touching a soccer ball while submerged in a virtual world (M=6.89, SD=2.83). Other items, such as seeing a crowd in the stands, presence of water stands, or viewing teammates perform a sport skill unsuccessfully, were rated of less interest. In terms of gender, men were more interested than women in using VR both for injury recovery (Male: M=8.24, SD=2.18, Female: M=6.34, SD=2.70) and to enhance performance (Male: M=9.00, SD=1.84, Female: M=7.21, SD=2.77).

**CONCLUSION:** VR interest is high among collegiate soccer athletes, both for injury recovery and performance enhancement. The athletes were particularly interested in a VR environment that incorporates sport-specific scenarios and physically touching a soccer ball. Men had stronger interests in VR, but both men and women athletes at all levels indicated interest in engaging in VR to assist in injury recovery and performance enhancement.
on DEE for on-body time [F (1, 17) = 4.892, p = 0.041]. When weight was included in the model, there was a trend towards a significant effect on DEE [F (1, 16) = 4.366, p = 0.053]. However, weight was not used for analysis in the main ANCOVA model as it is outside the significance level. CONCLUSION: Pokémon Go players exhibited a significantly greater DEE than their non-player counterparts (Players: 2735 ± 666 kcal vs non-players: 2274 ± 474 kcal, p = 0.031).

## Table 1. Demographic data.

<table>
<thead>
<tr>
<th></th>
<th>Players</th>
<th>Non-players</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>27.89 ±/-.62</td>
<td>25.73 ±/-.85</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>78.99 ±/.160</td>
<td>73.02 ±/-.123.5</td>
</tr>
<tr>
<td>BMI (Kg/m²)</td>
<td>27.66 ±/.420</td>
<td>24.73 ±/-.3.69</td>
</tr>
</tbody>
</table>

## Results

### Purpose

The effects of exergaming physical activity (PA) interventions on preschoolers' cognition and health outcomes remain largely unexplored. Therefore, the purpose of this study was to discern the effectiveness of a home-based exergaming intervention on preschoolers' cognition and health outcomes in a randomized cross-over trial.

### Methods

Participants were 32 preschoolers (16 girls; 59.4% Asian; Mₚ = 4.72, SD = ±.73) recruited from the Twin Cities area in MN. During baseline testing, preschooler’s cognition, cardiovascular fitness, body fat percentage (BFP), and daily energy expenditure (EE) were assessed via validated instruments. Participants were then randomly assigned to 1) an intervention (INT) condition: engaged in home-based LeapTV exergaming at least 30 minutes/session 5 times/week for the first 12 weeks and then resumed their regular PA patterns without exergaming during the second 12 weeks; or 2) a delayed-intervention control (DLC) condition: maintained their regular PA patterns for the first 12 weeks, and participated in the same dose of home-based exergaming during the second 12 weeks. Identical assessments were conducted at the end of the 12th and 24th weeks.

### Results

Data were analyzed with PROC GLM in SAS. Results suggested significant interaction effects of treatment by period for cognition, F(1,28) = 16.90, p < 0.01. Significant carry-over (period) effects emerged for cognition, F(1,28) = 2.02, p < 0.04; and BFP, F(1,28) = 16.90, p < 0.01. Significant carry-over (period) effects emerged for fitness, F(1,28) = 15.24, p < 0.01; and EE, F(1,26) = 4.08, p < 0.04. In addition, there was a significant order (sequence) effect for BFP, F(1,28) = 16.90, p < 0.01. No other effects were identified. Detailed descriptive data are shown in table.

### Conclusions

Home-based exergaming may positively impact cognition, fitness, and BFP for some preschoolers, with slight positive effects on EE possible for most preschoolers. Therefore, an exergaming program might be a good option for home-based PA interventions.
CONCLUSIONS: Despite extensive user training, several intervention BCS found the Polar M400 difficult to use—possibly decreasing intervention adherence. Future interventions should utilize simpler smartwatches to promote PA among middle-aged clinical/non-clinical populations.

**B-38 Thematic Poster - High Intensity Interval Training**

Wednesday, May 30, 2018, 3:15 PM - 5:15 PM
Room: CC-Lower level L100H

**Chair:** Tom Hazell, Wilfrid Laurier University, Waterloo, ON, Canada.

(No relevant relationships reported)

---

649 Board #1
May 30 3:15 PM - 5:15 PM
**Blood Lactate steady state Level Sustained during Rest Time In Moderate Intensity Interval Training**

Juan C. Mazza1, Raúl R. Festa1, Lisandro Ruffo1, Patricia Cosolito1, Sandra L. Prieto2, Alvaro Gurovich, FACSM1.

1Biosystem Institute Sports Sciences, Rosario, Argentina; 2Colombia State University, Bogotá, Colombia. The University of Texas at El Paso, El Paso, TX.

(No relevant relationships reported)

---

650 Board #2
March 30 3:15 PM - 5:15 PM
**Impact Of The Fractionated Distance On Endurance Training In Soccer Players**

Raúl R. Festa1, Juan C. Mazza1, Lisandro Ruffo1, Carlos Groppo1, Patricia Cosolito1, Alvaro Gurovich, FACSM1.

1Rosario Central Soccer Athlete Club Rosario, Argentina. The University of Texas at El Paso, El Paso, TX.

(No relevant relationships reported)

---

651 Board #3
May 30 3:15 PM - 5:15 PM
**Effects of Two Types of Exercises on Serum MGS3 and Its Relationship with Metabolic Biomarkers**

Jing Shao, Naixi Liu, Yingbin Ren, Jinde Fu, Lili Zhou, Baohua Xu, Qi Han, Muqing Yi. National Research Institute of Sports Medicine, Beijing, China.

(No relevant relationships reported)

---

652 Board #3
May 30 3:15 PM - 5:15 PM
**Purpose of Endurance Interval (EIT) and Endurance Intermittent (Elmt) trainings**

The present study showed that EIT is a more metabolic and cardiovascular stressful stimulus than Elmt. Same volume and intensity, but higher fractionated distance might not produce the same physiological adaptations. In addition, the low correlations between La and HR might not be a valid and reproducible variable to control metabolic intensity during EIT in soccer.

**Key word:** Endurance training; Blood Lactate; Soccer.

---

**B-38**

**Thematic Poster - High Intensity Interval Training**

**PURPOSE:** To determine if Endurance Interval Training (EIT) or Endurance Intermittent Training (Elmt) generates more physiological stress to improve the performance of oxidative system in soccer players.

**METHODS:** Fifteen male soccer players (17.9±0.6 yr) performed 2 sessions of EIT with the same absolute volume and intensity but different design, with a 4-day rest period between Endurance sessions. Endurance protocols were: a) 8 x 400 m, at 4.5 m/s, with 60s rest between reps. (EIT volume: 3,200 m); b) 8 sets of 6 x 67.5 m (405 m per set), at 4.5 m/s, with 15s:60s work:rest ratio, and 60s rest between sets (Elmt volume: 3,240 m). Blood lactate (La) and heart rate (HR) were collected at the end of repetitions/sets 2-4-6 and 8. We compared La and HR values between EIT and Elmt, applying paired t-test with a p<0.05 level, and Pearson’s correlation coefficient (r) between La and HR for each test.

**RESULTS:** The session average La and HR were different between EIT and Elmt: 4.55±0.46 vs. 1.28±0.41 mmol/l, respectively (p<0.01) and 182±17 vs. 152±10 bpm, respectively (p<0.01). In addition, La and HR at repetitions/sets 2-4 and 6 were different between EIT and Elmt: 3.28±0.86 vs. 1.53±0.55; 4.44±0.91 vs. 1.21±0.33; 4.94±1.31 vs. 1.19±0.32; 5.51±1.64 vs. 1.18±0.34 mmol/l, respectively. And 179±5 vs. 153±9; 183±6 vs. 152±7; 186±7 vs. 152±9; 184±7 vs. 153±9 bpm, respectively. Additionally, there we found low r between La and HR, in each test (EIT: r= 0.26; Elmt: r= 0.42).

**CONCLUSION:** The present study showed that EIT is a more metabolic and cardiovascular stressful stimulus than Elmt. Same volume and intensity, but higher fractionated distance might not produce the same physiological adaptations. In addition, the low correlations between La and HR might not be a valid and reproducible variable to control metabolic intensity during EIT in soccer.

**Key words:** exercise training; soccer; heart rate; blood lactate; metabolic stress.
High intensity interval training (HIIT) is a safe and effective workout that can be modified to meet all fitness levels. During each session bouts of high intensity exercise are interspersed with active recovery periods. Music has been shown to increase anatomical movement while music can minimize residual fatigue. In addition, music may provide a greater perceptual stimulation and motivation to complete the training. In this study, we compared the metabolic and cardiorespiratory responses of a high-intensity interval training (HIIT) protocol with and without music to determine if music can improve the metabolic and cardiorespiratory responses during high-intensity interval training.

**METHODS:** Participants attended two, sixty minute, counterbalanced HIIT sessions modified to meet all fitness levels. During each session bouts of high intensity exercise were interspersed with active recovery periods. Music has been shown to increase anatomical movement while music can minimize residual fatigue. In this study, we compared the metabolic and cardiorespiratory responses of a high-intensity interval training (HIIT) protocol with and without music to determine if music can improve the metabolic and cardiorespiratory responses during high-intensity interval training.
Kinetic factors have been implicated in the development of several running-related injuries (RRIs). Most research has focused on measures of vertical loading, such as the average vertical loading rate (AVLR), instantaneous vertical loading rate (IVLR), and vertical impact peak (VIP), as they have all been associated with RRI in retrospective analyses. Less studied has been the horizontal braking force exerted on the body during running.

**PURPOSE:** To prospectively predict the capacity of vertical and horizontal loading variables on RRI risk.

**METHODS:** 47 healthy female recreational runners ran at their preferred speed on an instrumented treadmill while ground reaction force data and 3D joint kinematics were collected. Main kinetic outcomes were VIP, AVLR, IVLR, active vertical peak, vertical impulse, and peak braking force (PBF). After baseline testing, participants began a 15-week half-marathon training program. Pain and running volume were recorded via a weekly online log. Exposure time (hours of running) was calculated from the start of the training program until onset of injury (IND) or right-censoring at non-RRI, loss to follow-up, or end of 15-week program (UNINJ). After converting kinetic variables from continuous to ordinal variables based on tertiles, Cox proportional hazard ratios were fit for each kinetic variable independently.

**RESULTS:** 65 participants were included in the final analysis. 22 were diagnosed with an RRI (mean exposure of 17.46+/−9.81 hours). 33 completed the program without injury (mean exposure of 43.46+/−10.48 hours). PBF was the only kinetic variable significantly associated with increased injury risk when compared to the middle tertile. Participants with a high PBF were injured at 4.87 (95% CI: 1.54-15.44) times the rate of those in the middle tertile of PBF. IND participants also had a significantly greater (more negative) PBF than UNINJ (-0.27±0.04 BW vs. -0.24±0.04 BW; p=.002, ES=0.91). Finally, when analysed in a multivariable model, no other kinetic variables were significantly associated with increased injury risk when compared to the middle tertile. **CONCLUSIONS:** Findings from this study suggest PBF is associated with a significantly increased risk of RRI in female recreational runners. Future studies should include this variable in their analysis.

658 Board #1 May 30 3:15 PM - 5:15 PM

**Peak Braking Force as a Risk Factor for Running-Related Injuries**

Christopher Napiern, Christopher L. MacLean, Jack E. Taunton, FACSM, Jessica Maurer, Michael A. Hunt.1 University of British Columbia, Vancouver, BC, Canada. 2Fortius Institute, Burnaby, BC, Canada. (Sponsor: Jack Taunton, FACSM)

660 Board #3 May 30 3:15 PM - 5:15 PM

**Association Of Isometric Hip And Ankle Strength With Frontal Plane Kinetics In Females During Running**

Kathryn Harrison, Bhushan Thakkar, David Pumphrey, Robert Tickes, Gregory Crosswell, D.S. Blaise Williams III, FACSM. Virginia Commonwealth University, Richmond, VA. (Sponsor: D.S. Blaise Williams, FACSM)

Abstracts were prepared by the authors and printed as submitted.
Running-related overuse injuries are endemic among active populations. During the stance phase of running, the ground reaction force vector (GRF) and shank are not always aligned. Thus, some portion of the GRF is directed perpendicular to the shank and causes a bending moment, which may be implicated in the etiology of injury.

**METHODS:** Twenty-seven runners were followed for a minimum of 43 weeks. Fourteen sustained injury. Overground kinetic and kinematic data were collected at 4.0 m/s (normalized to body weight). Using the sagittal plane angle between the shank and the GRF (GRF/SK angle), the sagittal plane GRF was decomposed into two components: one parallel to the shank (on-axis GRF) and one perpendicular to the shank (off-axis GRF). Group differences were assessed with an independent-samples t-test (α = 0.05).

**RESULTS:** While impact peak was a prominent feature of the on-axis GRF, it was mostly absent in the off-axis GRF. Peak off-axis GRF occurred at midstance for all subjects (Figure 1). Off-axis GRF at impact was similar (p = 0.52, Cohen’s d = 0.25) between injured (0.22 ± 0.13 BW) and uninjured groups (0.20 ± 0.10 BW). Peak off-axis GRF was also similar (p = 0.11, d = 0.63) between injured (1.24 ± 0.09 BW) and uninjured (1.31 ± 0.13 BW) groups. GRF/SK angle was highly variable (range -25.0° to 25.3°) during initial contact but means were similar between groups (injured 6.08 ± 13.5°; uninjured 7.97 ± 14.4°; p = 0.73, d = 0.14). **CONCLUSION:** Concerning running injury, the off-axis GRF may be 1) not a significant contributor to injury, 2) only important when combined with other factors, or 3) related only to specific injuries.

**Figure 1.** On-axis and off-axis components of GRF relative to the shank during stance in uninjured and injured runners. The impact peak is not a prominent feature of off-axis GRF. Neither off-axis GRF at impact nor peak off-axis GRF differ between groups.

**REFERENCES:**

Conclusion: When controlling for sex and running speed, BOG accounts for 40% of the variance in peak hip adduction, while only predicting <1% of the variance in contralateral peak pelvic drop. The increased peak hip adduction that accompanied a more narrow BOG is likely due to femoral adduction, as contralateral pelvic drop was minimally affected by BOG.

**B-40 Thematic Poster - Vascular Function**

Wednesday, May 30, 2018, 3:15 PM - 5:15 PM
Room: CC-Lower level L100F

**665** Chair: R Matthew Brothers, University of Texas at Austin, Austin, TX.

(No relevant relationships reported)

**666 Board #1** May 30 3:15 PM - 5:15 PM
Physical Activity Modulates Blood Pressure Regulation During Controlled Low and High Salt Diets

Austin T. Robinson1, Kamila U. Migdal1, Matthew C. Babcock1, Joseph C. Watson2, Megan M. Wenzel3, Sean D. Stocker2, William B. Farquhar, FACSM1, 1University of Delaware, Newark, DE.

*University of Pittsburgh, Pittsburgh, PA. (Sponsor: William B Farquhar, FACSM)*

(No relevant relationships reported)

**Purpose:** Increased blood pressure (BP) reactivity and variability are predictive of future cardiovascular events. Excess dietary salt exaggerates neurally-mediated BP reactivity, and BP variability in salt-resistant rodents. Regular physical activity (PA) blunts BP reactivity in rodents. However, the interaction of salt and PA on neurovascular regulation has not been investigated in humans. Therefore, we sought to test the hypothesis that high habitual PA mitigates high dietary salt-induced increases in BP reactivity and BP variability in healthy, young adults.

**Methods:** Nine participants (5F/4M, 27.2 ± 2 yrs, BMI: 23.3 ± 0.9 kg/m²) completed randomized, controlled 10-day diets of low (2.6 g/day) and high (18 g/day) sodium. Beat-to-beat BP variability (ΔBP ARV) were correlated against PA. Twenty-four-hour ambulatory BP monitoring. Habitual PA was assessed via accelerometry (Actigraph GT3X). Differences in high vs. low salt BP reactivity (ΔBP reactivity) and BP variability in salt-resistant rodents. Regular physical activity (PA) blunts BP reactivity in rodents. However, the interaction of salt and PA on neurovascular regulation has not been investigated in humans. Therefore, we sought to test the hypothesis that high habitual PA mitigates high dietary salt-induced increases in BP reactivity and BP variability in healthy, young adults. 

**Results:** There were no differences in 24-hr mean arterial BP on the high vs. low salt diet (82.9±2.1 vs. 79.8±2.4 mmHg; p>0.10). Urinary Na+ excretion increased on the high vs. low salt diet (256.9±20.5 vs. 39.5±11.2 mmol/24 hours; p<0.05). There was a trend for the high salt diet to augment systolic BP (p = 0.08), but not diastolic BP (p = 0.03), and there was a trend for an inverse correlation with Δ systolic BP reactivity (r = -0.68, p = 0.03) during hand grip exercise. There was a trend for higher 24-hr systolic BP ARV on the high vs. low salt diet. There was a trend for an inverse correlation with Δ diastolic BP reactivity (r = -0.68, p = 0.03) during hand grip exercise. There was a trend for higher 24-hr systolic BP ARV on the high vs. low salt diet. 

**Conclusion:** These preliminary data suggest that high habitual physical activity may offset some of the adverse neurovascular effects of high dietary salt in young, healthy, salt-resistant humans.

**667 Board #2** May 30 3:15 PM - 5:15 PM
Particulate Matter Air Pollution and Vascular Function in Older Adults: A Natural Experiment

Jayson R. Gifford1, Tyler Mangum2, Joshua Weavil2, Ashley Nelson3, Joshua F. Lee1, H. Jon Green2, Ryan Broxterman4, Matthew Rossman5, Russell Richardson6, 1Brigham Young University, Provo, UT. 2University of Utah, Salt Lake City, UT. 3University of Colorado: Boulder, Boulder, CO.

(No relevant relationships reported)

**Purpose:** The risk of cardiovascular complications in the elderly increases with acute elevations in ambient, fine particulate matter air pollution (PM2.5), and may be related to pollution-induced vascular dysfunction. Therefore, the purpose of this study was to utilize the large, episodic swings in ambient PM2.5, typical of the Wasatch Front in Utah, as a natural experiment to determine the extent to which acute exposure to ambient PM2.5 affects vascular function in healthy, older adults. 

**Methods:** Vascular function (flow-mediated dilation, FMD; passive-leg-movement-induced hyperemia, PFM), and pulmonary function were measured in 10 elderly subjects (70.5±2.3 years) during acute episodes of ~120 hours of low (3.4±0.8 μg/m³) and 24-96 hours of high (50.0±1.2 μg/m³), naturally-occurring ambient PM2.5 (Figures A and B). Markers of systemic inflammation were also assessed in venous blood during each visit. 

**Results:** Notably, high ambient PM2.5 exposure was associated with a 34% reduction in vascular function assessed by FMD (Low PM2.5: 8.9±1.0%; High PM2.5: 5.9±1.0%; P<0.05; Figure C), and a 78% reduction in vascular function assessed by PFM (area under the curve: Low PM2.5: 145±38 ml, High PM2.5: 31±25 ml; P<0.05, Figure D). Additionally, acute exposure to high ambient PM2.5 was accompanied by an increase in markers of systemic inflammation (e.g. Plasma C-Reactive Protein, Low PM2.5: 87±143 ml, High PM2.5: 136±220 ml/ml; P=0.05), which may contribute to the decrease in vascular function. Interestingly, natural exposure to high levels of PM2.5 did not significantly affect pulmonary function (FEV1/FVC: Low PM2.5: 74±2%; High PM2.5: 72±2%, P=0.05). 

**Conclusions:** Despite a lack of detectable changes in pulmonary function, acute, natural exposure to elevated ambient PM2.5 results in markedly impaired vascular function in older adults, possibly a consequence of pollution-induced systemic inflammation.

Within injured skeletal muscle the capillary bed plays a crucial role in leukocyte invasion through modulations of the endothelial integrity, associated with increased permeability. However, direct observation of altered microvascular permeability and compromised capillary integrity has not been technically feasible. Two-photon laser scanning microscopy (TPLSM) allows three-dimensional in vivo imaging which, given the depth of penetration and high resolution of TPLSM, will facilitate measurement of microvascular leakage. However, direct observation of altered microvascular permeability and compromised capillary integrity has not been technically feasible. Two-photon laser scanning microscopy (TPLSM) allows three-dimensional in vivo imaging which, given the depth of penetration and high resolution of TPLSM, will facilitate measurement of microvascular leakage. 

**Purpose:** We hypothesized that the regulation of capillary permeability in vivo, as assessed by real-time TPLSM, is temporally related to acute inflammatory and regenerative processes following muscle injury. 

**Methods:** Tibialis anterior muscles of anesthetized male Wistar rats (n=57) were subjected to eccentric contractions (ECC) via electrical stimulation. The skeletal muscle microcirculation was imaged by a intravenously infused fluorescent dye (rhodamine b isothiocyanate dextran, molecular weight 70,000 Daltons) to assess microvascular permeability via TPLSM 1, 3 and 7 days after ECC. 

**Results:** Compared with non-ECC control, the volumetrically-determined interstitial leakage of fluorescent dye had increased significantly on days 1 and 3 post-ECC (5.9±1.0%; High PM2.5: 74±2%; P<0.05 respectively days 1 and 3 vs. control). Percentage of VEGF-A positive muscle fibers in the damaged muscle. 

**Conclusion:** Notably, high ambient PM2.5 exposure was associated with a 34% reduction in vascular function assessed by FMD (Low PM2.5: 8.9±1.0%; High PM2.5: 5.9±1.0%; P<0.05; Figure C), and a 78% reduction in vascular function assessed by PFM (area under the curve: Low PM2.5: 145±38 ml, High PM2.5: 31±25 ml; P<0.05, Figure D). Additionally, acute exposure to high ambient PM2.5 was accompanied by an increase in markers of systemic inflammation (e.g. Plasma C-Reactive Protein, Low PM2.5: 87±143 ml, High PM2.5: 136±220 ml/ml; P=0.05), which may contribute to the decrease in vascular function. Interestingly, natural exposure to high levels of PM2.5 did not significantly affect pulmonary function (FEV1/FVC: Low PM2.5: 74±2%; High PM2.5: 72±2%, P=0.05). 

**Conclusions:** Despite a lack of detectable changes in pulmonary function, acute, natural exposure to elevated ambient PM2.5 results in markedly impaired vascular function in older adults, possibly a consequence of pollution-induced systemic inflammation.
skeletal muscle fibers were found only at 7 days post-ECC. CONCLUSION: In vivo TPLSM imaging represents a powerful investigative technique for skeletal muscle microvascularity research. Microvascular hyperpermeability is associated with ECC-induced muscle damage and increased VEGF expression.

669 Board #4 May 30 3:15 PM - 5:15 PM
Acute Ultraviolet Radiation Exposure Attenuates Nitric Oxide-Mediated Vasodilation in the Cutaneous Microvasculature
S. Tony Wolf, Anna E. Stanhewicz, Tyler B. Garner, Nina G. Jablonski, W. Larry Kenney, FACSM. Pennsylvania State University, University Park, PA. (Sponsor: W. Larry Kenney, FACSM)
(No relevant relationships reported)

The bioactive metabolite of folate, 5-methyltetrahydrofolate (5-MTHF), is degraded by ultraviolet radiation (UVR) in vitro, and UVR exposure to the skin may deplete bioavailable 5-MTHF in the exposed area. Adequate 5-MTHF is essential for full expression of nitric oxide (NO)-mediated vasodilation of the cutaneous microvasculature through its indirect role in enzymatic coupling of nitric oxide synthase (NOS). Purpose: To determine the acute effects of UVR exposure on NO-mediated vasodilation in the cutaneous microvasculature and the role of 5-MTHF on this response. We hypothesized that acute UVR exposure would attenuate NO-dependent vasodilation and that local delivery of 5-MTHF would augment NO-dependent vasodilation after UVR exposure. Methods: Two microdialysis fibers were placed in the central skin of both forearms in 11 healthy young adults (23±4 y; 56±9 kg/m²) for full expression of nitric oxide-mediated vasodilation of the cutaneous microvasculature. Once a stable skin blood flow plateau was achieved, 15mM NG-nitro-L-arginine methyl ester (L-NAME) was perfused at all sites to inhibit NOS. Cutaneous vascular conductance was calculated (CVC = LDF/MAP) and expressed for each phase of the local heating response (initial peak, plateau, NO-mediated vasodilation) as a percentage of maximum (%CVCmax). 28mM sodium nitroprusside (+43°C). Results: No differences were seen for %CVCmax between UVR and CON for the initial peak (p=0.51) or plateau heating (p=0.58) across microdialysis sites. UVR exposure blunted NO-mediated dilation in the UVR exposed arm compared to CON (16.4±12.1 vs 33.4±17.9%; p=0.02). Local delivery of 5-MTHF augmented NO-mediated vasodilation compared to the control site in the UVR exposed arm (36.4±19.9 vs 16.4±12.1%; p=0.005). Conclusion: NO-mediated vasodilation is attenuated after acute UVR exposure, but is restored with local delivery of 5-MTHF. Acute UVR exposure may impair NO-mediated vasodilation through photodegradation of 5-MTHF.

670 Board #5 May 30 3:15 PM - 5:15 PM
No Sex Differences in Arterial Stiffness and Hemodynamics Response to Resistance Exercise in Older Individuals
Georgios Grigoriadis1, Alexander J. Rosenberg1, Sang Ouk Wee1, Elizabeth C. Schroeder1, Garet Griffith1, Bo Fennhall, FACSM1, Tracey Baynard, FACSM2. 1University of Illinois at Chicago, Chicago, IL. 2California State University, San Bernardino, CA. (No relevant relationships reported)

Arterial stiffness (AS) contributes to high blood pressure and cardiovascular disease in both men and women. However, sex differences do exist in the incidences rates of stroke with aging, with older women having a greater risk. These sex differences in other individuals have not been fully explained and an acute hypertensive stimulus (e.g. resistance exercise (RE)) may provide a viable physiological stresor to elucidate potential differences. PURPOSE: To determine if sex differences exist for arterial stiffness following acute RE among older individuals. METHODS: Ten males (61 ± 6 yrs, 30.9 ± 4.4 kg/m²) and 15 females (59 ± 6 yrs, 25.6 ± 3.5 kg/m²) completed 3 sets of 10 reps of maximal isokinetic knee extension and flexion on a force dynamometer. Central AS was evaluated by pulse wave velocity (PWV), obtained from an automated ambulatory BP monitor at baseline, immediate and 30 min post-RE. Hemodynamic variables (cardiac output (Q), cardiac index (QI), heart rate (HR), stroke volume (SV), mean arterial BP (MAP),) were also acquired from the brachial oscilometric BP waveforms. Local AS was determined by carotid measurements (brachial stiffness index, pressure-strain elasticity modulus (Ep) and arterial compliance (AC)) using ultrasonography. RESULTS: See Table 1. PWV, Q, HR and MAP increased immediate post-RE similarly in both groups (p>0.05). However, females had an overall lower AC and Q compared to older males (p>0.05). CONCLUSION: No sex differences were observed in arterial stiffness following acute RE. Thus, the AS response to an acute RE bout did not provide insight regarding contributing factors as to why women are at a greater risk of cerebrovascular events.

671 Board #6 May 30 3:15 PM - 5:15 PM
Moderate-to-Severe Sleep Apnea and Total Body Fat are Inversely Associated with Vascular Function Changes Following Exercise Training
Devon A. Dobrosielski1, Christopher Papandreou2, Susheel Patil1, Hyunjeong Park1. 1Towson University, Towson, MD. 2Rovira i Virgili University, Reus, Spain. Johns Hopkins School of Medicine, Baltimore, MD. (No relevant relationships reported)

Obstructive sleep apnea (OSA) is associated with increased cardiovascular morbidity in middle-aged men due, in part, to impaired vascular function. Exercise confers cardioprotection by improving vascular health. Whether this beneficial effect is attenuated in the presence OSA is not known. PURPOSE: Examine the joint association of OSA severity and total body fat % with brachial artery flow mediated dilation (BAFMD) changes following exercise training in overweight men with and without OSA. METHODS: At baseline, all participants underwent overnight polysomnography to determine the presence of OSA, as defined by the apnea-hypopnea index (AHI). Total body fat was measured using dual energy X-ray absorptiometry. BAFMD was assessed using high-resolution ultrasonography before and upon completion of a 6-week (3 sessions/week; 1 hour/session) exercise training program. RESULTS: Five men with moderate to severe OSA (+OSA) and five men with no to mild OSA (+OSA) completed the study. Per study design, the AHI of the +OSA group was higher compared to the *OSA group (34 ± 12 events/hour vs. 8 ± 5 events/hour; p=0.009). While no baseline differences were observed between the groups in age (49 ± 6 years vs. 46 ± 9 years, p=0.528) or BMI (36.1 ± 6.2 kg/m² vs. 32.6 ± 8.3 kg/m²; p=0.250), total body fat % was higher in the +OSA group (41 ± 3 % vs. 36 ± 3 %, p=0.009). Stepwise regression analysis revealed that an AHI above 15 events/hour and total body fat % above the median (joint category) [beta coefficient = -2.89, (95% CI -3.59 - -2.21), p=0.000] were significant independent determinants of the change in BAFMD with exercise, after adjusting for baseline BAFMD, age and BMI. CONCLUSION: A combination of moderate-to-severe OSA and high total body fat % was inversely associated with the level of improvement in vascular function following exercise training.

672 Board #7 May 30 3:15 PM - 5:15 PM
Acute Influence of Caffeine on Arterial Stiffness and Central Blood Pressures Following Aerobic Exercise
Nicholas A. Carlini, Allison H. Steinbeck, Brittany Smith, Brandon Kistler, Bradley S. Fleenor, Matthew P. Harber, FACSM. Ball State University, Muncie, IN. (No relevant relationships reported)

Caffeine ingestion alters blood pressure (BP), however, the interactive effect of caffeine and exercise on central BP is unknown. PURPOSE: Examine the acute influence of caffeine and moderate-intensity aerobic exercise on post-exercise
central BP and arterial stiffness. METHODS: Ten males (aged 55±5; range 31-71 years) completed two exercise trials after ingestion of caffeine (400 mg) or placebo. Peripheral (brachial) and central (aortic) BP were assessed via pulse wave analysis (PWA) and arterial stiffness via pulse wave velocity (PWV) before and after 30 min post-ingestion. Participants performed 40-min of cycling at 70% of HRmax using identical workloads between trials. PWA and PWV were collected again 10 and 30 min post-exercise. Data were analyzed via two-way ANOVA with repeated measures.

RESULTS: Prior to exercise, compared to placebo, caffeine increased (P<0.05) brachial systolic blood pressure (bSBP) (+12mmHg), brachial diastolic blood pressure (bDBP) (+8mmHg), central systolic blood pressure (cSBP) (+11mmHg) and central diastolic blood pressure (cDBP) (+7mmHg). PWV was higher (0.75 vs. 0.22m/s) 30 minutes post caffeine ingestion, independent of trial (P<0.05) while there was a trend for an interaction (P=0.074), suggesting an increase in PWV with caffeine. Post-exercise, bSBP (+4.8 vs. -6.1mmHg) and PWV (+0.40 vs. -0.74m/s) were higher in caffeine (P<0.05), likely due to the influence of caffeine prior to exercise. cSBP (-5 vs. -6mmHg) and bSBP (-3.5 vs. -1.8mmHg) were lower after exercise, independent of trial (P<0.05) while bSBP (-4.8 vs. -6.1mmHg) and cDBP (-3.1 vs. -1.5mmHg) tended (P=0.07) to be lower after exercise, independent of trial. PWV (+0.11 vs. -0.06m/s) remained higher (P<0.05) after exercise in caffeine compared to placebo but was not influenced by exercise. Accordingly, AP (-2.7 vs. -1.1mmHg) and Aix (-5.5 vs. -1.2%) were lower (P<0.05) after exercise in placebo only. CONCLUSION: These findings suggest that the stimulatory effects of caffeine ingestion elevates central hemodynamics and arterial stiffness, which persists even after exercise, exerting a greater afterload on the heart.

Chronic kidney disease (CKD) is an independent risk factor for the development of cardiovascular disease, with both diseases characterized by reduced nitric oxide (NO) bioavailability and vascular dysfunction. Passive leg movement (PLM) has previously been shown to produce NO-mediated hyperemia in the lower extremity, however this technique has not yet been utilized to assess vascular function in patients with CKD. PURPOSE: To assess vascular function in patients with CKD using PLM, in addition to the traditional flow-mediated dilation (FMD) technique. METHODS: Assessment of vascular function via PLM and FMD was performed on 12 patients (CKD, 67±3 yrs) and 12 healthy controls (CON, 59±2 yrs). Hemodynamics and artery diameters during PLM and FMD were measured utilizing ultrasound Doppler of the femoral and brachial arteries, respectively. RESULTS: Patients with CKD had reduced peak leg blood flow (LBF) (CKD, 384±39 vs. CON, 626±93 mL/min, p<0.05) and a reduced change in LBF from baseline to peak (ΔpeakLBF) (CKD, 153±27 vs. CON, 274±41 mL/min, p<0.05) during PLM compared to CON. Additionally, ΔpeakLBF was significantly correlated with kidney function as estimated glomerular filtration rate for all participants (r=0.93, p<0.05). As anticipated, FMD was also significantly attenuated in CKD patients compared to CON. CONCLUSION: Vascular function as assessed by PLM and FMD is attenuated in patients with CKD compared to controls, supporting a reduction in NO bioavailability in this chronic disease state. Additionally, PLM appears to be a novel and feasible approach to assess NO-mediated vascular function in CKD and is associated with kidney function.

Body composition is an established predictor of cardiometabolic risk. Novel body composition variables may also predict risk and therefore, warrant further examination. PURPOSE: To assess the influence of fat to muscle ratio (FMR), percent body fat (%BF), and body mass index (BMI) on cardiometabolic risk factors in healthy adults. METHODS: Data were analyzed from 78 women (29.9±13.5 years) and 45 men (25.0±8.5 years). Height, weight, %BF (via dual-energy X-ray absorptiometry), resting blood pressure, and resting heart rate (RHR) were measured. BMI and mean arterial pressure (MAP) were calculated. Fasting total cholesterol (TC), high-density lipoprotein cholesterol (HDL), TC:HDL ratio, low-density lipoprotein cholesterol (LDL), triglycerides (TG), glycosylated hemoglobin (A1c), glucose (GLU), and insulin (INS) were measured. A 2-hour oral glucose tolerance test was performed, with 2-hour glucose (2Hr-GLU) and 2-hour insulin (2Hr-INS) measured. Intrafast sensitivity index (ISI) and homeostasis model assessment for insulin resistance (HOMA) were calculated. The influence of FMR [visceral fat area (cc) - fat free mass (kg)], BMI (kg · m⁻²), and %BF on markers of cardiometabolic risk was determined. RESULTS: Regression analysis showed that FMR was the strongest predictor of MAP, TC, TC:HDL ratio, LDL, TG, GLU, INS, and HOMA. %BF was the strongest predictor of RHR, 2Hr-GLU, 2-HR-INS, and ISI. BMI was the strongest predictor of HDL and A1c. One-way MANOVA (above- vs below-75th percentile) showed a significant multivariate (MAP, TG, HOMA) main effect for FMR. Wilks’ Lambda = 0.628, F (4,96) = 14.24, p < 0.001, with univariate main effects for MAP (F = 22.2, p < 0.001), TG (F = 8.39, p = 0.005), and HOMA (F = 16.27, p < 0.001). MANOVA also revealed a multivariate main effect for BMI (Wilks’ Lambda = 0.695, F(6,96) = 10.55, p < 0.001), with univariate main effects for MAP (F = 18.7, p < 0.001) and HOMA (F = 19.5, p < 0.001). MANOVA showed a multivariate main effect for %BF (Wilks’ Lambda = 0.770, F(4,96) = 7.17, p < 0.001), with univariate main effects for MAP (F = 13.8, p < 0.001) and HOMA (F = 10.6, p = 0.002). CONCLUSION: These data show FMR was a better predictor of several risk factors compared to %BF and BMI. This suggests that this method of calculating FMR may be effective for assessing cardiometabolic risk in adults.

Purpose: The purpose of this study was to determine the association between changes in weight to changes in total and regional fat and lean mass in a group of division 1 football players. Methods: A total of 78 players completed a pre-season (June) and Post-season (December) body composition scan using dual x-ray absorptiometry. Absolute and percentage changes in total and regional body composition were calculated. Linear regression was used to measure the association between change in weight and change in total lean (TLM) and total fat mass (TFM) for the entire sample and for each position. Linear regression was also used to analyze the association between change in TLM and TFM with %change in regional lean and fat mass. Results: Position did not have a significant effect on the association between change in weight and change in TFM or TLM (p=0.171, p=0.172 respectively). However, change in weight was strongly associated with change in TFM for the entire group (slope ± SE = 0.8 ± 0.06, p <0.001 R²=0.72). Conversely, change in weight was weakly associated with change in TLM for the entire group (slope ± SE = 0.2 ± 0.06, p <0.001 R²=0.14).
Change in TLM was not significantly associated with change in TFM (slope(SE) = -0.12(0.06); p = 0.125, R² = 0.03). Regionally, the strongest association was between %change in TFM with %change in Total body fat (1.62(0.08), p < 0.001, R² = 0.54). For lean mass, both %change in Trunk LM and Leg LM had similar associations with %change in TLM (R² = 0.43 & 0.38, p<0.001 for both). When comparing each position separately, only RB (n=6) had a strong positive association between change in weight and change in TLM (R² = 0.82, p = 0.001), but no association between change in weight and change in TLM (R² = 0.05, p = 0.879). Conclusion: These data suggest that changes in weight during a competitive football season are largely driven by changes in fat mass, except for potentially RB. The slopes of the relationship suggest that on average from every 1 kg (2.2 lbs) of weight increase there is 0.8 kg (1.8 lbs) increase in TFM. Additionally, there a higher proportion of fat increase is distributed to the android and abdominal region. Given the relationship between increased fat mass with both reduced performance and injury risk, teams should focus on closely maintaining athlete weight during the season.

Impact on BIA-Derived Measurements of Body Composition

Caffeine Consumption in Habitual Users Has No Impact on BIA-Derived Measurements of Body Composition

Cassie M. Williamson, Brett S. Nickerson, Emily E. Betchke, Cherlyn McFaster, Brian M. Kiszczewicz, Kennesaw State University, Kennesaw, GA, 30040.

Sponsor: Miller Tillman, FACSM

No relevant relationships reported

Biomechanical impedance analysis (BIA) is often used to estimate total body water (TBW), intracellular body water (ICW), extracellular body water (ECW), and body fat percentage (BF%). A common restriction for BIA analysis is abstinence from caffeine (2-12 hours) before testing. However, researchers have attempted to determine whether the consumption of caffeine influences BIA testing results. PURPOSE: The purpose of this study was to determine if the consumption of caffeine influences BIA-derived BF% and body water values in habitual caffeine users. METHODS: 20 apparently healthy males (26.6 ± 4.1 years) identified as habitual caffeine consumers (≥ one 95mg serving per day ≥ 4 days per week) participated in this study. Participants came to the lab on three occasions, the first visit serving as the control (CON) with no supplementation. The remaining two visits were performed in a randomized double-blind, cross-over fashion. Participants consumed 200g of dextrose (PLA) or caffeine (CAF) in capsule form. During each visit, seven multi-frequency BIA measurements were conducted before (PRE) and after (POST) and (P<0.05) for the remaining time points (i.e., 30-, 45-, 60-, 75-, and 90-min). However, the effect size (ES) of the BF% differences were small. The CON, PLA and CAF conditions had higher PRE ICW values than their associated post time points (i.e., 15-, 30-, 45-, 60-, 75-, and 90-min). However, similar to BF%, the ES of the mean difference for ICW were all marginal. No other differences were observed. CONCLUSION: Caffeine consumption in habitual users produced trivial changes in TBW, ECW, ICW, and BF%. Therefore, the pre-testing guidelines for caffeine consumption may be too stringent in habitual caffeine consumers.

Regional Variations in Physical Fitness and Activity in Ecuadorian Adolescents

Cheryl A. Howe, FACSM,1 Sharon L. Casapulla,1 Jay Shubrook,2 Pablo Lopez,2 Mario J. Grijalva,1 Darlene Berryman,1 L. Benelizcar,1 1Ohio University, ATHENS, OH; 2Toaru University, Valles, Chi. 1Pontificia Catholic University of Ecuador, Quito, Ecuador.

No relevant relationships reported

As obesity rates are related to physical inactivity, and physical inactivity is positively related to economic status, it is important to assess the lifestyle habits of adolescents in countries, like Ecuador, who are undergoing significant economic growth. PURPOSE: Assessed the physical fitness (PF) and physical activity (PA) levels of adolescents from two different regions of Ecuador and their relationship with peer/familial influence on PA and PF. METHODS: Adolescents (N=407) were recruited from 4 schools: 2 from a suburb of Quito (n=217; Northern Sierra region) and 2 from the smaller town of Cariamanga (n=214, Southern Sierra region). Height (cm) and weight (kg) measurements were used to calculate BMI for weight classification. PF was estimated using a post-exercise heart rate following a 3-min step test. A questionnaire was used to assess PA habits (moderate-vigorous PA and sedentary behavior) and perceived peer/familial support for being physically active. T-Tests and ANOVAS assessed differences in outcome variables by sex, weight status and location. Person correlations assessed relationships among PF, PA habits, and perceived peer/familial influence. RESULTS: According to IOTF standards, 12.3% of the adolescents were classified as overweight or obese. Overall, PF level was 43.4±8.9 ml/kg/min, with males significantly higher than females (48.3±9.4 vs. 41.1±7.5 ml/kg/min) and Southern Sierra adolescents significantly higher than Northern Sierra (47.1±9.6 vs. 39.7±6.1 ml/kg/min) adolescents. Overweight adolescents had significantly lower PA levels compared to healthy and overweight adolescents only in Southern Sierra region (42.3±8.5 vs. 46.9±8.6 vs. 50.5±11.1 ml/kg/min, p < 0.0001). Most adolescents reported participating in <60 min/day of moderate-vigorous PA (91.6%) and spending >2 hours/day in sedentary behaviors (79.9%). While perceived peer/familial influence did not correlate well with PF or PA levels (r=0.18 and 0.20; adj. r=0.05), males perceived greater peer influence for PA participation than females, regardless of weight status or location. CONCLUSIONS: While adolescents of Southern Sierra had higher PF levels, these values were impacted by sex and weight status, but not by PA levels or perceived peer or family influence.
Official Journal of the American College of Sports Medicine
Vol. 49 No. 5 Supplement S123

(UH: PP = 913 ± 305 to 1033 ± 300 W; AP = 11.5 ± 1.1 to 12.6 ± 1.1 W/kg; SH: PP = 839 ± 162 to 887 ± 181 W; AP = 11.8 ± 1.1 to 12.5 ± 1.2 W/kg) and aerobic capacity (UH VO2 max = 35.8 ± 6.9 to 38.9 ± 6.1 ml/kg/min; SH: VO2 max = 39.7 ± 9.3 to 42.6 ± 9.1 ml/kg/min) significantly (p<0.05) increased in both groups. There were no significant (p>0.05) differences between groups. **CONCLUSION:** Current literature has shown a 20:10s work-to-rest ratio to be the shortest, most effective HIIT protocol, as performed by the SH group. However, in the present study, the UH group improved FFM, VL CSA, anaerobic, and aerobic fitness in a similar manner to the SH group. These findings suggest that individuals may be able to achieve similar health benefits as the SH protocol, despite exercising for less total time by performing HIIT with a 10:5s work-to-rest ratio.

**B-42** Free Communication/Slide - Mitochondria and Metabolism in Health and Disease

**Wednesday, May 30, 2018, 3:15 PM - 5:15 PM**
**Room: CC-101CD**

**683** Chair: Gordon Fisher, FACSM. University of Alabama - Birmingham, Birmingham, AL.
(No relevant relationships reported)

Cancer associated muscle wasting (cancer cachexia) negatively affects the prognosis and treatment of cancer. Specifically, 20-40% of cancer deaths are attributable to cancer cachexia, however current treatments for cachexia are ineffective at reducing mortality. More so, it is currently postulated that once cachexia has developed, it may be impossible to halt its progression. Therefore, a better understanding of the early mechanisms contributing to cachexia are necessary to develop effective therapeutics to halt cachexia before significant muscle loss occurs. Mitochondrial function is thought to largely mediate muscle health and may be a key contributor to the development of cachexia. **PURPOSE:** To examine the initial effects of tumor cell-derived factors on mitochondrial function and subsequent cell proliferation. **METHODS:** C2C12 cells were treated with either CON media (1:1 ratio of DEMEM to C2C12 conditioned media) or LLC media (1:1 ratio of DEMEM to Lewis Lung Carcinoma conditioned media) for 4-72 hrs. Cells were then measured for mitochondrial polarization, superoxide production, and cell proliferation. Results were analyzed by blocked t-tests (CON v. LLC, blocked by experiment repeat). Results: After 4 hrs of incubation with LLC media, cells had a ~12% greater mitochondrial polarization compared to CON (p=0.0002, Hedge’s g effect size=1.08), with no difference in mitochondrial superoxide production (p=0.78, Hedge’s g effect size= 0.10). After 24 hrs of incubation, mitochondrial polarization remained elevated by ~10% compared to CON (p=0.008, Hedge’s g effect size=0.69) and mitochondrial superoxide production was increased ~12% compared to CON (p=0.009, Hedge’s g effect size=0.99). However, LLC incubation for 24, 48 and 72 hrs did not alter cell proliferation (p=0.89, 0.13, and 0.45 respectively, Hedge’s g effect size = 0.05, 0.53, and 0.27 respectively). **CONCLUSIONS:** Tumor-derived factors appear to have dramatic effects on muscle mitochondrial polarization and subsequent superoxide production. However, these alterations do not appear to affect muscle proliferative capacity. This study was supported by The National Institutes of Health R15AR069913.

**684** May 30 3:15 PM - 3:30 PM
**Tumor Derived Factors Induce Muscle Mitochondria Hyperpolarization And Subsequent Superoxide Production**

Megan E. Rosa-Caldwell, Jacob L. Brown, David E. Lee, Tyrone A. Washington, Nicholas P. Greene. University of Arkansas, Fayetteville, AR. (Sponsor: Dr. Stephen Crouse, FACSM)
(No relevant relationships reported)
S124 Vol. 49 No. 5 Supplement

MEDICINE & SCIENCE IN SPORTS & EXERCISE®

WEDNESDAY, MAY 30, 2018

ACSM May 29 – June 2, 2018 Minneapolis, Minnesota

PURPOSE: We studied the effects of HSPT2 knockout (KO) on metabolism in female mice to determine whether sex plays a role in phenotypic outcome.

METHODS: We used a standard metabolic phenotyping evaluation of WT and HSPT2-KO female mice fed a normal chow diet (age 3 - 10 months). Additionally, to induce metabolic challenge, WT and HSPT2-KO mice performed two exercise protocols. Protocol 1: Chronic voluntary wheel running for 30-days. Protocol 2: Acute treadmill running (90 min, 15 m/min, 5° incline). Comparison of means of difference were by two-way ANOVA or t-test (P<0.05, a priori; values presented as mean ± SEM).

RESULTS: In contrast to male HSPT2-KO mice, female KO animals were protected against aging-induced metabolic dysfunction and insulin resistance. Moreover, we observed no significant difference in grip strength, run time to exhaustion, latency to fall, or maximum running speed, between the genotypes. Although no differences in metabolic homeostasis or physical performance were detected between the genotypes of female mice, we did observe marked differences in expression of compensatory signaling nodes including transcription factors, the mt proteome, and mt fission-fusion-mitophagy dynamics in HSPT2-KO compared with WT. Computational modeling and pathway analysis identified over 100 proteins differentially expressed between the genotypes. We found that ERα is strongly induced in muscle of female HSPT2-KOs compared with WT, and we are currently testing whether ERα confers preservation of metabolic function in female vs. male HSPT2-KOs.

CONCLUSIONS: Our findings show sex differences related to importance of HSPT2 expression for the maintenance of metabolic health and exercise performance.

May 30 3:45 PM - 4:00 PM
Mitochondrial Fusion Is Essential For Regulation Of Adult Skeletal Muscle Mass And Protein Synthesis
Graham R. McGinnis, Zachary D. Bush, Margaret B. Bell, Glenn C. Rowe. University of Alabama at Birmingham, Birmingham, AL.

(no relevant relationships reported)

Purpose: Mitochondrial dynamics and the function and health of skeletal muscle are inextricably linked. To preserve proper function, muscle mitochondria undergo constant remodeling through fusion and fission events. Mitochondrial fusion is regulated by fission 1 (Fis1) and dynamin-related protein 1 (Drp1), while fusion is regulated by three GTPases; mitofusin 1 and 2 (Mfn1, Mfn2) and optic atrophy 1 (Opa1). However, the role of mitochondrial fusion in adult skeletal muscle mass regulation is not fully understood. We hypothesized that genetic disruption of mitochondrial fusion in adult skeletal muscle will impair muscle function and growth.

Methods: We therefore developed and characterized adult inducible skeletal muscle specific Mfn1/2 double knockout mice (MFNDKO). Genetic deletion was induced in adult mice and confirmed by qPCR and western blot. Body/muscle size and composition was analyzed gravimetrically and by QMR. Muscle function was assessed by grip test. Interruption of pathways regulating muscle mass, including atrophy and autophagy were performed by qPCR and western blotting. In vivo and in vitro protein synthesis rates were evaluated using a puromycin incorporation assay. Results: MFNDKO mice exhibited a progressive decrease in body weight (~20% lower than CON, respectively; p < 0.05). This reduction in body weight was accompanied by a decrease in lean mass, confirmed by QMR, gastrocnemius wet weight (~20% lower than CON, respectively; p < 0.05). This reduction in body weight was associated with a decrease in protein expression of ETC subunits for Ndufb8 (86%; p <0.05) and Mtc0I (50%; p <0.05). We did not observe any significant changes in mRNA expression of nuclear encoded ETC subunits, while mitochondrial encoded subunits (ND2, NDS, Cvtb, COX2 and ATP6) were all reduced in MFN2 KO by ~77% (p <0.05). These data suggest that the decrease in exercise activity is the result of impaired ETC complex activity and expression.

Conclusion: Taken together these results suggest that mitochondrial fusion in adult skeletal muscle is required for normal exercise performance.

Acknowledgments: We are grateful to the UAB DRC BARB Core P30 DK079626. This work supported in part by NIH AR062128 to GCR.

May 30 4:15 PM - 4:30 PM
Human Muscle Fiber-Specific Responses of Mitochondrial Fusion Proteins to Sprint Interval and Moderate-Intensity Continuous Training
Lauren E. Skelly1, Jenna B. Gillen1, Barnaby P. Frankish2, Florence E. Godkin1, Mark A. Tarnopolsky3, Robyn M. Murphy4, Martin J. Gibala1. 1McMaster University, Hamilton, ON, Canada. 2La Trobe University, Melbourne, Australia. (Sponsor: Dr. Stuart Phillips, FACSIM

(no relevant relationships reported)

Mitochondrial dynamics, a process regulated by mitochondrial fusion and fission, is important for the maintenance of high quality mitochondria and healthy metabolic function. Low-volume sprint interval training (SIT) increases mitochondrial content to a similar extent as moderate-intensity continuous training (MICT); however, limited data are available regarding the effect of these diverse training approaches on mitochondrial dynamics proteins. Research has also relied primarily on whole muscle analyses which may mask fiber-type specific training adaptations.

PURPOSE: To examine changes in mixed whole muscle and fiber-type specific mitochondrial fusion protein abundance following 12 weeks of low-volume SIT and MICT.

METHODS: Sedentary adults performed 32 sessions of SIT (n=8) or MICT (n=9). SIT involved 3 x 20 sec “all out” cycle sprints at 5% body mass (~500 W) interspersed with 2 min rest and MICT involved 45 min of continuous cycling at ~70% of maximal heart rate (~110 W). Biopsies (vastus lateralis) were obtained before training and 96 h after the final session. The protein contents of optic atrophy 1 (OPA1) and mitofusin 2 (Mfn2) were measured in mixed muscle homogenates and pooled segments of type 1 and II fibers using Western blotting, normalized to total protein content within each sample.

RESULTS: Training increased the mixed whole muscle protein content of OPA1 [1.0 ± 0.3 to 1.5 ± 0.3 (arbitrary units (AU))] and Mfn2 [1.0 ± 0.2 to 1.1 ± 0.2 (AU)] with no differences between treatments (p < 0.05, main effect). OPA1 content increased after training (p < 0.05, main effect) in both type I (1.3 ± 0.6 to 1.9 ± 0.8 AU) and type II fibers (1.0 ± 0.4 AU) but there were no fiber-type differences in Mfn2 content. OPA1 content increased after training in type I (1.4 ± 1.1 to 2.2 ± 1.5 AU, p = 0.03) but not type II fibers (1.9 ± 1.6 to 2.0 ± 1.1 AU; p = 0.73). Prior to training, OPA1 content was higher in type I versus type II fibers (1.3 ± 0.6 vs. 1.0 ± 0.4 AU, p < 0.01) but there were no fiber-type differences in Mfn2 content.

CONCLUSIONS: Twelve weeks of low-volume SIT and MICT induces similar increases in mixed whole muscle and fiber-type specific mitochondrial fusion proteins. The potential of SIT to induce comparable skeletal muscle adaptations as MICT despite a reduced exercise volume may be related to a higher intensity per se and/or the intermittent contractile pattern.

May 30 4:00 PM - 4:15 PM
Skeletal Muscle Mitochondrial Fusion is Required for Exercise Performance and Mitochondrial Oxidative Capacity
Glenn C. Rowe, Zachary D. Bush, Margaret B. Bell, Graham R. McGinnis. University of Alabama at Birmingham, Birmingham, AL.

(no relevant relationships reported)

PURPOSE: Endurance exercise has been shown to be a positive regulator of skeletal muscle metabolic function. Changes in mitochondrial dynamics (fusion and fission) have been shown to influence mitochondrial oxidative capacity. We therefore tested whether genetic disruption of mitofusins (Mfn1s) affected exercise performance in adult skeletal muscle.

METHODS: We generated adult inducible skeletal muscle-specific Mfn1 (iMS-Mfn1KO), Mfn2 (iMS-Mfn2KO) and Mfn1/2 knockout mice (iMS-MfnDKO). We assessed exercise capacity with a treadmill time to exhaustion stress test pre-deletion and up to 8-weeks post-deletion. We measured individual electron transport chain (ETC) complex activity of both the subsarcolemmal (SS) and intermyofibrillar (IMF) mitochondria by high resolution spectrophotometry. We also performed qPCR and western blotting analysis to measure the expression of ETC subunits.

RESULTS: Analysis of either the iMS-Mfn1KO or iMS-Mfn2KO did not reveal an effect on exercise capacity, suggesting a possible functional redundancy between the two Mfn1s. However, analysis of the iMS-MfnDKO animals revealed a progressive reduction (66% reduction; p <0.05) in time to exhaustion. The decrease in exercise capacity was associated with a reduction in ETC activity in both the SS and IMF mitochondrial fraction for Complex I (70% and 80% respectively; p <0.05) and Complex IV (60% and 80% respectively; p <0.05). Notably only the IMF fraction for Complex II and Complex V exhibited a significant reduction in activity (70% and 67% respectively; p <0.05), while Complex III was completely unaffected. These changes in enzymatic activity was associated with a decrease in protein expression of ETC subunits for Ndufb8 (86%; p <0.05) and MtCOI (50%; p <0.05). We did not observe any significant changes in mRNA expression of nuclear encoded ETC subunits, while mitochondrial encoded subunits (ND2, NDS, Cvtb, COX2 and ATP6) were all reduced in IMF by ~77% (p <0.05). These data suggest that the decrease in exercise activity is the result of impaired ETC complex activity and expression.

Conclusion: Taken together these results suggest that mitochondrial fusion in adult skeletal muscle is required for normal exercise performance.

Acknowledgments: We are grateful to the UAB DRC BARB Core P30 DK079626. This work supported in part by NIH AR062128 to GCR.
Sleep-loss is emerging as an important risk factor for the development of impaired glucose tolerance, insulin resistance (IR) and, subsequently, type 2 diabetes mellitus. While the mechanisms underlying these changes remain to be fully elucidated, in some instances their development may be associated with reduced mitochondrial function. This suggests sleep-loss may also impair mitochondrial function, but this has not been investigated. Given the possible relationship between mitochondrial function and IR, exercise could be used as a strategy to counteract the detrimental physiological changes induced by sleep-loss; however, this has not been demonstrated. 

**Purpose:** To investigate the effect of sleep-loss, with or without exercise, on skeletal muscle mitochondrial function and glucose tolerance. 

**Methods:** Twenty healthy male participants were allocated into one of three experimental groups: control group (CON, n=7) (8 h sleep opportunity for 5 nights), a sleep-restricted group (SR, n=7) (4 h sleep opportunity for 5 nights), and a sleep-restricted and exercise group (SR+EX, n=6) (4 h sleep opportunity for 5 nights and 3 x high-intensity interval exercise (HIIE) sessions). 

**Results:** Mean sleep duration per night for CON, SR, and SR+EX was 44±25, 23±13 and 237±55 minutes, respectively. There was a significant reduction in mitochondrial respiratory function (Ȯ2 flux - pmol/sec/mg tissue) from pre-to post-intervention in the SR group (316±16 vs 65±24, p<0.05), but this remained unchanged in the CON (70±5 vs 64±12, p>0.05) and SR+EX (78±20 vs 79±28, p>0.05) group. OGTT total area under the curve was altered post intervention in the SR group (692±89 vs 832±57 units, p<0.05), but remained unchanged in the CON (741±202 vs 677±184, p>0.05) and SR+EX (645±51 vs 702±83, p>0.05) groups.

**Conclusion:** Sleep-loss was associated with a reduction in mitochondrial respiratory function and a decrease in glucose tolerance. However, these changes were mitigated by performing HIIE, demonstrating exercise as a potent and cost-effective strategy to alleviate some of the negative metabolic effects of sleep loss.

**Purpose:** Bariatric weight-loss surgery can resolve or ameliorate type 2 diabetes (T2D). The cellular and molecular adaptations driving this response remain largely unknown, but some evidence points to epigenetic changes in skeletal muscle following surgery. We assessed global skeletal muscle methylation patterns prior to and 1 year after Roux-en-Y gastric bypass surgery (RYGB) in women with and without T2D to determine if diabetes modifies the response of the skeletal muscle methylome to weight-loss surgery. 

**Methods:** Global vastus lateralis methylation profiles were generated via Illumina 450k Arrays pre- and 1 yr post-RYGB in adult female diabetics (N=12) with (D; n = 6, age = 51 ± 6 yr, BMI = 53.0 ± 5.8 kg/m²) and without (ND, n=6, 43 ± 6 yr, 51.0 ± 9.2 kg/m²) T2D. Clinical values for insulin, glucose, and HOMA were measured at each time point. RM ANCOVA (group*time with age covariate) assessed changes in skeletal muscle methylation profiles in Partek Genomics Suite. Resultant methylation probes were filtered at p<0.001 and uploaded into Ingenuity Pathway Analysis for biological interoperation. 

**Results:** RYGB reduced BMI (P < 0.01; 46.2% ± 28.3) and HOMA (p = 0.01, -1.9 ± 2.4) 1 yr following surgery; with no differences between groups. ANCOVA detected interaction effects in 9016 methylation sites in 6059 known genes. Overall, 7541 methylation sites in 4557 genes were altered 1 yr following RYGB in ND as compared to 4056 methylation sites in 3245 genes in diabetics. Biological pathway analysis of genes with differential methylation in diabetics identified key metabolic signaling pathways such as AMPK Signaling (80 genes; p = 9.7 x 10^-4), and PI3K/AKT Signaling (52 genes; p = 2.7 x 10^-4), and P70S6K Signaling (44 genes; 9.82 x 10^-4). Our analysis also identified hypomethylation in the promoter region of key metabolic genes IRS1 (-4.8% methylated following surgery), SLC2A4 (GLUT4; -2.8% to -3.9%), and GSK3 (-3.4%) following surgery. 

**Conclusion:** Skeletal muscle DNA methylation 1 year following RYGB suggest epigenetic changes in key metabolic signaling genes that are modified by diabetes. Changes in gene and protein expression of these genes have previously been demonstrated with improved glucose homeostasis. These data identify DNA methylation patterns that may play an important role in diabetes resolution following surgery.
Clinical Case Slide - Foot and Ankle

Wednesday, May 30, 2018, 3:15 PM - 4:55 PM
Room: CC-200E

692 Chair: Stephen M. Simons, FACSM. South Bend Notre Dame Sports Medicine Fellowship, Mishawaka, IN. (No relevant relationships reported)

693 Discussant: Adam S. Tenforde. Spaulding Rehabilitation Hospital, Milton, MA. (No relevant relationships reported)

694 Discussant: David Smith. University of Minnesota, Minneapolis, MN. (No relevant relationships reported)

695 May 30 3:15 PM - 3:35 PM
Ankle Injury - Rugby Union (7-players-a-side)

HISTORY: A 22-year-old men’s club Division I Rugby-7s winger, injured his right ankle post a simultaneous opposing two-player tackle. Tackler—one locked the ball carrier’s foot in place wrapping the lower leg, and tackler-two changed the direction of the upper body of the player which overcame ankle mortise stability and strength, inducing an ankle inversion. Post-tack, injured player complained of pain and inability to bear weight. History noted, no ankle supports/brace or tape used, and no previous ankle injury/surgeries. PHYSICAL EXAMINATION: Side-line emergency services removed injured foot cleat, found ankle deformity, which was secured for transport. ED exam revealed patient with a medially deformed right foot. Exam noted localized pain and tenderness, post-palpation on right ankle deformity and lower leg, plantar flexed and supinated. Mild swelling, no lacerations or open wounds noted. Patient’s limited exam secondary to pain, however, reflected no decreased right sided lower extremity sensation, reflexes or strength. Patient was able to flex and extend toes despite extreme pain of deformed limb. Injured limb had a noted palpable dorsalis pedis and posterior tibialis pulse. DIFFERENTIAL DIAGNOSIS: 1. Subtalor joint subluxation/dislocation 2. Open sub-talar dislocation 3. Tibial-talar dislocation 4. Fractures of the ankle/foot TEST AND RESULTS: Ankle anteroposterior radiograph - right posterior dislocation, ankle lateral radiographs— navicular dislocation laterally from talus -rotation subluxation of calcaneus medially from the talus -no associated fractures of the tibia/talus including malleoli. FINAL WORKING DIAGNOSIS: Closed right posterior medial peri-talar dislocation without associated fracture. TREATMENT AND OUTCOMES: 1. Emergency. Clearly seen on radiograph 2. Immediate ED conscious sedation closed-reduction, entailing injured knee flexion to relax gastrocnemius, with traction to heel/forefoot of injured ankle to reduce joint. 3. Short-leg cast post-reduction, PWB for 4 weeks. Rehabilitation post cast removal, with ROM and heel/calf stretches, progressing to strengthening. FWB at 7 weeks post-injury and cleared for sport. 4. 3-month follow-up, FWB, 7° dorsiflexion, 32° plantar-flexion, 14° inversion, and 10° eversion with no restrictions.

696 May 30 3:35 PM - 3:55 PM
Toe Injury - Dance
Julie Han, Andrea Stracciolini, Pierre d’Hemecourt. Boston Children’s Hospital, Boston, MA. (No relevant relationships reported)

HISTORY: A 21-year-old female college dancer presented with right great toe injury that occurred in February 2017 when she twisted the toe while pivoting then felt a pop and severe pain. X-rays at the ED were negative for fracture. She was able to continue dancing despite pain and had multiple episodes of re-injury. She was first evaluated in the Sports Medicine clinic in April 2017 after a recent episode of re-injury of first toe medial deviation while dancing with buddy taping, and intrinsic foot injury of first toe medial deviation while dancing with a pop sensation and swelling. MRI right foot: Complete lateral collateral ligament tear of the first MTP joint at the metatarsal attachment. No bony avulsion, normal alignment, normal plantar plate. FINAL DIAGNOSIS: Tear of the first MTP lateral collateral ligament in a dancer with resultant joint instability OUTCOME: Walking boot for 5-6 weeks, without dancing, and improvement of symptoms at follow-up in July 2017-Weaned out of boot, started physical therapy, progressed back into dancing with buddy taping-August 2017, noted 60% improvement of pain but continued 1st MTP joint instability-Referral to Orthopedic Surgeon Dr. Lyle Micheli for surgical opinion with consultation from Dr. William Hamilton, dance medicine expert in New York City-Per recommendations, she underwent two series of PRP injections of the LCL in August and October 2017, follow-up is pending.

697 May 30 3:55 PM - 4:15 PM
Footloose
Julie Shelly. University of Oklahoma Health Sciences Center, Oklahoma City, OK. (No relevant relationships reported)

History:
A 27 year-old minor league baseball player presents to the ER with right ankle pain after sustaining an injury landing on first base. After hitting a ground ball, the player ran to first base and inverted his right ankle after stepping on the first baseman’s foot. He had immediate pain and an obvious deformity in the right ankle. He was not able to ambulate due to pain. He had no neurovasculary intact. There was no obvious skin puncture. The patient’s right foot and ankle were immobilized on the field in a SAM splint, and the player was sent to the ER. He denied any previous injury to this ankle.

Physical Exam:
Examination of the right foot and ankle revealed an obvious deformity of right ankle without laceration or skin puncture. Patient was able to move all toes but unable to move the ankle due to pain. He was neurovasculary intact. Exam was limited due to pain.

Differential Diagnosis:
1. Subtalar Dislocation
2. Talonavicular Dislocation
3. Talus Fracture
4. Tibia Fracture

Test and Results:
Right ankle and foot x-rays: Closed dislocation of the medial subtalar joint and talonavicular joint without obvious fracture.

Final/Working Diagnosis:
Right Medial Subtalar dislocation, Talonavicular Dislocation, Talus Fracture

Discussion:
Consent was obtained, and the patient was taken to the OR for reduction under general anesthesia. After reduction of the right ankle, CT was performed which showed a successful reduction of the medial subtalar and talonavicular dislocations. The CT also revealed a nondisplaced fracture of the medial border of the talus. He was placed in a posterior splint and stirrup and made non-weightbearing. It was not determined why this relatively low impact mechanism caused such rare and significant injuries. Proper reduction was critical in this case to avoid future equinovarus deformity, ankylosis, or severe degenerative arthritis warranting further intervention.

Outcome:
The patient was unable to play baseball for the remainder of the season. However, due to his successful reduction, he did not require further interventional treatment. He was transitioned to a short leg walking boot after being non-weightbearing for 6 weeks and participated in a physical therapy program to regain strength and function of his right ankle. His roster status was changed from “disabled” to “active” 8 weeks after his injury.

698 May 30 4:15 PM - 4:35 PM
The Bare Necessities of Foot Pain-Running
Alex B. Behr. University of Illinois at Chicago, Chicago, IL. (Sponsor: Terry Nicola, FACSMD) (No relevant relationships reported)

HISTORY: 35 year old female presents with left dorsal foot pain beginning 2 weeks prior to presentation noticed at mile 10 of a half marathon. She is an established barefoot runner with no previous injuries. Denies trauma or mechanism of injury to the foot. The pain is ≤10, sharp, and intermittent. It is exacerbated by weight bearing and relieved by non-steroidal anti-inflammatory agents (NSAIDS) and ice. The pain returns once the medication or modality wears off. She eats a well balanced diet and takes a multi-vitamin daily. Her last menstrual period was 10 days prior to presentation and states no dorsal subluxation with 1st MTP joint drawer test. 5/5 great toe dorsiflexion & plantarflexion strength with discomfort. Lateral 1st MTP joint tenderness to palpation. Minimal fibular sesamoid tenderness to palpation. Intact distal sensation & dorsalis pedis pulse. DIFFERENTIAL DIAGNOSIS: 1. 1st MTP lateral capsule tear 2. 1st MTP lateral collateral ligament tear 3. Adductor hallucis brevis tear IMAGING: MRI right foot: Complete lateral collateral ligament tear of the first MTP joint at the metatarsal attachment. No bony avulsion, normal alignment, normal plantar plate.
it is regular. Denies changes to her running technique or mileage. X-rays performed prior to presentation demonstrate no fracture or deformities. She denies back pain, weakness, or paresthesias.

**PHYSICAL EXAMINATION:** Inspection of foot and ankle demonstrates edema on dorsal aspect of left foot without ecchymosis. No pes planus or pes cavus is observed. Tenderness over the left dorsal proximal 2nd metatarsal head is present. Full active range of motion of the ankle, foot, and toes in all planes with pain at the 2nd metatarsal during toe extension and flexion. Sensation intact to light touch in all dermatomes. Strength is 5/5 in all myotomes. Reflexes are 2/4 at L4 and S1.

**DIFFERENTIAL DIAGNOSIS:** 1) Lisfranc injury 2) Metatarsal stress fracture 3) Forefoot sprain 4) Tibialis anterior strain/enthesopathy

**TEST AND RESULTS:**

- Ultrasonound: Evaluation of 2nd metatarsal using a linear probe demonstrates disruption of periosteum with no subcutaneous edema or disruption of soft tissue. X-ray: No evidence of fracture with mild degenerative changes at 1st MTP joint.
- MRI: Second metatarsal stress reaction without visible fracture line

**FINAL WORKING DIAGNOSIS:** Left 2nd metatarsal stress fracture in an established barefoot runner.

**TREATMENT AND OUTCOMES:** Patient is educated on stress fractures in barefoot runners. Continues ice and NSAID’s for symptomatic pain control and inflammation. Recommend a short leg off loading boot to decrease stress on the foot. She should wean out of the boot and progress to a barefoot running program. Physical therapy to work on foot intrinsic, barefoot gait analysis, and ankle stabilizers. DEXA scan ordered for bone density evaluation. Consider ultrasound instead of MRI for future monitoring of stress fractures.

699  May 30 4:35 PM - 4:55 PM

**Ankle Injury - Football**

Sabrina P. Gawlani, Brian McColl. Presence Resurrection Medical Center, Chicago, IL. (Sponsor: Poonam Thaker, MD, FACSM)

(No relevant relationships reported)

**HISTORY:** A healthy Caucasian 12-year-old male presents with right ankle pain after slipping and twisting his ankle during a recreational football game at day camp. Hours after injury, he was seen by his PCP, who ordered plain films and referred him to orthopedic surgery for further evaluation.

**PHYSICAL EXAMINATION:** Examination in-office revealed mild swelling over the right lateral ankle with tenderness over the anterolateral tibia. Active range of motion was significantly decreased in all directions, and he was unable to bear weight on the right lower extremity. There was good peripheral perfusion, no open wounds or lacerations, and no erythema or ecchymoses.

**DIFFERENTIAL DIAGNOSIS:**

1. Lateral ankle sprain
2. Triplane fracture
3. Pediatric distal tibial fracture
4. Juvenile Tillaux ankle fracture
5. Incisural ankle fracture
6. Adolescent pilon fracture

**TEST AND RESULTS:**

- XR Right Ankle 3+ Views: On AP view, the fracture is vertical through the epiphysis. On lateral view, the fracture extends posteriorly into the metaphysis.
- CT Right Lower Extremity: Comminuted distal tibia fracture with intra-articular extension through posterior malleolus through metaphysis and 3 mm separation. Multiple fractures involving epiphysis. Approximately 3.5 mm separation anteriorly at fracture site. Nondisplaced fracture extending through medial malleolus. Tiny fracture fragment within tibiotaral joint space adjacent to fracture site.

**FINAL WORKING DIAGNOSIS:** Triplane fracture of right distal tibia with intra-articular extension

**TREATMENT AND OUTCOMES:**

1. Open reduction internal fixation of the right distal tibia with intra-articular extension performed by orthopedic surgery under general anesthesia.
2. Intraoperative post-reduction ankle films demonstrated satisfactory alignment and position with postoperative tarsal injuries of distal tibial metaphyseal and epiphyseal fractures.
3. 2-week postoperative follow-up with repeat ankle films demonstrated the fracture to be anatomically reduced with hardware in optimal position. Physical exam had appropriate wound healing and excellent range of motion.
4. Toe-touch weight-bearing while in boot for 4 weeks post surgery.
5. Limited range of motion exercises out of boot during weeks 2 through 4 post surgery.
6. Weight-bearing initiated 4 weeks post surgery.
16 year old male high school athlete was referred to sports medicine clinic with complaint of intermittent right knee pain exacerbated by cutting maneuvers. Pain began after feeling a strain and pop when pushing off a starting block in track season one year ago. Patient’s mother stated that ice, compressions, use of hinged knee brace makes it better and working out without the knee brace makes it worse. The pain usually starts at the medial side of the knee and radiates to the lateral side and is associated with occasional buckling and locking. No change in character of pain after a course of physical therapy and relative rest during the summer. He just completed football season and is currently in middle of basketball season, participation has been limited at times due to pain.

PHYSICAL EXAM:
Right knee exam reveals skin intact with minimal effusion. ROM-0-130 degrees with no pain at extremes. +JLT medially-this is more on the condyle then the meniscus. Medial joint line pain with McMurray and Thessaly; however, no palpable click. 1A Lachman. Stable knee to varus and valgus stress at zero and 30 degrees of flexion. Negative Posterior drawer and sag sign. Sensation intact to light touch on all distributions distally. 2+ distal pulses.

DIFFERENTIAL DIAGNOSIS:
1. Osteochondritis dissecans
2. Osteochondral lesion
3. Meniscus tear

TEST AND RESULTS:
The initial diagnostic test available was the ultrasound. There had been no prior imaging. A limited ultrasound of the RIGHT Knee showed + mild joint effusion and a step off in the lateral portion of the medial femoral condyle. Impression: + effusion and chondral defect of the lateral portion of the medial femoral condyle.

FINAL/WORKING DIAGNOSIS:
1. osteochondritis dissecans on the lateral portion of the medial femoral condyle

TREATMENT AND OUTCOMES:
He was given instruction to remain non weight bearing using crutches for 8 weeks pending results of imaging to determine stability of lesion.

Appearance: No effusion or ecchymosis
Patella: Tracks normally with negative apprehension and compression tests
Tenderness: Absent

Special Tests: Negative Valgus/Varus stress, Lachman’s, McMurray’s, Wilson’s sign

DIFFERENTIAL DIAGNOSIS:

TEST AND RESULTS:
Left knee MRI with 18.1 x 27.1 x 10.0mm osteochondral lesion of the medial femoral condyle with subchondral fluid consistent with Grade III lesion. Medial femoral condyle with bony edema and subchondral cyst. FINAL WORKING DIAGNOSIS: Osteochondral defect TREATMENT AND OUTCOMES: The worrisome appearance of the patient’s MRI was discussed in detail. However, given the relatively benign physical exam and high functionality he was instructed to remain active and avoid surgical intervention as long as possible. He was advised that the traumatic nature of endurance running would likely lead to faster progression of the cartilage defect. Follow-up 6 months later, after completion of his triathlon, without change in symptoms. He remained extremely physically active but with a greater emphasis on swimming and biking.

This case exemplifies the importance of maintaining clinical perspective when treating individuals rather than the severity of their images.
hypedextended while being contacted by an opponent, producing forced valgus and lateral rotation. He immediately fell to the ground, required on field medical attention, and was unable to bear weight.

**PHYSICAL EXAMINATION**

Sideline examination occurred within 5 minutes. Left knee examination revealed a moderate effusion, normal patellar tracking, and no bony deformity. Neurovascular examination normal. Able to perform straight leg raise against light resistance. Active ROM limited to 60° flexion and lacked 10° extension. No bony tenderness. Ligamentous examination revealed a positive Lachman and valgus stress in 30 degrees of flexion. Unable to tolerate compression testing. Left hip and ankle examination normal. Contralateral knee normal.

**DIFFERENTIAL DIAGNOSIS**

1. Acute ACL tear
2. Acute MCL tear
3. Meniscus tear
4. Patellar location
5. Tibial plateau fracture or contusion

**INTERVAL COURSE**

Office visit 7 days after injury. Arthrocentesis of the left knee returned 35 mL of blood. Initial treatment included use of crutches, ice, hinged-knee brace, and quadriiceps rehabilit. MRI ordered, however study was delayed about 6 weeks due to gap in parent’s insurance.

**TESTS AND RESULTS**

- Left Knee Radiographs: Normal
- Left Knee MRI: - Marrow contusion of medial, lateral compartments, fibular head, nondisplaced posterior tibial plateau fracture, subchondral impaction injury of lateral femoral condyle and lateral tibial plateau-ACL rupture, acute sprain of MCL, IT band, and LCL- Complex medial meniscus tear, large fragment from posterior horn flipped anteriorly- Complex medial meniscus tear, vertically through posterior horn

**FINAL DIAGNOSIS**

Left knee acute ACL rupture, MCL sprain, medial and lateral meniscus tears, bone contusion

**TREATMENT COURSE**

1. Referred to orthopedics, underwent arthroscopic ACL reconstruction with hamstring autograft, lateral meniscus repair, and partial medial meniscectomy 8 weeks after initial injury.
2. Significant discussion on post-op rehab and long-term activity modification.

**History:** Patient is an active 41 year-old female (160 cm and 68 kg) who had a history of left, anterior knee pain with mechanical symptoms while playing tennis. Patient revealed a surgical history including: s/p partial lateral meniscectomy with lateral release, s/p lateral retinacular repair, manipulation under anesthesia (MUA), s/p open quadriiceps tendon repair respectively, all within the last two years. Patient complained of continued pain, patella instability and functional deficits.

**Physical Examination:** Knee alignment and patella tracking was normal. She had 1° joint effusion. She had significant restriction of knee flexion (0-70 degrees). Ligamentous tests were stable. Neurovascular exam was normal.

**Differential Diagnosis:**

1. Patella tendon tendinopathy
2. Patellofemoral pain syndrome
3. Patella baja

**X-ray (February 2016):** Insall-Salvati Ratio: 0.38; Blackburne-Peel Ratio: .31 MRI: Confirm patella baja; no patella tendon pathology; evidence of previous quadriceps tendon repair

**Final Diagnosis:** Patella baja with inadequate extensor mechanism

**Treatment and Outcomes:**

1. Surgical intervention included: left patella tendon Z-lengthening with patella tendon reconstruction with left hamstring autograft, left quadriceps tendon V-Y shortening and augmentation of medial patellofemoral retinaculum with a dermal graft.
2. Patient was fitted for a T-scope post-operatively with knee restricted to a maximum of 0-30 degrees of knee flexion for the first 2 weeks. The patient was restricted at 0-60 from weeks 2-4 then at 0-90 degrees from weeks 4-6.
3. At 6 weeks post-op, the patient had 65 degrees of active knee flexion.
4. Continued small improvements were present but by week 14 the patient only had 80 degrees of flexion.
5. An MUA was performed and within the first 4-6 weeks post-op and by October 2016, the patient had been discharged from physical therapy for meeting goals and was going to the gym autonomously. The patient had 112 degrees of active knee flexion.

6. Patient and surgeon satisfaction were achieved, and patella positioning was maintained throughout the patient’s recovery.
713 May 30 3:35 PM - 3:55 PM  
**A 37 Year Old Female Dance Instructor with Leg and Buttock Pain**

John Franco, Cara Prideaux. Mayo Clinic, Rochester, MN.  
(Sponsor: Dr. Karen Newcomer, FACSM)  
(No relevant relationships reported)

**HISTORY:** A 37 year old female dance instructor with a history of stable multiple sclerosis presented with a 5 year history of left buttock and posterolateral thigh pain with radiation to the plantar surface of her foot that began during pregnancy. Pain was minimal at rest and aggravated by prolonged sitting and activities such as dancing, bicycling, and hiking. Pain progressed and now markedly limited activity. She reported tingling of the posterolateral calf and plantar surface of the foot. She denied weakness. Chiropractic care provided no relief. Previously obtained lumbar spine MRI was unremarkable and the patient completed 6 months of physical therapy without improvement.

**PHYSICAL EXAMINATION:** There was no appreciable deformity, malalignment, or rotation of the lumbar spine, hips, or knees. She walked with a non-antalgic gait, including normal heel and toe walking. Palpation of deep left gluteal muscles reproduced pain with radiation down the left lower limb. Range of motion of the lumbar spine and hips was grossly normal. Manual muscle testing of the lower limbs was normal. Passive hip flexion, abduction, and external rotation, as well as flexion, adduction, and internal rotation of the left hip reproduced pain. Remainder of provocative lumbar spine and hip maneuvers, including straight leg raise, were normal. She was neurovascularly intact.

**DIFFERENTIAL DIAGNOSIS:**
- Chronic Piriformis Strain
- Lumbosacral Radiculopathy
- Hip Osteoarthritis
- Multiple Sclerosis Flare
- Sciatic, Tibial, or Peroneal Neuropathy

**TEST AND RESULTS:**

MRI Lumbosacral Plexus: 2.8 X 2.5 X 3.0 cm mass along the left sciatic nerve between the gluteus maximus and quadratus femoris with extension into the ischiofemoral space, consistent with cystic schwannoma

**FINAL WORKING DIAGNOSIS:** Left sciatic nerve tumor, concern for cystic schwannoma

**TREATMENT AND OUTCOMES:**

Neurosurgery evaluation  
Underwent surgical resection of mass  
16 weeks after surgery, reported 100% resolution of her symptoms

---

714 May 30 3:55 PM - 4:15 PM  
**Persistent Lower Back Pain In A Gaelic Footballer.**

David Keohane. Cork University Hospital, Cork, Ireland.  
(No relevant relationships reported)

**History:** A 27 year old, male, high-level, Gaelic Football and Hurling player presented to the Sports Medicine Clinic with a 3-year history of gradually deteriorating lower back pain rated 6/10. The pain was exacerbated by activity and improved by rest. He denied any history of trauma. He denied any radiation or radicular symptoms. Three years prior to presentation MRI had demonstrated a Schueermann’s kyphosis involving T12 with associated disc space narrowing at the T12-L1 level in addition to a transitional S1 vertebra. **Physicial Exam:** Visual inspection was unremarkable. There was no pain on palpation over lumbar spine or paraspinal musculature. Lumbar flexion, extension and lateral side flexion were pain free and range of motion was within normal limits. Straight Leg Rise, Schobers and the Femoral Nerve Tension Test were normal. Examination of the hips revealed pain free but restricted internal and external rotation on the right but was otherwise normal. Neurovascular exam of lower limbs was normal. **Differential Diagnosis:** 1) Degenerative disc disease. 2) Lumbar disc prolapse. 3) Spondyloilolisthesis. 4) Fracture of a lumbar vertebral body. 5) Hip pathology. 6) Inflammatory arthritis. 7) Seronegative spondyloarthropathy. 8) Infection. **Tests and Results:**

---

Results: Bloods were analysed to rule out inflammation or infection. MRI lumbar-sacral spine demonstrated L2-L3 facet joint hypertrophy but no significant thecal sac or nerve root compression and no evidence of saccrolithiasis. X-ray of right hip showed significant acetabular dysplasia with uncovering of the femoral head. MRI right hip revealed oedema and multiple small cysts in the right femoral head with remodelling and fragmentation, features consistent with avascular necrosis. **Final Working Diagnosis:** Idiopathic Avascular Necrosis of the Femoral Head. **Treatment and Outcomes:** The patient was advised to abstain from training and competition. NSAIIDs were prescribed for pain and Alendronate 70mg once weekly was initiated to inhibit osteoclastic activity and reduce the risk of femoral head collapse. The patient was referred for an orthopaedic opinion where options included, observation, femoral head core decompression, non-vascularized bone grafting and hip arthroplasty. The decision was ultimately made to pursue a conservative medical approach as outlined above.
Challenging The Testing Protocol Of The Bod Pod

Eric Shamus, PhD, DPT, Sarah Bengston, DPT, Sierrra Griffin, DPT, Ahmed Eldoka, PhD, PT, Liza Maalley, BS. Florida Gulf Coast University, Fort Myers, FL. (Sponsor: Mitchell L. Cordova, FACSM)

The Bod Pod uses air displacement plethysmography to determine an individual’s body composition as percentages of fat mass and fat free mass. The Bod Pod presents potential use in a clinical setting, but the feasibility is currently unknown. There were no studies found examining the consumption of fluids and pre-urination prior to body composition testing utilizing the Bod Pod. PURPOSE: The objective was to determine if the Bod Pod protocol, as set forth by Life Measurement, Inc., needs to be followed in its entirety to ensure validity of body composition results, where urination and fluid consumption prior to testing were both independently tested.

METHODS: Thirty-two division 1 male (15) and female (17) soccer athletes were recruited for this research study. Male soccer players weighed 162.6 pounds (±19.03) and female soccer players weighed 133.8 pounds (±10.38). All athletes were between 18 and 22 years old (Male = 1.37 & Female = 1.17). Four separate measurements of body composition were taken: pre-urination, standard LMI protocol test position, and consumption of water equal to 10% of their body weight in ounces. RESULTS: A Pearson product moment correlation between the second condition (post urination) and the third condition (post urination retest) signified a good to excellent relationship between the standard test and the retest conditions (0.977, p < .001). A MANOVA analysis was performed comparing pre-urination and post-urination test/ retest indicated that not urinating prior to testing had no significant effect on body composition measurements (p > .05). Consumption of water did have a significant effect on the results of the body composition measurements. It was found that post water consumption, male participants’ measurement of fat mass on average had a significant difference of 0.6% and female participants’ fat mass measurements on average had a difference of 1.4%. CONCLUSION: Results did not support the need to urinate prior to Bod POD testing while supporting the need to refrain from water consumption directly prior to testing.

Assessing The Impact Of Body Fat Percentage And Lean Mass On Wingate Performance

Robert T. Sanders1, Andy Bosak1, Matthew L. Sokoloski2, Hannah E. Nelson1, James Kelly1, Jared Feister1. Liberty University, Lynchburg, VA. Texas Woman’s University, Denton, TX. (Sponsor: Dr. James Schoffstall, FACSM)

The Wingate test is commonly utilized to assess the anaerobic power capabilities of athletes across various sporting disciplines. Although prior studies have assessed the impact that body composition values have on anaerobic performance in above average fit populations, it appears that no study has evaluated the relationship between body fat percentage (BF%), lean mass (LMM), and trunk lean mass (TLM) on Wingate performance in men. PURPOSE: To investigate the relationship between BF%, LLM, and TLM on Wingate performance in no less than averagely fit males. METHODS: After having descriptive data recorded, 38 no less than averagely fit college-age males had their BF%, LLM, and TLM assessed via a bioelectrical impedance analyzer. BMI was also calculated. Subjects participated in an 8 min dynamic warm-up on a leg cycle ergometer, followed by the completion of a maximal effort 30s sprint. Pearson Correlations were then performed between BF%, LLM, TLM, peak power (PP), and mean power (MP) with significant differences determined at p ≤ 0.05. RESULTS: High to moderately high positive correlations existed between BP and TLM (r = .834, p = .001), LLM (r = .773, p = .001), BMI (r = .657, p = .001) as well as between MP and TLM (r = .904, p = .001). LLM (r = .880, p = .001), and BMI (r = .619, p = .001) However, no relationship occurred between BP% and PP (r = .064, p = .123) while a low negative relationship occurred between MP (r = -.234, p = .049) and BF%. CONCLUSIONS: TLM, LLM, and BMI appear to have a strong positive relationship with Wingate performance in no less than averagely fit males. Further research may be necessary in order to determine if fitness level, sport specificity, or a different type of body fat percentage measurement technique may play a factor when considering if BMI, BF%, LLM, and TLM has a relationship with Wingate performance.
devices at any site. CONCLUSIONS: Given the strong relationships, insignificant mean differences, and lack of systematic bias, the low-cost, low-resolution A-mode ultrasound provides subcutaneous fat thickness measurements similar to the more expensive, high-resolution B-mode ultrasound.

### AGREEMENT IN FAT AND MUSCLE ESTIMATION BETWEEN BIOELECTRICAL IMPEDANCE AND ANTHROPOMETRY IN YOUTH ATHLETIC POPULATION


(No relevant relationships reported)

**PURPOSE:** The purpose of this research was to measure the level of agreement in the assessment of the body fat and muscle masses between an anthropometry-based model and the bioelectrical impedance analysis in youth athletes.

**METHODS:** A sample of 252 subjects was studied (137 boys and 115 girls). The participants covered an age range from 12.5 to 16.6 years (Body mass = 59.1 ± 9.8 kg, BMI = 21.2 ± 2.4 kg m⁻²; mean ± SD). Body composition was indirectly achieved by bioelectrical impedance analysis (BIA) and by the anthropometry-based model of De Rose and Guimaraes (1980) (DRG). DRG was updated using the simple regression equations of Withers et al. (1987, cited by Norton, 1996) to estimate body density, and Siri formula (1961) was then utilized to calculate the percentage of body fat. The means of the body fat and muscle masses given by the two methods were compared within each gender stratum, using the Student’s t-test for independent samples. The Bland-Altman analysis was employed to estimate 95% limits of agreement. Statistical significance was set at p<0.05.

**RESULTS:** The differences between DRG and BIA were statistically significant in both genders (p<0.001). In boys, the mean values were, respectively, 7.4 and 7.9 kg for the fat mass, and 28.9 and 31.0 kg for the muscle mass; the 95% limits of agreement were from -3.8 to 2.7 kg, and from -6.0 to 1.6 kg. In girls, the mean values were, respectively, 9.4 and 11.8 kg for the fat mass, and 22.4 and 23.3 kg for the muscle mass; the 95% limits of agreement were from -6.3 to 1.5 kg, and from -4.3 to 2.4 kg. The means for the variables expressed in percentage values were, in boys, 11.5 and 9.4 kg for the fat mass, and 41.7 and 43.2 % for the muscle mass; the 95% limits of agreement were from -3.8 to 2.7 kg, and from -6.0 to 1.6 kg. In girls, the means were 16.8 and 21.2 % for the fat mass, and 41.7 and 43.2 % for the muscle mass; the 95% limits of agreement were from -11.1 to 2.3 %, and from -7.2 to 4.1 %.

**CONCLUSIONS:** There was found a negative bias of DRG with respect to BIA for the two variables. In boys, the difference between methods was higher for the muscle mass, and in girls it was higher for the fat mass. The bias between DRG and BIA had a detrimental impact on the limits of agreement.

### NORMALIZATION FOR BODY MASS AFFECTS THE CORRELATION OF STRENGTH TESTS TO SPEED AND AGILITY TESTS

Anthony Catersiano, FACSM, Mike Gentry, Furman University, Greenville, SC; 1Virginia Polytechnical Institution, Blacksburg, VA.

(No relevant relationships reported)

Previous research has explored the correlation between strength tests and speed-agility tests among athletes with varying results. Much of this can be attributed to differences in reported results based on absolute strength test values versus those normalized to body mass (BM). **PURPOSE:** This study was to compare the correlation between absolute strength, speed, and agility test results to those normalized using body mass.

**Methods:** Varsity Division I male football players (n = 327) were tested during several seasons. Tests for strength included one repetition maximum (1RM) back squat (BS), push clean (PC), and power jump (PJ). Results were recorded as absolute values as well as normalized values, calculated by dividing each 1RM by the athlete’s BM. Tests for speed and agility included 40-yard dash (40YD), 10-yard dash (10YD), 20-yard shuttle run (SR) and standing vertical jump (VJ). A Pearson Product-Moment Correlation analysis was used to determine significant correlations between tests. **Results:** Results are presented below, with the first table displaying the absolute values of the strength tests and the second table showing the normalized values:

<table>
<thead>
<tr>
<th>Test</th>
<th>Shuffle Run</th>
<th>40-yd Dash</th>
<th>Vertical Jump</th>
</tr>
</thead>
<tbody>
<tr>
<td>Push Jerk</td>
<td>.22*</td>
<td>.11*</td>
<td>.25*</td>
</tr>
<tr>
<td>Power Clean</td>
<td>.09</td>
<td>.02</td>
<td>.12*</td>
</tr>
<tr>
<td>Back Squat</td>
<td>.16*</td>
<td>.05</td>
<td>.13*</td>
</tr>
</tbody>
</table>

**Conclusion:** Based upon the results of this study, the LeanScreen app accurately determines WHR, but does not accurately determine %BF on an individual basis.

Waist-to-hip ratio (WHR) and percent body fat (%BF) are commonly used to assess body composition in health and wellness settings. While there is only one commonly used method for measuring WHR, %BF can be determined many ways. However, the accuracy, cost, and ease of use of these methods vary greatly. The LeanScan app is a new method designed to determine WHR and %BF using photographs. **Purpose:** This study was designed to assess the accuracy of the LeanScan app to determine WHR and %BF against laboratory-validated methods. Eighty subjects (40 males; 40 females) participated in this study. Waist-to-hip ratio was manually measured and %BF was determined using the BOD POD. Photographs of each subject were taken from the front and back with the LeanScan app according to the procedures demonstrated by the program software. **Results:** There was no significant difference in WHR between the LeanScan app (r1 = .087) and manual (r1 = .087) WHR measurement (r = .83). Additionally, it was found that 73 subjects (91%) were within one standard deviation (0.08) of the mean. Overall, %BF was significantly underpredicted by the LeanScan app compared to the BOD POD (20.7 ± 7.4 vs. 21.6 ± 8.77). Although there was a high correlation between the two methods (r = .82), only 35 subjects (44%) were within ±3% of BOD POD derived %BF and there was a high degree of variability between methods (SEE = 5.1). **Conclusion:** Based upon the results of this study, the LeanScreen app accurately determines WHR, but does not accurately determine %BF on an individual basis.

There is a high demand for affordable body composition assessments of body fat and fat free mass. Research has demonstrated that skinfold prediction equations recommended by the American College of Sports Medicine (ACSM) underestimate body fat percentage (%BF). **PURPOSE:** The purpose of this study was to validate an alternative equation for women created from dual energy x-ray absorptiometry (DXA). The DXA criterion (DC) equation is: %BF = -6.40665 + 0.491946(S3SF) - 0.00126(S3SF). The DXA criterion (DC) equation is:

%BF = -6.40665 + 0.491946(S3SF) - 0.00126(S3SF).

Conclusions: Given the strong relationships, insignificant difference was low (2.98%). **Conclusion:** The DC equation more accurately predicted %BF across a general population of women than the recommended ACSM equations. Practitioners should consider its use and exercise caution when using older equations since they may yield lower %BF compared to DXA.
Methods: The three-site skinfold measure was administered to 176 university students
(30 min of cycling at an intensity of 60% VO\textsubscript{2}\text{max} peak at three time points during the menstrual cycle: follicular phase, FP; ovulation phase, OV; luteal phase, LP). Blood samples were collected at rest (0 min), immediately after the exercise (30 min), 30 min after the exercise (60 min), and 60 min after the exercise (90 min). The duration of each menstrual cycle phase was estimated by assessing the levels of ovarian hormones.

RESULTS: Total body fat was significantly different between AB and WC athletes than just muscle size and regional measures (arms and legs) allowed body composition comparisons between AB athletes (SCI, non-SCI) when evaluating total body fat. However, there were no significant differences when evaluating %BF of the working limb. This suggests that there may be more to the VO\textsubscript{2}\text{max} results (AB 44.62 ± 14.98 ml/kg/min) and VO\textsubscript{2}peak results (SCI: 31.70 ± 19.40%) and regional (AB: 20.40 ± 15.90%; NSCI: 25.67 ± 13.93%; SCI: 22.60 ± 14.70%) VO\textsubscript{2}\text{max} results during each phase of the menstrual cycle. Ovarian hormones can have an effect on body weight and extracellular fluid levels during the menstrual cycle.

Purpose: To better understand the relationship between body composition and aerobic capacity, this study examined how body fat percent (%BF) would be related to heart rate (HR), maximal HR’s (%HRmax) and HR reserve (%HRR) when walking at 2.5 mph among university students.

Methods: The three-site skinfold measure was administered to 176 university students (mean age: 20.82±1.49; 102 males and 74 females) in the US and converted to %BF using the conversion tables by Jackson et al. (1985). The ACSM %BF satisfactory ranges (2014, 10%-22% for men and 20%-32% for women) were used to divide participants into three %BF categories: Normal, Lean, and Obese. In addition, using HR monitors (Sigma PC26.14) resting HR (after lying on the floor for five minutes) was measured to calculate HRR, and HR at the end of a three-minute treadmill walking at 2.5 mph when walking on MANOVA RHR, %HRmax, and %HRR at the end of the three-minute walking among the three %BF groups.

Results: There were 90 participants in Normal, 64 in Lean, and 22 in Obese group. No age difference (p >.70) was found among the three %BF groups (Normal 20.71±9.0, Lean 20.94±2.79, Obese 20.95±1.50). Significant differences (p values ranged from .000 to .012) were observed in HR, %HRmax, and %HRR at the end of the three-minute walking at 2.5 mph among the three %BF groups. Specifically, significant differences were identified in HR in all the three parwise comparisons: Lean (89.90±10.00) vs. Obese (104.77±10.32), Lean vs. Normal (98.39±11.10), and Normal vs. Obese (99.32±11.20). %HRmax and %HRR in all the three pairwise comparisons: Lean (45.18±5.14) vs. Obese (52.64±5.19), Lean vs. Normal (49.37±5.57), and Normal vs. Obese; and in %HRR between Lean (18.71±6.60) and Obese (24.39±6.69) and between Lean and Normal (22.06±6.61).

Conclusion: Even walking at the threshold of moderate intensity (2.5 mph, a 3-MET activity), lean individuals demonstrate significant increments in heart rate, and %HRR, %HRmax, and %HRR were significantly lower in the Obese group than in the Normal and Lean groups. The %BF classified with ACSM %BF ranges has significant impact on relative intensity experienced among university students when walking at 2.5 mph.
MEDICINE & SCIENCE IN SPORTS & EXERCISE®

Board #12
Effects of a Six Week Weight Loss Challenge on Body Composition and Cardiovascular Health
Melissa A. Whidden, Jamie M. Blose, Jared M. James, Antonia L. Battaglia, Alexis N. Trumbetti, Anna K. Schade, Katie M. Cooper, Paul K. Stickles, Melissa A. Reed, Selen Razan. West Chester University, West Chester, PA. (Sponsor: Dr. Craig Stevens, FACSM)

Conclusion: The Airmetrix system assess weight and BFP with good precision. Overall, the Airmetrix and InBody devices produce similar results, and both significantly underestimate BFP compared to DXA.

There has been a lack in research on the effects of large exercise-induced weight loss of more than 10 kg on fat distribution and metabolic profile of obese males.

PURPOSE: To examine large exercise-induced weight loss on fat distribution and metabolic risk factors, and their improvements associated with coronary heart disease.

METHODS: A total of 20 obese males (age: 19.3 ± 1.30 yrs) completed in the institutionalized regimented training (IRT) held over 16 weeks. Anthropometric, dual x-ray absorptiometry scan and resting metabolic rate (RMR) measurements were taken in the laboratory, while computerized tomography scan, fasting venous blood samples, and a 2-hour oral glucose tolerance test were completed at a local hospital. Daily activities and dietary habits were self-recorded over 2 weekdays and 1 weekend day. RESULTS: IRT resulted in an average weight loss of 13.4 ± 3.70 kg (p < 0.001), significantly reducing body fat percentage and body mass index (p < 0.001). There were significant reductions in total cholesterol (Pre: 47.9 ± 0.92 mmol/L, Post: 41.2 ± 0.82 mmol/L, p < 0.001), triglycerides (Pre: 1.19 ± 0.57 mmol/L, Post: 0.74 ± 0.30 mmol/L, p < 0.001), low density lipoprotein cholesterol (LDL-C) (Pre: 3.04 ± 0.83 mmol/L, Post: 2.51 ± 0.74 mmol/L, p < 0.001), Plasma Apolipoprotein (Apo) A-I (Pre: 133.3 ± 13.1 mg/dL, Post: 120.4 ± 14.5 mg/dL, p < 0.001), Apo B (Pre: 88.1 ± 25.7 mg/dL, Post: 70.1 ± 18.2 mg/dL, p < 0.001), Total/high density lipoprotein cholesterol (HDL-C) (Pre: 4.00 ± 1.01, Post: 3.26 ± 0.81, p < 0.001), and LDL/HDL-C (Pre: 2.54 ± 0.82, Post: 2.00 ± 0.72, p < 0.001). A 45% decrease in the insulin area glucose ratio was compatible with an increase in insulin sensitivity. Daily RMR decreased by 138.0 ± 164 kcal (p = 0.05). RMR after 16 weeks (Post: 25.1 ± 0.74 kcal/L, p < 0.001). A 45% decrease in the insulin area glucose ratio was compatible with an increase in insulin sensitivity. Daily RMR decreased by 138.0 ± 164 kcal (p = 0.05).

CONCLUSION: Large exercise-induced weight losses significantly reduced metabolic risk factors for disease and abdominal fat in young obese males. Therefore, large weight losses through exercise may be an effective strategy for maximizing health benefits to obese individuals.

Board #13
Evaluation Of Body Composition Measurements Obtained Using Whole-body Plethysmography
Timothy R. Macaulay, Conor D. Uhlir, E. Todd Schroeder, FACSM, University of Southern California, Los Angeles, CA. (Sponsor: E. Todd Schroeder, FACSM)

PURPOSE: Body composition assessments provide important health information, as excess body fat percentage (BFP) in relation to lean body mass can increase risk of cardiovascular disease and diabetes. While dual-energy x-ray absorptiometry (DXA) is a gold standard measurement of body composition, faster alternatives that do not expose participants to radiation, such as bioelectrical impedance (BIA), can promote awareness and be used to determine training efficacy. In this study, we compared body composition measurements obtained using whole-body plethysmography by the Airmetrix Whole-Body Self-Service Analyzer to those obtained via multifeature BIA analysis and DXA BFP assessment.

Methods: Twenty-six volunteers (17 female, 36.7 ±12.3 years of age) were tested on two visits. On the first visit, body composition was assessed under fasted conditions by one Biospace InBody 770 analysis, one DXA scan (GE Lunar iDXA), and at least two Airmetrix tests. The second visit was performed at least 24 hours later, at a different time of day, and after the participant had consumed a meal. Body composition was assessed by one InBody analysis and at least two Airmetrix tests. The second visit was performed at least 24 hours later, at a different time of day, and after the participant had consumed a meal. Body composition was assessed by one InBody analysis and at least two Airmetrix tests. The second visit was performed at least 24 hours later, at a different time of day, and after the participant had consumed a meal.

Results: The Airmetrix system showed good precision, with a within-visit retest mean range of 0.04 lbs and 0.51% for weight and BFP, respectively. Although there were statistically significant absolute changes in weight and BFP between visits, there was no systematic direction and was therefore likely due to normal physiological fluctuation. Comparing devices, Inbody and average Airmetrix BFP measurements were significantly longer than DXA BFP measurements for both visits (p < 0.001). Although the Airmetrix system had slightly greater absolute mean percent error compared to InBody (18.9-19.4% vs. 16.8-17.1%, respectively), the difference in errors between devices was not statistically significant (p = 0.067).

Purpose: To compare the morphological distribution of regional bone mineral content (BMC) and lean mass (LM) between men and women athletes in comparable sports.

METHODS: NCAA Division-II male (n = 87) and female athletes (n = 60) in four sports [soccer (SOC), basketball (BB), cross-country (XC), and baseball/softball (BS)] were measured for regional BMC and LM using dual-energy X-ray absorptiometry (DXA). Inactive men (n = 23) and women (n = 27) served as a control group (CON). Ratio of BMC to LM for arms, legs, and trunk was calculated to indicate regional proportionality.

RESULTS: Men were taller and heavier than women and had lower %fat (p < 0.001). BB was taller (p < 0.05) than other sports and CON. Men had significantly greater total LM (3.3 ± 3.4% vs women) and BMC (p < 0.05), but SOC was significantly greater in BS and BB than in XC, CON, and SOC which did not differ significantly among those groups. Sex x sport multivariate ANOVA revealed women had a greater arm BMC/LM than men (p < 0.005) but total body, trunk, and legs BMC/LM were similar. Leg BMC/LM was greater in SOC (6.6 ± 0.5) and BB (6.5 ± 0.5) than in BS (6.1 ± 0.5), XC (6.4 ± 0.3), or CON (6.2 ± 0.7). Independence of BMI differences, there was a large exercise-induced weight loss of more than 10 kg on fat distribution and metabolic profile of obese males.

PURPOSE: To examine large exercise-induced weight loss on fat distribution and metabolic risk factors, and their improvements associated with coronary heart disease.

METHODS: A total of 20 obese males (age: 19.3 ± 1.30 yrs) completed in the institutionalized regimented training (IRT) held over 16 weeks. Anthropometric, dual x-ray absorptiometry scan and resting metabolic rate (RMR) measurements were taken in the laboratory, while computerized tomography scan, fasting venous blood samples, and a 2-hour oral glucose tolerance test were completed at a local hospital. Daily activities and dietary habits were self-recorded over 2 weekdays and 1 weekend day. RESULTS: IRT resulted in an average weight loss of 13.4 ± 3.70 kg (p < 0.001), significantly reducing body fat percentage and body mass index (p < 0.001). There were significant reductions in total cholesterol (Pre: 47.9 ± 0.92 mmol/L, Post: 41.2 ± 0.82 mmol/L, p < 0.001), triglycerides (Pre: 1.19 ± 0.57 mmol/L, Post: 0.74 ± 0.30 mmol/L, p < 0.001), low density lipoprotein cholesterol (LDL-C) (Pre: 3.04 ± 0.83 mmol/L, Post: 2.51 ± 0.74 mmol/L, p < 0.001), Plasma Apolipoprotein (Apo) A-I (Pre: 133.3 ± 13.1 mg/dL, Post: 120.4 ± 14.5 mg/dL, p < 0.001), Apo B (Pre: 88.1 ± 25.7 mg/dL, Post: 70.1 ± 18.2 mg/dL, p < 0.001), Total/high density lipoprotein cholesterol (HDL-C) (Pre: 4.00 ± 1.01, Post: 3.26 ± 0.81, p < 0.001), and LDL/HDL-C (Pre: 2.54 ± 0.82, Post: 2.00 ± 0.72, p < 0.001). A 45% decrease in the insulin area glucose ratio was compatible with an increase in insulin sensitivity. Daily RMR decreased by 138.0 ± 164 kcal (p = 0.05). RMR after 16 weeks (Post: 25.1 ± 0.74 kcal/L, p < 0.001). A 45% decrease in the insulin area glucose ratio was compatible with an increase in insulin sensitivity. Daily RMR decreased by 138.0 ± 164 kcal (p = 0.05).

CONCLUSION: Large exercise-induced weight losses significantly reduced metabolic risk factors for disease and abdominal fat in young obese males. Therefore, large weight losses through exercise may be an effective strategy for maximizing health benefits to obese individuals.

Board #15
Sport-Specific Changes to Bone and Lean Mass Proportionality among College Athletes
Taylor Burris1, Elijah Farrales1, Robert Taylor2, Jerry L. Mayhew, 635011, William F. Brechue, FACSM3, Laurel M. Wentz2, Truman State University, Kirksville, MO. 1T. St. Tull University, Kirksville, MO, 2Appalachian State University, Boone, NC. (No relevant relationships reported)
CONCLUSIONS: Sports and sport-specific training appears to impact LM and BMC accrual differently. Men and women athletes in sports that required more intense running and perhaps more weight lifting had greater legs BMC/LM than sports that apparently do not place the same degree of stress on bones and/or LM. The degree of stress on bones for the arms does not seem sufficient to differentiate among these sports or inactive individuals, but may be more related to differences in regional LM and specific strength training programs.

**Measurement of body fat can be performed using two, three, and four compartment models. Determining which technique to use in different populations is still being debated based on reliability, validity, ease of use, and subject safety.**

**PURPOSE:** To determine the differences between percent body fat measured by Dual X-ray Absorptiometry (DEXA), leg-to-leg electrical impedance, and 7-site skinfold techniques in college age students. **METHODS:** Students were recruited from undergraduate exercise science and dietetics classes, and graduate athletic training, exercise science, and nutrition classes. Sixty-one students (M age 21.7 ± 2.5 yrs, M wt. 71.1 ± 14.9 kg) (43 females (M age 21.3 ± 2.5 yrs, M wt. 67.1 ± 13.4 kg), 18 males (M age 22.4 ± 2.2 yrs, M wt. 80.7 ± 14.3 kg) provided informed consent and completed the DEXA Screening Questionnaire, then had their body composition measured by the three different techniques. Subjects were asked to dress in t-shirts and shorts, and on the day of the appointment to do no vigorous physical activity, take no vitamin or mineral supplement, be well hydrated, not to eat 4-5 hours prior or consume alcohol or caffeine 24 hours prior. Females were screened for pregnancy. Once height and weight were measured, a 7-site skinfold measurement, a leg-to-leg electrical impedance measurement, and a whole body DEXA scan were performed. Comparisons between the techniques were done using repeated measures ANOVA, with Fisher’s least significant differences post hoc test to determine differences. Significance was noted if p<0.05. **RESULTS:** Significant differences in percent body fat were noted between the three techniques (p<0.0001). DEXA (26.7 ± 7.5%) was significantly greater (p<0.0001) than both impedance (24.9 ± 7.5%) and skinfolds (20.1 ± 6.9%). Impedance was significantly greater (p<0.0001) than skinfolds and significantly lower (p<0.0001) than DEXA and impedance. **CONCLUSION:** With the significant differences noted, care should be used when measuring and interpreting body fat composition.

**Fat free mass index (FFMI) and body fat mass index (BFMI) are valuable tools to determine body composition in individuals that differ in height. Currently there are no published ranges for FFMI or BFMI in trained females.**

**PURPOSE:** To compare body composition in individuals that differ in height.**

**METHODS:** 58 female NCAA D1 lacrosse players underwent whole body DEXA scans. Height and body mass of each player were measured on a stadiometer before each scan. A linear mixed effects model was used to determine whether body fat percentage differed by player position. Position was entered as a fixed factor, and height and body mass were included as covariates into the full factorial model. **RESULTS:** The final model demonstrated significant main effects for position (p<0.015), body mass (p<0.001), height (p<0.001), and the interaction between position and body mass (p=0.009). Post-hoc analyses revealed attack (30.8 ± 4.2%) had significantly greater body fat than defense (29.8 ± 3.3%, p=0.021) and midfield (28.5 ± 3.9%, p=0.045). There were no other statistically significant differences in body between positions. Attack (61.8 ± 7.7%) had a statically significant lower body mass than goalies (76.0 ± 4.1kg, p=0.012). Midfielders (60.4 ± 14.8kg) had a significantly lower body mass than defense (67.3 ± 6.2kg, p=0.044) and goalies (p=0.007). **CONCLUSIONS:** Positions differed in mean body composition, with the attack position having the greatest body fat percentage. Body mass was also significantly different by position. It was unexpected that the attack position had a greater body fat percentage, despite having one of the lower mean weight (although only statistically less than goalies). There were few data points for goalies (n=4), which may have limited statistical power. It is a limitation that these data are from one university team across multiple seasons. The style of play for this team influences aerobic demand and may differ from that of other teams. Because there is limited data on body composition in women’s lacrosse, further comparisons across other teams is needed.

**Body Fat Differences Between Skinfold, Impedance, And DEXA Measurements**

**Donna J. Terzian, FACSM, Shannon David, Kyle J. Hackney, Sherrin Stastny, Elizabeth Hilliard, Bryan Christensen, Yeong Rhee, Steven Mitchell. North Dakota State University, Fargo, ND.**

**North Dakota State University and Sanford Health, Fargo, ND.**

(No relevant relationships reported)

**PURPOSE:** With the significant differences noted, care should be used when measuring and interpreting body fat composition.

**Characterization Of Fat-Free Mass Index And Body Fat Mass Index: Relationship To Strength Performance In Resistance-Trained Females**

**Alexis A. Pihoker, Eric T. Trexler, Austin M. Peterjohn, Donna J. Terbizan, FACSM. North Carolina at Chapel Hill, Chapel Hill, NC.**

(No relevant relationships reported)

**CONCLUSIONS:** There is limited scientific literature on women’s lacrosse players, especially for body composition measurements. Understanding the relationship between body fat percentages and player position can benefit both the team and individual players.

**PURPOSE:** To determine if body composition in female NCAA Division I lacrosse players differs between player position.

**METHODS:** 58 female NCAA D1 lacrosse players underwent whole body DEXA scans. Height and body mass of each player were measured on a stadiometer before each scan. A linear mixed effects model was used to determine whether body fat percentage differed by player position. Position was entered as a fixed factor, and height and body mass were included as covariates into the full factorial model. **RESULTS:** The final model demonstrated significant main effects for position (p<0.015), body mass (p<0.001), height (p<0.001), and the interaction between position and body mass (p=0.009). Post-hoc analyses revealed attack (30.8 ± 4.2%) had significantly greater body fat than defense (29.8 ± 3.3%, p=0.021) and midfield (28.5 ± 3.9%, p=0.045). There were no other statistically significant differences in body between positions. Attack (61.8 ± 7.7%) had a statistically significant lower body mass than goalies (76.0 ± 4.1kg, p=0.012). Midfielders (60.4 ± 14.8kg) had a significantly lower body mass than defense (67.3 ± 6.2kg, p=0.044) and goalies (p=0.007). **CONCLUSIONS:** Positions differed in mean body composition, with the attack position having the greatest body fat percentage. Body mass was also significantly different by position. It was unexpected that the attack position had a greater body fat percentage, despite having one of the lower mean weight (although only statistically less than goalies). There were few data points for goalies (n=4), which may have limited statistical power. It is a limitation that these data are from one university team across multiple seasons. The style of play for this team influences aerobic demand and may differ from that of other teams. Because there is limited data on body composition in women’s lacrosse, further comparisons across other teams is needed.

**Fat free mass index (FFMI) and body fat mass index (BFMI) are valuable tools to compare body composition in individuals that differ in height. Currently there are no published ranges for FFMI or BFMI in trained females.**

**PURPOSE:** To characterize FFMI and BFMI in resistance trained females. A secondary aim evaluated the relationship between FFMI, BFMI, and lean mass (LM) with strength performance in females with normal, overweight, and obese body mass index (BMI). **METHODS:** Forty-seven resistance-trained females (Mean ± SD; Age: 20.4 ± 2.2 yrs; Height: 165.4 ± 6.0 cm; Weight: 66.7 ± 11.0 kg) participated in the study. Body composition was determined using dual energy X-ray absorptiometry (DEXA) and used to calculate FFMI (kg/m²) was calculated by dividing the sum of lean mass (kg) and bone mineral content (kg) by height (m) squared. BFMI (kg/m²) was calculated by dividing fat mass (kg) by height (m) squared. Performance was evaluated by one replicate maximum testing on the leg and bench press (LP1RM and BP1RM, respectively). Participants were stratified by BMI classification (normal (18.5-25 kg/m²), overweight (25-30 kg/m²), and obese (>30 kg/m²)). **RESULTS:** Average FFMI in this sample was 16.7 ± 2.2 kg/m², with a range of 13.3-25.5 kg/m². Average BFMI was 7.5 ± 2.2 kg/m², with a range of 4.8-15.2 kg/m². In females with a normal BMI (n=33), FFMI and LM were both significantly correlated with LP1RM (R=0.873, p<0.001; R=0.779, p<0.001) and BP1RM (R=0.838, p<0.001; R=0.791, p<0.001), respectively. For the overweight cohort (n=9), FFMI and LM were significantly correlated with LP1RM (R=0.736, p=0.025; R=0.747, p=0.021) and BP1RM (R=0.883, p=0.002; R=0.757, p=0.018). In the obese cohort (n=5), FFMI neared significance for both LP1RM (R=0.846, p=0.017) and BP1RM (R=0.862, p=0.060); LM was not significantly correlated with LP1RM (R=0.845; p=0.072) or BP1RM (R=0.866, p=0.019). BFMI was not significantly related to performance for any BMI cohort (p=0.05). **CONCLUSIONS:** FFMI may be an adequate predictor of strength performance across all BMI ranges. LM was also significantly correlated with performance in both normal and overweight BMI cohorts, indicating that height may not be a moderating factor in this population.

**Body Fat Differences Between Skinfold, Impedance, And DEXA Measurements**

**Donna J. Terzian, FACSM, Shannon David, Kyle J. Hackney, Sherrin Stastny, Elizabeth Hilliard, Bryan Christensen, Yeong Rhee, Steven Mitchell. North Dakota State University, Fargo, ND.**

(No relevant relationships reported)
Dual Energy X-ray Absorptiometry (DXA) scans to assess body composition have become increasingly popular, especially in athletic populations. Acute factors, such as hydration status and food intake have been shown to alter DXA results (Tinsley, MSSE 2016). It is currently not known if prior strength and conditioning bouts may alter fat mass, lean mass, and bone density results.

**PURPOSE:** To determine if a strength and conditioning (S&C) bout, similar to what athletes regularly engage in, will alter the fat mass, lean mass, and bone content results of a DXA scan. **METHODS:** Fourteen strength-trained subjects (10 men, 4 women, age 24 ± 2 yrs, height 176.7 ± 8.1 cm, weight 69.2 ± 12.5 kg) completed four testing sessions across two days. ADP testing on day one was instructed to avoid all food intake until completion of the second scan. Subjects were encouraged to drink water ad libitum during the S&C bout from individually assigned 1-liter bottles; the volume consumed during the bout was measured by weight.

**RESULTS:** No significant difference was found (correlated t-test = 0.05) on any of the body composition measures between pre and post DXA body composition measurements after a S&C bout (changes pre to post: fat mass 46.4±6.0 kg, lean mass 64.8±6.9 kg, bone content 3.3±3.3 kg). **CONCLUSION:** Based on the results of the present study, S&C bouts do not need to be considered to ensure accuracy when performing DXA scans. The physiological changes that occur in response to a single S&C bout do not affect body composition analysis of DXA scans.

The accurate measurement of percent body fat (%BF) is important in the determination of a wrestler’s minimum wrestling weight (MWW) under the National Collegiate Athletic Association (NCAA) Wrestling Weight Management Program (WMP). Currently, skinfold measurements (SF), air displacement plethysmography (ADP), and hydrostatic weighing are the only approved methods of assessing body composition for the WMP. While dual energy x-ray absorptiometry (DXA) is considered a criterion method and type-A ultrasound (US) may serve as an alternative method, to our knowledge, no previous study has examined DXA or US in the determination of a wrestler’s MWW. **PURPOSE:** To compare SF and MWW determined using SF, ADP, US, and DXA. **METHODS:** Twenty-three college-aged men (21.1±0.8 yrs) participated. As per NCAA WMP guidelines, participants reported to the lab in a euhydrated state (Urine specific gravity/Usg<1.020). %BF was estimated using SF, ADP, DXA, and US. **RESULTS:** Body mass and Usg values were 83.2±13.2 kg and 1.005 ± 0.004, respectively. There was a significant difference between methods for both %BF (p<0.001) and MWW (p=0.001). %BF values (SF=15.7±5.2%; ADP=18.1±6.4%; DXA=21.6±6.2%; US=15.2±5.2%) and MWW (SF=73.3±8.1; ADP=71.1±7.5; DXA=68.5±8.2; US=73.8±8.9) were significantly different between all methods except SF and US (p=0.586, respectively). When comparing the MWW determined by DXA to those determined by SF, the use of DXA would have allowed 57% of participants to reach one weight class lower and an additional 30% of participants to reach two weight classes lower. Compared to ADP, DXA would have allowed 48% of participants to reach one weight class lower and an additional 9% of participants to reach two weight classes lower. **CONCLUSION:** These data indicate that US may provide an alternative to the SF procedure when determining the MWW of a wrestler. However, when compared with two WMP-approved methods of assessment, DXA would permit approximately 57% (ADP) to 87% (SF) of wrestlers the opportunity to certify at a lower weight class. Given these preliminary
findings, future research should further examine if the currently approved methods of assessment during the NCAA WMP put a wrestler at a disadvantage by restricting weight.

Maura L. Jegerski, Baruch Vainshelboim, Gabrielle M. Brennan, Henry Piascik, Sara D. Dieterich, Patricia Fitzgerald, Stephen LoRusso, Kristofer S. Wisniewski, Saint Francis University, Loretto, PA.

Previous studies have shown that bioelectrical impedance analysis (BIA) is a simple and reliable noninvasive way to measure body composition. However, the results differ in accuracy compared to other methods. Purpose: To compare the validity of different BIA devices against the Bod Pod (BP) for estimating percent body fat (%BF) and lean body mass (LBM) in young adults. Methods: Eighty-seven subjects (45 males, 42 females) aged 20.3 ± 1.6 years with BMI 25.1 ± 5.2 kg m^2 were assessed for %BF and LBM using BodPod, Tanita TBF-300A [both Athletic (TA) and Standard (TS) modes], and InBody770 (InB) in a counterbalanced order in one session. Subjects followed the most stringent pre-testing guidelines suggested for the InB. Pearson’s correlations and Repeated measures ANOVAs were utilized. Results: Results for each method (mean ± SD) and correlations are displayed in Table 1. ANOVA showed TA significantly underestimated (p=0.001), and TS significantly overestimated (p<0.001) %BF compared to BP. There was no significant difference between TA and InB (p=0.701) %BF. ANOVA showed TA significantly overestimated (p<0.001) LBM, and the LBM from TS (p=0.197) and InB (p=0.825) were not significantly different from BP. Conclusions: The results show that each method is strongly correlated with the BP. However, there were significant differences between Tanita scale values and the BP. Therefore, BIA devices using both hand and feet sensors and multiple frequencies may be more accurate at estimating body composition than devices using feet and one frequency only.

Results for each method (mean ± SD) and correlations are displayed in Table 1. ANOVA showed TA significantly underestimated (p<0.001), and TS significantly overestimated (p<0.001) %BF compared to BP. There was no significant difference between TA and InB (p=0.701) %BF. ANOVA showed TA significantly overestimated (p<0.001) LBM, and the LBM from TS (p=0.197) and InB (p=0.825) were not significantly different from BP. Conclusions: The results show that each method is strongly correlated with the BP. However, there were significant differences between Tanita scale values and the BP. Therefore, BIA devices using both hand and feet sensors and multiple frequencies may be more accurate at estimating body composition than devices using feet and one frequency only.

Table 1. Comparison of Body Composition Methods

| Method | %BF Correlation with BP (%BF) LBM (kg) Correlation with BP (LBM) |
|--------|---------------------------------|-----------------|-----------------|
| BP     | 21.1 ± 11.3                     | 1.00 ± 0.00     |
| TA     | 18.3 ± 6.9                      | r= 0.922, p<0.001 |
| TS     | 22.5 ± 9.3                      | r= 0.909, p<0.001 |
| InB    | 21.3 ± 10.9                     | r= 0.932, p<0.001 |

Table 1. Comparison of Body Composition Methods

<table>
<thead>
<tr>
<th>Sitting Time (hours/day)</th>
<th>Lean Body Mass (kg)</th>
<th>%Fat</th>
<th>Physical Activity (MET-min/week)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.300</td>
<td>p= 0.006*</td>
<td></td>
</tr>
<tr>
<td>0.310</td>
<td>p= 0.001*</td>
<td>0.276</td>
<td></td>
</tr>
<tr>
<td>0.365</td>
<td>p= 0.001*</td>
<td>0.276</td>
<td></td>
</tr>
<tr>
<td>0.376</td>
<td>p= 0.011*</td>
<td>0.276</td>
<td></td>
</tr>
</tbody>
</table>

**significant**

Multi-frequency bioelectrical impedance analysis (MFBJA) is a rapid, non-invasive, and relatively inexpensive method of assessing body composition that has been suggested as an alternative to laboratory methods including dual energy X-ray absorptiometry (DXA) and hydrostatic weighing. Purpose: To determine the accuracy of a commercially-available MFBJA analyzer for the assessment of percent body fat (%BF) in young adults.

Methods: Three hundred eighty-four (209 women; 175 men) subjects volunteered to participate in this study (age = 20.8 ± 2.1 years). %BF was assessed using MFBJA (InBody 770, Biospace Co.) and DXA (GE Lunar Prodigy) within the same visit. Results: When compared to DXA, MFBJA significantly (p<0.001) underestimated %BF (men = 16.8 ± 6.5% vs. 19.4 ± 8.0%; women = 28.8 ± 7.8% vs. 32.7 ± 8.3%). Linear regression analyses revealed significant correlations (men = 0.92, women = 0.93; p<0.001) and standard error of estimate values (men = 3.2%; women = 3.1%) rated as "very good" between methods. However, Bland-Altman plots revealed a weak bias for %BF (r = 0.36, p<0.001) and a large percentage of the subjects (women = 53%, men = 41%) were outside the ± 3.5% minimally acceptable standard for accuracy. Conclusions: When compared to DXA, the InBody 770 underestimated %BF by greater than 3.5% in approximately half of the subjects tested in this study. Given this consistent underestimation, we recommend interpreting the %BF values produced by the InBody 770 with caution.

Previous studies have shown lean body mass (LBM) is positively correlated with muscle strength in older and younger individuals. Studies have also shown a strong correlation between grip strength when muscle mass is adjusted for height. However, previous studies have not looked into young adults. Purpose: The purpose of this study was to examine the relationship between segmental LBM and various measures of muscular strength in healthy young adults.

Methods: Forty subjects (23 females, 25 males) aged 20.4 ± 1.9 years underwent bioelectrical impedance analysis using the InBody770 to determine total LBM, legs LBM (sum of both legs), right arm LBM, left arm LBM, and LBM (sum of both arms). Strength tests included 1RM bench press, 1RM leg press, maximal voluntary contraction (MVC) handgrip, and MVC deadlift. Standard 1RM protocols were used to assess 1RM for bench press and leg press. Maximal handgrip scores were measured for each arm independently and added together for the summed handgrip strength. MVC deadlift was measured using a Baseline Back, Legs, and Chest Dynamometer. Results: Correlation analyses showed a moderate correlation between total LBM and MVC deadlift (r = 0.557, p<0.001), legs LBM and 1RM leg press (r = 0.520, p<0.001), right arm LBM and 1RM deadlift strength (r = 0.428, p<0.001), and left arm LBM and 1RM deadlift strength (r = 0.425, p<0.001).
strong correlation was observed between arms LBM and 1RM bench press (r = 0.763, p < 0.001). Conclusion: Segmental BIA assessed using the InBody770 showed a correlation of 0.96 (95% CI: 0.93-0.97) with DXA and a moderate correlation with the total body LBM assessed using the InBody 770 (r=0.69). In total, the findings indicate that InBody 770 BIA can be used as a valid tool to assess segmental body composition. 

769 Board #30 May 30 2:00 PM - 3:30 PM
Efficacy Of Ketogenic Diet On Body Composition during Resistance Training In Trained Men.
Vargas Salvador1, Ramón Romance2, Jorge L. Petro1, Diego A. Bonilla1, Iseme Galancho3, Sergio Espinar4, Rick B. Kreider, FACSM5, Javier Benitez-Porres6,7. 1EADE-University of Wales, Málaga, Spain. 2University of Malaga, Málaga, Spain. 3University of Córdoba, Málaga, Spain. 4University of Bogota, Bogota, Colombia. 5Better By Science, Málaga, Spain. 6BetterByScience, Málaga, Spain. 7Texas A & M University, Málaga, Spain. (Sponsor: Richard Bruce Kreider, FACSM) (No relevant relationships reported)

Nowadays, ketogenic diet (KD) is widely used in people accomplishing fast weight loss and significant improvements in metabolic control. However, there is a lack of data regarding the relationships between KD and body composition, making KD studies with high quality and design needed. PURPOSE: The purpose of this study was to evaluate the efficacy of an 8-week KD during energy surplus and a resistance training protocol on muscle hypertrophy in trained men. METHODS: 24 healthy men (age 30 ± 4.7 years; weight 76.7 ± 8.2 kg; height 174.3 ± 19.7 cm; > 2 years of consecutive training experience) performed an 8-week resistance training (RT) program with similar hypertrophy training variables. Participants were randomly assigned to either a KD (10:20:70; n=10, NKD) or a non-ketogenic diet (55:20:25; n=10, NKD), or a control group (n=5, CQ) in hypercaloric conditions (39 kcal · kg⁻¹ · d⁻¹). Body composition changes were measured by dual energy X-ray absorptiometry (DXA) before and after each nutritional intervention and training program in all participants. Compliance with the ketosis state was monitored by measuring urinary ketones weekly. Statistical evaluations to determine significant differences between groups and substantive significance were performed with paired t-test, where critical α was p<0.05, and Cohen’s d effect size (ES), respectively. RESULTS: There was a significant reduction in fat mass (Δ=-10.4%, p=0.030, ES = 0.46) and abdominal visceral adiposity in KD (Δ=-16.3%, p<0.008; ES = 0.84); while no significant changes were observed in the NKD and CG groups. Muscle mass significantly increased after 8 weeks of RT program in the NKD group only (Δ=+2.1%, p<0.01; ES=0.31). CONCLUSIONS: Our results suggest that KD can be helpful for decreasing abdominal visceral adiposity and fat mass, but not to increase muscle mass during positive energy balance in men undergoing RT. This study shows the relevance of macronutrient manipulation in RT programs, in order to improve body composition parameters focusing on training goals (fat reduction and/or increase of muscle mass) in trained men. Supported by University of Málaga (Campus of International Excellence Andalucía Tech).

770 Board #31 May 30 2:00 PM - 3:30 PM
Bioelectrical Impedance Analysis Versus Dual-Energy X-ray Absorptiometry Body Fat Percentage Measurements in Collegiate Basketball Players.
Michelle L. Otte. Southeast Missouri State University, Cape Girardeau, MO. (Sponsor: Joe Pujol, FACSM) (No relevant relationships reported)

Body composition (BC) is an important component of health-related fitness and is also related to athletic performance. There are many quick, cost efficient, accessible, and user-friendly ways to assess BC. Field measurement methods, including body mass index, waist circumference, skinfolds, and bioelectrical impedance analysis (BIA). Criterion methods for measuring BC, which are more expensive and generally less accessible, include techniques like dual-energy X-ray absorptiometry (DXA). BIA is commonly used to assess body fat percentage (BF%) in endurance training programs, in clinical settings due to its standard deviation (±2-4%). The manufacturer of the Direct Segmental Multi-frequency InBody230, which uses eight separate contact points with two electrical frequencies, claims a similar BF% accuracy range to DXA. PURPOSE: To assess the reliability of the InBody230 BIA to DXA BF% values in college-aged, male basketball players. METHODS: Participants were 72 male collegiate basketball players (age=20.51±1.32 yr; wt=89.35±10.68 kg; ht=183.96±5.97 cm; BMI=27.50±3.02 kg/m²). The participants had BF% assessed, in the early morning, using the InBody230 BIA in the standing position followed by a total-body DXA scan which served as the criterion value. RESULTS: A paired samples t-test revealed a significant difference between the InBody230 (r=0.51; 95% CI: 0.35-0.65) and DXA (20.55±6.13) (p<0.001). CONCLUSIONS: While the two modes of BF% were significantly different, the standard deviation (SD) (i.e., reliability) of the InBody230 BIA was more than double the DXA. This SD difference is supported by past research using athletes of similar age and BMI. However, research finding significant difference between modes with high SD values have utilized varying sample sizes of non-athletes, including both genders and children. Future research needs to be conducted comparing the InBody230 BIA to DXA using various populations to assess the InBody230 manufacturer accuracy claim of (98.3-3.5%).
Appropriate stature and adequate somatotype is believed to be some of the most important prerequisites for sports participation and success. In baseball, there is scarce evidence on players’ anthropometric profiles, such as body weight (BW), body height (BH), and body fat % (BF%) and their association with baseball performance statistics (PS) which has led to form anecdotally based beliefs. The present study aimed to (a) compare BMI and BF% and selected baseball-specific PS, such as batting average % (bavg%), slugging % (slg%), and on-base % (ob%) in NCAA Division I batters; to examine the relationship between BW, BH, BF%, and baseball-specific PS. METHODS: During a 5-year period, 232 collegiate batters (age 19.7±1.3 yr; weight 87.9±7.7 kg) were assessed for body weight (BW), body height (BH), and body fat % (BF%). Batters’ respective specific-sports specific PS were collected with regards to bavg%, slg%, ob%, BW, BH, BF%, and PS were normalized to z-scores. Missing data were estimated from least squares prediction from non-missing variables. Forward multiple stepwise regression was used to evaluate the relative impact of BW, BH, and BF% on PS (IMP's P< 0.05). RESULTS: From the selected anthropometric variables, only BF% is significantly negative correlated with both bavg% (r = −0.19, p = 0.0043) and slg% (r = 0.17, p = 0.0103). Slg% was selected as the independent variable with the highest goodness of fit significantly correlating with BF% (p = 0.0007) and BW (p = 0.0151) with adjusted R² = 0.04. CONCLUSIONS: The results indicate that leaner batters have higher bavg% and slg%. BF% and BW appeared to provide the greatest predictive power of slg%. Slg% is a measure of the batting productivity of a hitter and only 4% of this productivity can be explained by anthropometric variables, such as BW and BF%. The common anecdotal belief that heavier players are better batters, no matter their motor skill abilities, is not justified from the results of this study. Practitioners want to improve their batters’ hitting productivity. Therefore, they may need to focus on other factors than anthropometrics, for instance agility, speed, power, and lower-body performance.

Anthropometric and body composition measurements can offer insight into athletes’ health as well as assist in developing training or diet regimens to enhance competitive potential. Valid and reliable assessments of these measures are vital. PURPOSE: The purpose of this analysis was to compare overall and segmental body composition data of collegiate track athletes using bioelectrical impedance analysis (BIA) and dual energy X-ray absorptionmetry (DXA). METHODS: Participants visited the Human Performance Laboratory once for measurement of anthropometric data (ht via stadiometer) and body composition assessment by BIA (via InBody 570) and DXA (via GE Healthcare Lunar Prodigy Advance). Contraindications were addressed and jewelry was removed prior to testing. Athletes were instructed to remove their socks; thereafter, they followed verbal instructions provided by the InBody 570. Body weight (lbs.) determined by the InBody 570 was converted to kilograms (kg) and used in the DXA analysis, for consistency. Relative body fat % and regional lean mass in the arms (ArmsLea.m), legs (LegsLea.m), and trunk (TrunkLea.m) (kg) were compared between methods, by sex, using paired-samples t-tests. RESULTS (females): Twenty-four females (age: 19.6±1.0 yr, ht: 168±8.7 cm, wt: 65±13.7 kg) volunteered for testing. There were statistical differences (ordered by BIA and DXA) for %BF [19.8±6.4 vs. 25.0±7.9%, p < 0.0001] and LeanLea.m [22.0±11.2 vs. 21.1±11.2 kg, p = 0.038]. No statistical differences were found for ArmsLea.m [5.1±1.1 vs. 5.3±0.92 kg, p = 0.163] or Slg% in a mean of the batting productivity of a hitter and only 4% of this productivity can be explained by anthropometric variables, such as BW and BF%. The common anecdotal belief that heavier players are better batters, no matter their motor skill abilities, is not justified from the results of this study. Practitioners want to improve their batters’ hitting productivity. Therefore, they may need to focus on other factors than anthropometrics, for instance agility, speed, power, and lower-body performance.
on acquiring ideal body weight on a long-term period to avoid dehydration and others short-period strategies that may lead to detrimental aspects of physical fitness and health risks. Re-hydration must be guided by electrolyte status to avoid major risks issues such as cardiac arrhythmias, hypotension and aedema. These strategies should be encourage by coaches leagues and federations worldwide.

Rugby Union is one of the most played and watched collision sports worldwide, with high injury incidences widely reported in the literature. Participation rates in Rugby Union are rising with increasing popularity, particularly in Ireland with 224 amateur clubs and approximately 190,400 players currently registered. Internationally, the Irish men’s team is currently ranked in the top five in the world. PURPOSE: To evaluate injury monitoring and player education practices in Irish amateur Rugby Union. METHODS: A survey was designed and distributed to coaches and medical staff of 58 clubs. These clubs represent the highest level of amateur Rugby Union in Ireland. The survey consisted of 27 questions, with five sections: 1) Club demographics, 2) Monitoring, 3) Education, 4) Staffing and 5) Injuries. RESULTS: Forty-nine clubs responded to the survey. Five surveys were incomplete and excluded from analysis. The overall response rate was 75.9% representing current practices of 4,843 amateur football athletes and investigate differences among specified groups.

The NCAA Division II Student-Athlete population may be subject to numerous mobility and stability deficiencies as it relates to sport and training requirements. Movement Deficiencies in Division II Male Football Athletes as it Relates to Class and Position

Taylor A. Taraski, Jenny A. Martinez, Christopher C. Winter, Jeremy E. Glaser, Brandon M. Fjerstad, Jeremy L. Knous, Giles D. Warrington, FACSIM, Andrew J. Harrison, Kevin Hayes, Mark Lyons, Mark J. Campbell, Ian C. Kenny, University of Limerick, Limerick, Ireland. (Sponsor: Dr. Giles D Warrington, FACSIM) (No relevant relationships reported)

PURPOSE: The current extreme heat policy for the National Rugby League (NRL) recommends 1-min cooling breaks mid-way through each half to permit greater fluid intake during EH compared to RG (p<0.05). This blunted rise in core temperature with EH persisted to the end of exercise with lower end-trial values in EH compared to RG (p=0.02). TS was also cooler at end-trial after EH (p=0.02) with no additive effect of in-play breaks (p<0.96). There were no differences (p=0.40) in WBSR between trials (RG: 1.25±0.25 L/h, R1C: 1.17±0.19 L/h, EH: 1.19±0.18 L/h, E1C: 1.23±0.25 L/h). CONCLUSIONS: Preliminary data indicate that extending halftime from 12 to 20 min in Rugby League is effective at reducing thermal strain whereas in-play cooling breaks of up to 3 minutes may not provide any additional benefit. These findings may also be applicable to all field based team sports (e.g. American football, soccer and Australian football (AFL)).

FUNDING: This research was funded by the National Rugby League (NRL), Australia.

Injury Monitoring and Player Education, a Survey of Current Practices in Irish Amateur Rugby Union

Caitriona A. Yeomans, Thomas M. Comyns, Roisin Cahalan, Giles D. Warrington, FACSIM, Andrew J. Harrison, Kevin Hayes, Mark Lyons, Mark J. Campbell, Ian C. Kenny, University of Limerick, Limerick, Ireland. (Sponsor: Dr. Giles D Warrington, FACSIM) (No relevant relationships reported)

Injury Monitoring is crucial in collision sports such as Rugby Union, where injury risk is substantial. While comprehensive monitoring systems are prevalent in professional sport, injury monitoring is often infrequent and inconsistent in amateur settings. In order to minimize injury risk, it is the duty of care of governing bodies to implement monitoring systems in both amateur and professional cohorts. In Ireland, 91% of clubs monitor injuries by various means. The implementation of a centralized monitoring system in Irish amateur Rugby would allow injury trends to be effectively tracked and used to guide evidence-based injury prevention strategies.

Funding: The Irish Rugby Injury Surveillance Project is funded by the Irish Rugby Football Union.

Wearable Sensors to Quantify Performance and Fatigue during Tournament Competition among Elite Developmental Ice Hockey Players

Ken Martel, Andrea Workman, Davor Stojanov, Stephen J. McGregor. Eastern Michigan University, Ypsilanti, MI. (Sponsor: Andrew R. Coggan, Ph.D., FACSIM, FACSIM) (No relevant relationships reported)

At the highest performance levels of ice hockey (e.g. senior/professional), rules govern the number of successive competition days and prevent multiple competitions on a single weekend. Yet, some youth leagues run weekend showcase events that include multiple competitions per day. It is generally assumed that multiple competitions per day and several competitions over multiple days will impart excessive fatigue and impair performance, but there is no evidence directly related to ice hockey. PURPOSE: Use player-worn sensors (PWS) to compare accuracies (ACC) and heart rate (HR) over 4 games in 3 days among elite youth ice hockey players in order to establish changes in cardiovascular stress and physical exertion associated with fatigue. METHODS: 33 elite, youth ice hockey players in two age categories (U18: N=17, 18.2 yrs ± 92 ± 16U; N=16, 16.4 yrs ± 1) on two teams in a league showcase consented to procedures approved by the EMU-HSRC. Bioharness-3 (Zephyr, MD) recorded HR and ACC at 1 Hz over the 4 games (G1-G4) in the 3-day event. Peak ACC across multiple time frames (10, 15, 20, 30, 90 sec, and 2, 2.5, 3, 5, 10, .., 45 min) were quantified and analyzed and HR was quantified and used in conjunction with ACC to determine exertion profiles for each on-ice session. MANOVA’s for peak ACC and HR at each time point across G1 - G4 with Bonferroni post hocs and multiple games per day (M1, M2) for magnitude and time as main effects were performed using SPSS 23.0 (IBM, NY; α=0.05). RESULTS: HR (bpm) decreased G1 v G4 at 3 (187.5 ± 2.8 v 176.1 ± 2.8), 5 (178.7 ± 3.0 v 165.7 ± 3.0), 10 (170.4 ± 3.1 v 157.6 ± 3.1), 15 (167.1 ± 3.0 v 153.3 ± 2.9) and 20 min (164.3 ± 3.0 v 152.4 ± 2.9)(p<0.05). ACC were not different. Peak ACC (g’s) were lower for M2 vs M1 at G1 (G2) (0.632 ± 0.012 v 0.592 ± 0.012), 90 (0.501 ± 0.052 v 0.520 ± 0.012), 120 (0.494 ± 0.009 v 0.469 ± 0.009) and 180 sec (0.412 ± 0.009 v 0.368 ± 0.009)(p<0.05). CONCLUSIONS: The decline in HR, but not ACC across games over 3 days indicates a cardiovascular adaptation as opposed to overt fatigue. On the other hand, the reduced ACC from 60 - 180 sec between games 1 and 2 in a day indicate reduced shift capacity and one step in performance indicative of fatigue during the second contest.

WEDNESDAY, MAY 30, 2018
and LC in lower body strength (UC = 1.9 ± 1.4, LC = 3.1 ± 0.9; F = 11.9, p = 0.001) and single leg strength (UC = 3.8 ± 1.9, LC = 5.1 ± 1.2; F = 6.5, p = 0.02). Within position practices in Big 9 (J1: 13.2 ± 2.8, 26.5 ± 3.9) and small (J2: 13.2 ± 2.8, 26.5 ± 3.9) group presented greater deficiencies in posterior chain (F = 6.4, p = 0.004), core stability (F = 5.4, p = 0.01), hip girdle endurance (F = 3.6, p = 0.04) and posterior shoulder girdle strength (F = 3.6, p = 0.04) compared to Skill (3.7 ± 2.7, p = 0.01); 9.9 ± 3.3, p = 0.01; 1.8 ± 0.9, p = 0.01; 1.3 ± 0.9, p = 0.06) and Big Skill (4.3 ± 2.9, p = 0.01; 10.0 ± 2.8, p = 0.01; 1.8 ± 0.9, p = 0.01; 1.7 ± 1.1, p = 0.01). CONCLUSION: Identification of individual and group deficiencies allows for utilization of targeted training protocols with the goal of enhancing overall performance.

779 Board #40 May 30 2:00 PM - 3:30 PM Physical Demands of NCAA Division I Hockey Training and Competition Using Microtechnology
Bryce V. Murphy, Donald R. Dengel, FACSIM, Julian Wolfson, Calvin C. Dietz, Corey S. Petersen, Tyler A. Bosch. University of Minnesota, Minneapolis, MN. (Sponsor: Donald R Dengel, FACSIM)

No relevant relationships reported

PURPOSE: Wearable technology has gained popularity to measure external workloads during practices and games in sport. Most often a tri-axial accelerometer, combined with a magnetometer and gyroscope measures directional movement in three planes of motion. This study investigated the external loads of collegiate hockey teams. METHODS: Linear external (i.e. Player Load™ [PL]) and workload intensity, PL per minute (PL/m), were measured in 18 NCAA Division I Hockey athletes [11 forwards (FW) and 7 defenders (DEF)] using OptiEye S5 monitoring devices (Catapult Sports, Melbourne, Australia) during the 2016-2017 season. Measurements were recorded during games and practices. Linear mixed effects models with random intercepts for player and date were used to test the effect of position on each variable. Effect sizes were calculated to determine the magnitude of differences between groups. RESULTS: The PL for Period (PD) 1 was 2.27 PL higher than PD 3 (95% CI: 0.18, 0.55; p = 0.002). The PL for PL/m for PD 1 was 0.13 PL/m higher than PD 2 (95% CI: 0.09, 0.17; p = 0.001). The PL for PL/m for PD 1 was 0.18 PL/m higher than PD 3 (95% CI: 0.14, 0.23; p = 0.001). The PL for PL/m for PD 2 was 0.05 PL/m higher than PD 3 (95% CI: 0.01, 0.10; p = 0.014). There were no differences within PD by position (p = 0.198). The PL for practices was 19.43 PL lower than games (95% CI: -35.19, -3.69; p = 0.018). The PL/m for practices was 0.28 PL/m higher than games (95% CI: 0.20, 0.36; p < 0.001; d = 0.9). The PL for FW 2 was 29.2 PL higher than DEF during practice (95% CI: 12.6, 45.8; p = 0.003; d = 1.65). There were no differences in PL between FW and DEF during games (p = 0.167). The PL/m for FW was 0.36 PL/m higher than DEF across practice and games (95% CI: 0.18, 0.55; p = 0.002). CONCLUSION: Within this study we observed: 1) player workload intensity decreasing as the game progresses; 2) higher PL/m for practice compared to games; and 3) higher PL for FW compared to DEF during practice. However, these differences are relatively small in absolute terms and may not be meaningful considering individual variation between players. Playing time, penalties, and minor injuries may affect positional averages throughout the course of a game. Future studies should examine the effect of individual variation within and between weeks and by drill type.

780 Board #41 May 30 2:00 PM - 3:30 PM Physical Skills of Teen Student-Athletes of Combat Sports: A Comparative and Correlational Analysis

No relevant relationships reported

PURPOSE: To analyze comparatively the performances of elementary and high school athletes of combat sports in a set of tests of conditional abilities.

METHODS: Data for 151 male and female students (99 male) who took part in a provincial competition of judo, taekwondo and wrestling were collected (age range: 11.9 to 14.9 years). A battery of field tests was carried out: Handgrip strength (HAST), Abalakov, Countermovement and Squat jumps (ABJ, CMJ and SQJ), 0-10 m Sprint acceleration (0-10SA) and Sit and reach flexibility (SARF). Pearson’s r was used to test correlations among the physical skills. ANCOVA models were run to evaluate the performances in the HAST, 0-10SA and SARF, which included Gender, Sport and their interaction, and Age as a covariate. Feasible weighted least squares was applied on HAST and ABJ, to account for heteroscedasticity. Post hoc Tukey-Kramer tests were conducted for multiple comparisons. The statistical significance level was fixed at p≤0.05.

RESULTS: The correlations were high among the jumps (0.82 to 0.91; p<0.001), and from moderate to marked among HAST, 0-10AS and any of the jumps (0.50 to 0.65; p<0.001). SARF showed very low correlations (0.05 to 0.15; 0.0007≤p<0.25). The interaction term was not statistically significant in the models analyzed. Gender was a significant factor in the four models, and Sport was significant in the models for ABJ and SARF. Boys exhibited higher performances than girls in HAST, ABJ and 0-10SA, and lower in SARF. Post hoc comparisons between sports revealed that judokas and taekwondists had higher values than wrestlers in ABJ, and that taekwondists had higher values than wrestlers in SARF. In boys, the mean responses of HAST (kg), ABJ (cm), 0-10SA (m s⁻¹) and SARF (cm) were 28.8, 31.7, 4.7 and 5.1 for judokas; 28.0, 32.8, 4.7 and 5.7 for taekwondists; and 27.0, 29.9, 4.7 and 3.0 for wrestlers. And in girls, the mean responses were, respectively, 23.9, 25.4, 4.1 and 9.4; 23.6, 25.3, 4.0 and 10.8; and 23.6, 23.6, 4.0 and 8.2. CONCLUSIONS: Flexibility evidenced the lowest associations with the rest of the physical skills. The differences between boys and girls appeared to remain constant across sports. Averaged over both genders, martial arts athletes showed higher performances in ABJ, and taekwondists revealed to be more flexible than wrestlers.
RESULTS: Descriptive statistics showed that the mean age of the participants was 47.7±13.2 years old with a mean BMI of 29.0±3.0 kg/m². 50.0% of participants were classified as High Risk for CVD, 27.8% Moderate Risk, and 16.7% Low Risk. A significant correlation was found between age and total distance covered (r = -.505, p = 0.046) and while the correlation between BMI and extrinsic satisfaction (r = -.493, p = 0.062) was not significant, it did imply a moderate correlation. A one-way ANOVA exhibited a significant difference between ACSM risk classification and the number of skilled and non-skilled players (p = 0.044). A post-hoc Tukey test indicates that individuals who are High Risk officiate significantly more sports (p = 0.046) than those who are Moderate Risk. However, High Risk was not significantly different from Low Risk and Low Risk was not significantly different from Moderate Risk (p > 0.05).

CONCLUSIONS: Based on the results of the current study, it appears that the data can confirm that as officials get older they tend to drop out of officiating. In addition, a large degree of officials (77.8%) were considered either Moderate or High Risk for CVD, implying that the physiological stress that officiating typically entails could place these individuals at an increased risk of experiencing a cardiovascular event.

Global positioning tracking comparisons of selected NCAA Division I football player positions during conference games

Bert H. Jacobson, FACSM. Oklahoma State University, Stillwater, OK. (No relevant relationships reported)

PURPOSE: To compare differences in distance traveled, maximum velocity, and acceleration among DI football players during conference games.

METHODS: NCAA DI football players (N=21) were GPS monitors during four randomly assigned conference games to track selected variables of each athlete. Athletes were grouped by position: skill = wide receiver (WR), and defensive back (DB), and line = offensive linemen (OL) and defensive linemen (DL). Dependent variables included total distance covered (m), maximum velocity m·s⁻¹, and high acceleration (>3 ms²) distances. One-way ANOVAs were used to compare differences among groups and Newman-Keuls post hoc tests to determine location of significant differences.

RESULTS: For total distance, DBs traveled significantly (p<0.05) further than WR and OL, but not DL. There were no significant differences between DL and any other positions. DBs and WR had significantly greater maximum velocities than OL and DL, and DL had significantly greater velocity than OL. There was no significant difference between DBs and WRs. For high acceleration, DBs had significantly greater distance than all other groups. WRs had greater distance than DL and OL. No difference was found between OL and DL. CONCLUSION: This study provides quantification of physical demands of selected DI football positions by determining that defensive player traveled further than offensive players did and that skilled players noted greater velocity and acceleration distances than linemen. Fatigue is related to duration and exertion, which is also associated with potential injury. With factual data regarding these variables, it may be possible to avoid over-reaching, hence reducing injury susceptibility.

Tracking, velocity, athletes

Different aspects of body composition such as fat-mass (FM), fat-free mass (FFM), percentage of body fat (BF%), and body mass (BM) have been identified as affecting cardiorespiratory fitness (VO₂max) in children and young adults. In the sport of rugby union, different positions have been found to benefit from different body compositions based on their roles. Forwards have been found to have greater FM, FFM, BF%, and BM than backs. PURPOSE: To determine if FM, FFM, BF%, and BM had any relationship with VO₂max among positional groups in collegiate male rugby union players.

METHODS: Twenty-nine participants (20.3 ± 1.72 years) agreed to perform a 20m multi-stage shuttle-run until volitional failure with the aim of estimating their VO₂max, FM, FFM, BF%, and BM, were estimated through air-displacement plethysmography via a BodPod®. Players were split into two groups based on their general position (forwards, n=16 and backs, n=13). RESULTS: An independent sample t-test comparing FM, FFM, BF%, and VO₂max between forwards and backs revealed that the forwards had a significantly higher BM (t(27) = 5.64, p < 0.01), FM (t(27) = 2.69, p < 0.05), and VO₂max (t(27) = 4.9, p < 0.01). A Pearson correlation coefficient was calculated for the relationships between estimated VO₂max and FM, FFM, BF%, and BM for each positional group. Strong negative relationships were found between VO₂max and FM (r(14) = −0.76, p < 0.01), FFM (r(14) = −0.74, p < 0.01) and BM (r(14) = −0.69, p < 0.05) in the forwards. As for the backs, no significant relationships were found between VO₂max and FM, FFM, BF%, or BM.

CONCLUSION: The higher amounts of FM, FFM, and BM in forwards likely benefits them during play as they spend a large amount of time in contact with the opposition. However, the increased amount of FM, FFM, and BM may negatively affect the forwards’ cardiorespiratory fitness as they are required to move a heavier amount of mass.

Longitudinal Observation Of Cardiac Adaptation In Collegiate Male Rugby Union Players

Kazuo Oguri1, Kosho Kasugai, Takahiro Nakano, Tomoki Sakai, Gifu shokoku Gakuen University, Gifu, Japan, Gifu University, Gifu, Japan, Nagoya Gakuin University, Aichi, Japan. (Sponsor: Kiyoji Tanaka, FACSM) (No relevant relationships reported)

PURPOSE: The purpose of this study is to conduct a 3-year longitudinal study of cardiac adaptation in junior rugby players using echocardiography in an effort to examine how continuous practice of rugby during the growth period affects ventricular volume expansion and ventricular septum thickening.

METHODS: Subjects were 34 male junior high and 79 senior high school rugby players with top-level game experience. Subjects engaged in rugby training approximately 3 hours a day, 6 days a week continuously for 3 years. We measured height, weight, body blood pressure and took electrocardiogram and echocardiography measurements once a year for 3 consecutive years in these subjects. Echocardiography measurements were taken by portable ultrasonic measurement apparatus on B mode to measure left ventricular end-diastolic dimension (LVDD) and posterior left ventricle wall thickness (PWT). As a substitute for the control group, we estimated predicted values for each subject based on their height to make a cross-sectional comparison with the actual measured values.

RESULTS: A cross-sectional comparison of LVDD and PWT measured in junior high schoolers exhibited a significant increase between the 1st and 2nd grade (equivalent of American 7th and 8th grades, respectively) (p<0.01). A cross-sectional comparison of the predicted and actual LVDD values for each year of junior high school revealed a significant difference in 2nd year students (p<0.01). In contrast, there was a significant difference between predicted and actual PWT values in the 2nd and 3rd (equivalent of American 9th) grade students (p<0.05). In senior high schoolers, LVDD increased significantly between the 1st and 2nd grade as well as between the 2nd and 3rd grade, and PWT increased significantly between the 1st and 2nd grade (p<0.01). In senior high school, there was a significant difference between actual and predicted values of

ACSM May 29 – June 2, 2018 Minneapolis, Minnesota
Heart rate (HR) monitoring, GPS tracking, and accelerometry are new techniques for evaluating players’ activity levels during competition. Results from live tracking can help the coaches with practice schedules and game strategies. To date, there are few data available from these tracking modalities within NCAA varsity women’s field hockey. PURPOSE: Our purpose was to determine descriptive information related to players’ game performance and analyze the results by player position. METHODS: A team HR monitoring system was used to evaluate in-game HR responses and movement patterns of women field hockey players from a single NCAA Division I team. Players were divided into 3 groups based on position (back, midfielder, forward). Data were collected and averaged among 15 women who played in 3 games, and 95% confidence intervals were computed. HR max was determined through a continuous graded treadmill test with increases in intensity every 2 min. Given that field hockey is a fast-paced game, variables of interest in this preliminary investigation included time spent in HR Zone 4 (80-90%HRmax) and HR Zone 5 (>90%HRmax), maximum speed achieved, and number of sprints performed. RESULTS: On average, players spent 31.3% of game time in HR Zone 4 and 49.2% in HR Zone 5. Differences were seen according to player position as backs spent less time in HR zone 4 (22%) compared to midfielders (31.3%) and forwards (49.2%). Data were collected and averaged among 15 women who played in 3 games, and 95% confidence intervals were computed. HR max was determined through a continuous graded treadmill test with increases in intensity every 2 min. Given that field hockey is a fast-paced game, variables of interest in this preliminary investigation included time spent in HR Zone 4 (80-90%HRmax) and HR Zone 5 (>90%HRmax), maximum speed achieved, and number of sprints performed. RESULTS: On average, players spent 31.3% of game time in HR Zone 4 and 49.2% in HR Zone 5. Differences were seen according to player position as backs spent less time in HR zone 4 (22%) compared to midfielders (31.3%) and forwards (49.2%).
Do Metrics Between Back-to-Back National Hockey League Away Games Indicate a Presence of Fatigue? 

Anthony B. Ciccione, Joseph P. Weir, FACSM. University of Kansas, Lawrence, KS. (Sponsor: Dr. Joseph Weir, FACSM) (No relevant relationships reported)

**PURPOSE:** The purpose of this investigation was to estimate the fatigue caused by game one of a set of back-to-back games (away) as indicated by play-by-play metrics.

**METHODS:** The R package, nhlscrapr, was used to acquire the 2015-2016 National Hockey League play-by-play database. First, the database was filtered for all regular-season, full-length events with no pulled goals. Next, all back-to-back games were identified and coded as being either away-away, home-home, home-away, and away-away. Only away-away back-to-back games were analyzed. Finally, the data were filtered so each back-to-back team had a frequency count for games one and two of the following variables: goals for, goals against, shots on goal for, shots on goal against, missed shots for, missed shots against, shots for blocked, shots against blocked, hits for, penalties against, and penalties for. All metrics were analyzed using mixed models, with random effects for team and fixed effects for game number. Goals, penalties, and blocked shot models were fit using Poisson distributions, and all other models were fit using Gaussian distributions. Alpha was set at 0.05.

**RESULTS:** 186 away-away pairs of games were identified; teams had anywhere from 1 to 10 pairs. There was a significant effect of game number on goals for (game 1 = 1.81 ± 1.3; game 2 = 2.51 ± 1.2; p = 0.035), shots against (game 1 = 20.80 ± 5.5; game 2 = 22.00 ± 6.2; p = 0.004), and missed shots against (game 1 = 8.93 ± 7.8; game 2 = 9.94 ± 9.0; p = 0.11). There was no significant effect of game number on goals against (game 1 = 8.11 ± 2.7; game 2 = 7.11 ± 3.4; p = 0.46), shots on goal for (game 1 = 20.86 ± 8.6; game 2 = 19.99 ± 5.5; p = 0.14), missed shots for (game 1 = 8.83 ± 3.6; game 2 = 8.83 ± 3.7; p = 0.95), shots for blocked (game 1 = 10.94 ± 4.5; game 2 = 11.44 ± 4.7; p = 0.13), shots against blocked (game 1 = 10.44 ± 4.2; game 2 = 10.53 ± 4.7; p = 0.92), penalties against (game 1 = 2.0 ± 1.5; game 2 = 2.81 ± 1.5; p = 0.004), penalties for (game 1 = 2.0 ± 1.5; game 2 = 2.62 ± 1.1; p = 0.10), and hits for (game 1 = 21.43 ± 8.9; game 2 = 20.70 ± 7.6; p = 0.31).

**CONCLUSIONS:** Hit data indicates that physicality is likely not as affected by game 1 fatigue. However, teams give up a greater number of total shot attempts in game 2’s and score fewer goals in game 2’s. Thus, game 1 fatigue may result in lower-quality shots for and generally poorer defensive play by skaters.

Do Metrics Between Back-to-Back National Hockey League Away Games Indicate a Presence of Fatigue? 

Anthony B. Ciccione, Joseph P. Weir, FACSM. University of Kansas, Lawrence, KS. (Sponsor: Dr. Joseph Weir, FACSM) (No relevant relationships reported)

**PURPOSE:** The aim of this study was to verify the effect of the rapid weight loss (RWL) induced by the restriction of fluids at different moments on the manual grip strength in mixed martial arts (MMA) athletes.

**METHODS:** Twenty-seven male amateur MMA athletes (age 24.0 ± 5.3 years, height 175.8 ± 8.2 cm, body mass 76.0 ± 14.66 kg) and twenty-three women (age 19.0 ± 6.9 years; height 164.0 ± 6.1 cm; body mass 66.0 ± 6.70 kg) participated in this study. All athletes had BM, handgrip strength, and hydration status assessed at baseline (10 days before the onset of RWL), the official match weigh-in, and again 24 h later (match time).

**RESULTS:** A repeated measures ANOVA showed for men and women, basal body weight (male: 75.0 ± 2.0; female: 66.1 ± 6.7) was significantly higher than at the time of weighing (male: 65.2 ± 2.1; woman: 56.9 ± 4.9) and match time (male: 68.5 ± 2.1; female: 59.6 ± 6.1). Density for males was higher at baseline (1.039 ± 0.1) compared to 24 h later (1.018 ± 0.1). However, women presented a difference in density for the three moments (baseline: 1.040 ± 0.2 > 1.030 ± 1.0 > 1.017 ± 0.1). In the handgrip for men it was evidenced difference between baseline (44.2 ± 13.8) and weighing (40.3 ± 17.7); however for women not found difference.

**CONCLUSIONS:** Rapid weight loss showed to reduce significantly manual grip strength. In addition, was observed that this technique leads the athlete to dehydration. This would possibly interfere in a negative way in the performance of the athletes. In this way, the subjective criterion of a supposed advantage in the reduction and supercompensation of the weight must be well planned so that there is no deleterious effect on the performance and health of the athlete.

Changes In Elite Canadian Collegiate Hockey Player’S Body Compositions And Physiologic Tests Across Playing Careers 

Nathan Charliffti, Patrick Delisle-Houde, Ryan RE Reid, Alex Siros, Cory Kennedy, Ross E. Anderson, FACSM, FACSM. McGill University, Montreal, QC, Canada. (Sponsor: Ross Anderson, FACSM) (No relevant relationships reported)

The combined athletic and academic demands place a significant burden on collegiate hockey players. Numerous cross-sectional studies have been conducted with professional hockey players assessing body composition and skeletal fitness; yet, no research has investigated the longitudinal physiologic changes among elite collegiate athletes. **PURPOSE:** To examine changes in body composition and physiologic tests across a player’s collegiate hockey career. **METHODS:** Over three seasons, six elite male Canadian university hockey players (age = 21.35 ± 28 years, weight = 84.3 ± 7.26 kg, height = 179.4 ± 7.60 cm, body fat percentage = 15.55 ± 1.68% at baseline) participated in the study at the beginning of their hockey seasons. All participants underwent physical testing (as outlined in the 2016 NHL combine) and a day after testing, one total body dual energy x-ray absorptiometry (DXA) scan to measure body composition. **RESULTS:** A repeated measures ANOVA was used to track body composition and physiologic performance variables over a three-year period. Players gained body weight (1.06 ± 1.96 kg), total body fat percentage (2.83 ± 1.91%), visceral adiposity (1.6 ± 1.5 kg), upper fat mass (1.57 ± 1.20 kg), and lower fat mass (0.52 ± 36 kg) (p < .05 for all comparisons). Total and regional lean tissue mass stayed relatively constant throughout their careers. There were no significant changes in agility scores, left grip strength, long jump distance or impulse generated in the vertical jump as all of these assessments stayed relatively consistent throughout the seasons. As players progressed through their careers, they achieved significantly different body compositions and physiologic performance variables over time.

Relaxation Jumps: A Potential Tool for Individuals Engaged in Training for Sports with High Physical Demands 

Katie L. Eichholz, Taylor Manes, Jerry L. Mayhew, William F. Brechue, FACSM, J Bryan Mann, A. T. Still University of Health Sciences, Kirksville, MO. 1 A. T. Still University of Health Sciences, Kirksville, MO. 2 University of Missouri, Columbia, MO. (No relevant relationships reported)

Ability to generate force quickly is a primary evaluation protocol for assessing athletic potential. Jumping indices have become major indicators of potential or justifiable training improvement. However, there is limited information concerning these indices for college football players. **PURPOSE:** To compare two forms of reactive strength index (RSI) between college football linemen and backs. **METHODS:** Linemen (n = 11) and backs (n = 12) from an NCAA D-II program were tested for one-repetition maximum (1RM) squat (SQ), paused squat jump (SJ) and drop-jump vertical jump (DVJ) determined from reach height. Flight time during SJ and ground contact time (GCT) were measured using an automated contact mat. Each player performed 3 trials of each jump. Relative 1RM SQ was expressed alometrically (SQkg^-1). RSI was calculated as a ratio of DVJ to GCT (RSI-1) and Ft/GCT (RSI-2). Data were analyzed with GCT ANOVA and Bonferroni accepted with p < 0.05. **RESULTS:** Linemen were significantly taller (186.7 ± 3.6 cm) and heavier (117.3 ± 15.7 kg) than backs (180.1 ± 6.0 cm and 90.1 ± 5.3 kg, respectively). 1RM SQ was greater in linemen (200.0 ± 26.7 kg) than backs (182.7 ± 28.4 kg), but relative SQ was similar (linemen: 8.20 ± 1.05; backs: 8.99 ± 1.32). Reliability for GCT (ICC = 0.922), Ft (ICC = 0.990), DVJ (ICC = 0.960), and SJ (ICC = 0.991) was high. RSI-1 (2.12 ± 0.52) was greater than RSI-2 (2.04 ± 0.54), although they were highly correlated (r = 0.93). RSI-1 and RSI-2 were greater in backs (23.2 ± 0.38 and 2.42 ± 0.46, respectively) than in linemen (1.67 ± 0.49 and 1.91 ± 0.48, respectively) with large effect sizes (ES = 1.52 and 1.07, respectively). Relative SQ was moderately correlated with RSI-1 (r = 0.63) and RSI-2 (r = 0.59), but there was no relationship with 1RM SQ (r = 0.06 and 0.13, respectively). RSI-1 and 1RM SQ correctly classified 86% of linemen and 85% of backs to the proper position. **CONCLUSION:** Ratios utilizing contact time appear more effective at evaluating reactive strength than measurements of strength or simple jump performance (jump height). The relationship between relative strength and reactive jumps suggests that players who have greater relative strength can move more effectively in reactive situations which may more accurately identify performance potential in college football players.
and nutritionists to optimize meal plans in an effort to prevent weight and adipose tissue gain which may enhance on-ice play and player health across their three-year university careers.

The Association Among Body Composition, Explosive Leg Power and Aerobic Capacity in Male Varsity Hockey Players

Sebastien Beauregard, Nathan A. Chiarlitti, Patrick Delisle-Houde, Ryan E. Reid, Ross E. Andersen. McGill University, Montreal, QC, Canada. McGill University, bromont, QC, Canada. (Sponsor: Ross E. Andersen, FACSIM) (No relevant relationships reported)

Fitness testing and body composition assessments in sports are ubiquitous and rapidly becoming an indispensable resource for strength and conditioning coaches. Previous research has shown that higher amounts of lean tissue mass have been associated with increased power outputs and lower levels of body fat percentage have been associated with improved aerobic fitness. PURPOSE: To examine the relationship between body composition and lower body power and aerobic fitness in elite collegiate hockey players. METHODS: Sixteen elite male Canadian university hockey players (age = 22.194 ± 0.99 years, weight = 85.74 ± 5.80 kg, height = 182.25 ± 6.67 cm), participated in the study at the beginning of their hockey season. All participants completed the long jump and the beep-test and a day after testing, one total body dual energy x-ray absorptiometry scan to measure body composition. Simple linear regression was used to explore the relationship between body fat percentage, visceral adipose tissue, and abdominal adipose tissue with aerobic fitness evaluations and leg lean with lower body power. RESULTS: On average body fat percentage was 16.6 ± 3.0%, fat mass 13.7 ± 2.8 kg, abdominal adipose tissue 0.9 ± 0.3 g, leg lean mass 23.8 ± 1.97 kg, long jump 2.67 ± 0.16 m, beep test 12.8 ± 1.32 min. Visceral adipose tissue explained 24.5% of the variance in the test of aerobic fitness (p < .05), while other adiposity measures were non-significant. Body fat percentage and lower body power did not significantly contribute to aerobic fitness and lower body power respectively (all p > .05). CONCLUSIONS: Despite a lack of inter-relationships among field tests and body composition, these variables should remain part a test battery to allow strength and conditioning coaches to better tailor training programs for elite hockey players. Keywords: body composition, hockey, Fitness testing

Football is considered an anaerobic sport, therefore anaerobic evaluations are usually the main tests performed. Nonetheless, due to the number of plays and the duration of the game, the evaluation of the aerobic system through the measurement of the maximum oxygen consumption (VO2 max) becomes an important variable in the sport performance. The direct evaluation of the VO2 max can be expensive due to the equipment and special laboratory conditions needed to perform it. Normally, most Mexican coaches perform indirect estimation of the VO2 max through field test. PURPOSE: To determine direct VO2 max of a sample of a Mexican College football team and compare the measurements with two different indirect methods. METHODS: Twenty voluntary Mexican College football players participated in the study. Informed consents were signed. Athletes were divided according to their play position into two groups: Lineman (LM) and No-Lineman (NL). SIM was performed using open-circuit spirometry by indirect calorimetry during a maximal graded exercise test, using the Bruce protocol. The first indirect measurement (FIM) was performed using the Bruce protocol equation [VO2 max (mL . kg⁻¹ . min⁻¹) = 14.8 + 1.379 (time in min) + 0.451 (time²)] for a maximal graded exercise test. The second indirect measurement (SIM) was taken using the ACSM’s running metabolic equation [VO2 max (mL . kg⁻¹ . min⁻¹) = 0.2 (speed) + 0.9 (speed) (fractional grade) + 3.53] in the 1.5-mile run test. VO2 max comparisons were made using Spearman’s correlation coefficient test. RESULTS: LM’s direct VO2 max (34.77 ± 10.41 mL . kg⁻¹ . min⁻¹) was lower than NL’s direct VO2 max (46.82 ± 4.41 mL . kg⁻¹ . min⁻¹) (β = 14.87; p < .05). Regarding, FIM of LM (32.56 ± 7.67 mL . kg⁻¹ . min⁻¹) and SIM of LM (36.87 ± 5.18 mL . kg⁻¹ . min⁻¹) both of them were lower than FIM of NL (42.56 ± 3.74 mL . kg⁻¹ . min⁻¹) and SIM of NL (45.96 ± 4.84 mL . kg⁻¹ . min⁻¹). Correlations between direct VO2 max and indirect VO2 max were as follows: LM’s FIM = 0.79 (p < .05), LM’s SIM = 0.63 (p < .05), NL’s FIM = 0.78 (p < .05) and NL’s SIM = 0.73 (p < .05).

CONCLUSIONS: Indirect measurements of VO2 max can be used reliably to determine Mexican College football player’s aerobic capacity when it is not possible or feasible to measure VO2 max direct.

The use of player-worn sensors (PWS) has become increasingly common in team sports. We have previously shown a relationship between PWS metrics during on-ice sessions and laboratory measures in ice hockey. It is not clear, though, if metrics derived from PWS are indicative of player performance in terms of performance results based metrics (e.g., goals, assists, etc.). PURPOSE: To determine if on-ice measures obtained from PWS relate to player in-game statistics: plus/minus, goals, assists, or shots on goal. METHODS: 19 members of the US National Team Development Program ice hockey team (17.5 ± 1.7 y, 1.82 ± 0.08 m, 83.1 ± 7.6 kg) consented to procedures approved by the EMU-HSRC. Zephyr Biokinesee-3 (Zephyr, MD) PWS measured triaxial accelerations and heart rate for games. Data was downloaded to Omnisense (Zephyr, MD) and exported to database for mean maximal acceleration (MMA) determination. MMA from 10 - 90 sec at 10 sec intervals and from 2 - 60 min were calculated and used to determine relationships to game statistics. Game statistical data for each player for 10 - 15 games was obtained from USA Hockey, including plus/minus, goals, assists and shots on net. Pearson product correlations for game statistics and linear stepwise regressions were performed for game statistics vs. MMA using SPSS 22.0 (IBM, NY; α = .05).

RESULTS: Goals were correlated with shots (r = .35; p < .01), while plus/minus was correlated to goals (r = .24; p < .01) and shots (r = .4; p < .05). Linear regressions showed that goals were significantly related to 3 min MMA (β = .139; p < .02). Assists were related to 2 min (β = .135), 30 min (β = .37), and 60 min (β = .226) MMA (p < .05). Shots were related to 3 min MMA (β = .135; p < .05). No variables were accepted into the regression for plus/minus vs MMA.

CONCLUSIONS: Some metrics derived from PWS during on-ice sessions are related to game performance statistics. In particular, 2 and 3 min MMA would be indicative of a combination of anaerobic and aerobic energy system contributions and appear important for all scoring metrics.

B-60 Free Communication/Poster - Perception

Wednesday, May 30, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

Board #58 May 30 2:00 PM - 3:30 PM Relationship Between Acceleration Profiles and Game Statistics among Members of a National U18 Ice-Hockey Team

Kristian Burke, Devon J. Erps, Davor Stojanov, Dakota J. Burke, Andrea Workman, Kenneth Martel, Stephen J. McGregor. Eastern Michigan University, Ypsilanti, MI. (No relevant relationships reported)

Abstracts were prepared by the authors and printed as submitted.

WEDNESDAY, MAY 30, 2018
variables obtained by a fitness professional. The equation published by Uhh et al. (USOP) is often used to predict VO\textsubscript{\text{max}} from age and RHR measures. No validated models incorporate perceived exertion of physical activities. Non-exercise prediction of VO\textsubscript{\text{max}} may provide a quick, valuable alternative to sub-maximal assessments for healthcare providers in order to stratify disease risk and prescribe aerobic exercise.

**Purpose**: The purpose of the study was to explore the efficacy of a non-exercise VO\textsubscript{\text{max}} assessment using a combination of perception of activities, body mass index (BMI), gender, and, age.

**Methods**: Twenty-seven subjects (ages 19-49) performed a maximal graded exercise test (GXT) and the Forestry Step Test (FST). Subject anthropometrics were assessed and all subjects completed a questionnaire in which perceived exertion was estimated for 15 well known physical activities. VO\textsubscript{\text{max}} estimations were derived from each of the activity items by dividing the metabolic equivalent by the percentage of predicted GXT VO\textsubscript{\text{max}}.

**Results**: We have uncovered an endogenous circadian effect on RPE with least perceived exertion during the circadian phase 210º, ≈10:45 AM) and highest RPE during the biological night (90º, ≈3:45 AM).

**Conclusion**: The inclusion of exertion perception in VO\textsubscript{\text{max}} prediction models may strengthen the validity of non-exercise estimations. Future research should elucidate the most predictive activity items across populations. Given their ability to be self-administered, VO\textsubscript{\text{max}} prediction surveys can provide valuable information to large populations where traditional evaluation methods are impractical to perform.

---

**Perceived Exertion as a Monitoring Strategy during CrossFit®: Useful or Useless?**

Derek Crawford, Nicholas Drake, Michael Carper. Pittsburg State University, Pittsburg, KS.

(No relevant relationships reported)

**Purpose**: Facing harsh criticism of potentially causing injury, CrossFit® (CF) may benefit from the inclusion of appropriate monitoring strategies. Rate of perceived exertion (RPE) is a monitoring strategy commonly used for both quantification and modulation of workloads during exercise and sports training. Despite its widespread use in CF investigations, the validity of RPE as a monitoring strategy in CF training remains untested.

**Methods**: Six males (height, 182.8±6.8 cm; weight, 84.3±12.4 kg; and age, 25.0±5.4 years) participated in three weeks (5 days/week) of CF training. Following each training session, RPE, workout duration (Dur), and immediate post-exercise heart rate (THR) were recorded. Dur and THR were used to quantify the workload (WL) for each session. Means for RPE, Dur, THR, and WL were calculated for week 1 and week 3 of training. The Profile of Mood States (POMS) questionnaire was administered pre-week 1 and post-week 3. A repeated measures MANOVA with Tukey post-hoc adjustments was used to assess differences in training session variables between weeks 1 and 3. Linear regression of mean RPE and WL were compared between weeks 1 and 3. POMS outcomes were compared between weeks 1 and 3 using magnitude-based inferences of each subscales' minimum clinically important difference (MCID).

**Results**: There are increases in mean session THR (%Δ=+6.2%); F=1.19, p=0.325, Dur (%Δ=+17.3%); F=4.55, p=0.065), and WL (%Δ=+23.9%); F=8.14, p=0.036) from week 1 to 3. In contrast, mean session RPE decreased (%Δ=−4.9%; F=1.42, p=0.183) between these weeks. RPE was a better predictor of WL during week 3 compared to week 1 (week 1: r=+0.36, R\textsuperscript{2}=13.5%, p=0.048; week 3: r=+0.614, R\textsuperscript{2}=37.7%, p<0.001, ΔR\textsuperscript{2}=24.2%). For POMS outcomes, total mood disturbance (2.69 foldΔ; 87.6% likelihood), tension-anxiety (3.13 foldΔ; 90.7% likelihood), and vigor-activity (3.25 foldΔ; 94.9% likelihood) subscales most likely highlight meaningful negative changes.

**Conclusion**: RPE has the potential to be a useful monitoring strategy for incorporation into CF training. Questions still remain as to whether or not RPE is sensitive enough to detect early signs of overreaching during CF training.
workouts on a cycle ergometer, with the sequence of sessions designed to test the hypothesis that sRPE for a given exercise bout would increase with progressive fatigue, whether from a longer bout, or from successive days of harder than usual bouts. The workouts were Monday through Thursday for two weeks. The first week was three 30-min sessions (e.g. normal training) followed by a 60-min session (30-min session repeated 2xs) (e.g. heavier than usual training). The second week was three 60-min sessions followed by a 30-min session. sRPE was measured 30-min post exercise, and RPE and HR intervals at 10 minute intervals during exercise. Results: The 30-min sessions in week 1 had sRPE that was significantly less than the 60-min session (4.3 ±1.7, 4.3 ±1.4, 4.5 ±1.7, 5.3 ±1.8). During week 2 the 60-min sessions became progressively harder, before the recovery 30-min session on day 4 (5.3 ±1.2, 5.9 ±1.6, 6.0 ±1.2 & 4.3 ±1.6). The mean RPE/HLA during the exercise bouts, a potental index of glycogen depletion mediated fatigue, followed a relatively constant course in week 1 (0.7±0.2, 0.9±0.4, 0.8±0.4 & 0.9±0.4) and an increasing course in week 2 (0.8±0.4, 0.9±0.4, 1.0±0.4 & 0.9±0.4). Conclusion: The results suggest that in addition to being a surrogate of exercise intensity, sRPE reflects accumulated fatigue during periods of increased training.

**RESULTS**

The Borg Rating of Perceived Exertion (RPE) and Category Ratio (CR-10) scales are the most well-known and frequently used scales for quantifying subjective intensity during exercise. However, limited data exists comparing the intra-individual correlations among the Borg RPE and CR-10 scales. PURPOSE: To evaluate the intra-individual variability between the Borg RPE and CR-10 scales during incremental exercise. METHODS: 5 males (20.4±0.14 years) and 5 females (22.0±0.71 years) completed two graded exercise tests (GXTs) on an electronically-braked cycle ergometer with a 48-hour interval in between. Each GXT included 2-minute stages with increments of 25 Watts/stage to volitional fatigue. Heart rate (HR), oxygen consumption (VO2max = 48.0±13.3 ml/kg/min, HRmax = 191.0±6.65 bpm; Peak PO = 238.1±56.83 Watts; RPEmax = 18.7±0.95; CR-10max = 9.1±1.28). There was a significant (p<0.0001) and very strong correlation coefficient (r=0.94, 95% CI: 0.91-0.96). CONCLUSION: Results from this study showed that the Borg RPE and CR-10 scales are related in a highly regular and predictable way.
The ideal performance state is manifested by optimal psychological and physiological efficiency. The effects of anxiety and self-confidence have been shown to alter the ideal performance state. Coaches and athletes could use this information in the training environment in order to make best use of personnel (assigned to spotting tasks), physical resources (ex. squat racks), and time management.

Performance foam, when used as an adjunct to training, may positively affect thresholds within the muscle allowing for more intense training, longer training sessions, possible muscle recovery, and a decrease in delayed onset muscle soreness symptoms. PURPOSE: To evaluate the effectiveness of a performance foam on perceived exertion and self-reported recovery on performance in adults participating in a high-intensity functional exercise program. METHODS: Thirty adults (age: 31.2 ± 8.1; males: n = 12, 176.9 ± 62 cm, 89.5 ± 15.1 kg; females: 164.7 ± 7.1 cm, 69.9 ± 11.1 kg) participated in a randomized counter-balanced and double blind trial over a 2-week period. Randomized experimental conditions (ExCon) consisted of performance foam (PF) or placebo (P) foam. Participants completed 5 workouts each week and applied either PF or P to the primary muscles used before and after each workout. RESULTS: A main effect was revealed for RPE and ExCon (F = 4615.2, P < 0.01, n² = 0.99) for all participants. Interactions existed between days (P ≤ 0.01) with no interaction found between ExCon and days. A main effect was revealed for RPS and ExCon (F = 1626.6, P ≤ 0.01, n² = 0.98) for all participants with no interactions between days and ExCon and days. Across gender, a main effect was revealed for RPE and ExCon (F = 2479.98, P < 0.01, n² = 0.99) with no interactions between days and ExCon and days. CONCLUSIONS: RPE declined at the end of 5-day regimen using PF compared to P and participants averaged RPS was higher throughout the week using PF compared to P. Participants felt more recovered from the previous workout when using PF and felt as if they were not exerting as much effort throughout the week. The decrease in RPE allows for one to continue exercising longer at the same intensity or increase their intensity levels, leading to a greater improvement in training results.
810 Board #71 May 30 2:00 PM - 3:30 PM
Comparing Training Load and Intensity Perceptions Between Female Distance Runners and Their Coach
Lawrence W. Judge, Beau M. Links, Andrew Mullally, Mark King, Zachary Waterson, David M. Bellar.
Ball State University, Muncie, IN. 'Fort Wayne Medical Education Program, Ft. Wayne, IN. 'University of Louisiana at Lafayette, Lafayette, LA. (Sponsor: Matthew Harber, FACSM)
(No relevant relationships reported)

The ability of athletes and coaches to adapt training in order to improve athletic performance and prevent injuries is the cornerstone of modern sports medicine. Overtraining syndrome occurs when training consistently occurs at or above lactate threshold without appropriate recovery. It is critical that the coach’s perceptions of effort and intensity of training are similar to what the athlete experiences.

PURPOSE: The purpose of this study was to evaluate the training regimen fidelity and quantify training load and intensity in female division I collegiate distance runners.

METHODS: An observational descriptive longitudinal design was utilized. The duration of the data collection was 14 weeks. The subjects were six collegiate female track and field distance athletes (≥18yrs of age) who ran >800 meter events. Baseline pre-training heart rate and blood lactate levels were recorded during a custom six stage treadmill test. Blood lactate, duration, rate of perceived exertion (RPE), average heart rate for each training session and hours slept nightly were recorded. RESULTS: Average training intensity (duration x RPE) over the course of the competitive season as prescribed was 159.56. The mean value was 144.5 and results ranged from 126.21 to 156.62. Coach intended training load (duration x blood lactate average) was 170.75; athletes ranged 73.25 to 140.66; mean = 109.36. Hours of sleep averaged 7.8 the day before a meet and 7.3 the day after. Easy training days (intended RPE of 1.5 out of a possible 10) showed a discernible difference with actual RPE higher than the target value (mean 3.4±1.2, range 2.7-4.2). Intermediate training days (intended RPE of 4.3) had a lower RPE than target with a mean of 3.9± 1.6 (range 3.0 - 4.8). Hard training days (intended RPE of 8.16) showed the most marked difference from target with a mean of 6.24±1.4 (range 4.94 - 7.25). CONCLUSIONS: Similar to male athletes, female athletes perceived easier workouts as more difficult and harder workouts as easier than their coaches intended. Average training intensity and training load (duration x blood lactate average) were measurably less than their coach intended. The combination of poor adherence to their coach’s training regimen and potentially inadequate recovery may be some of the etiologies for increased overuse injuries in female athletes.

811 Board #72 May 30 2:00 PM - 3:30 PM
Rating Of Perceived Exertion In The Squat Until Muscle Failure Versus Non-failure In Women.
Wanderson Divino Nilo dos Santos, Carlos Alexandre Vieira, Ronyson Camilo Soares, João Felipe Mota, Alcides Corrêa de Morais Junior, Martim Bottaro, Paulo Genili.
Federal University of Goias, Goiânia, Brazil. 'University of Brasília, Brasília, Brazil.
(No relevant relationships reported)

PURPOSE: The objective of this study was to compare the rating of perceived exertion (RPE) and the volume of repetitions performed during a parallel squat in the Smith machine in two different situations, repetitions until failure or non-failure.

METHODS: A randomized, crossover trial was performed, involving twelve women (24.93 ± 5.04 years, 59.29 ± 11.28 kg) with previous experience in strength training (4.5 ± 2.43 years). Participants were randomized to either muscle failure (MF) or non-muscle failure (NF) groups. The RPE (OMNI-RES 0-10) and the total volume of repetitions in women performing the parallel squat on the Smith Machine were evaluated. The protocol consisted of: 4 sets of 10 RM (determined non-muscle failure (NF) groups. The RPE (OMNI-RES 0-10) and the total volume (4.5 ± 4.23 years). Participants were randomized to either muscle failure (MF) or

CONCLUSIONS: With the same protocol and exercise, the exertion (RPE) and the volume of repetitions in women performing the parallel squat on the Smith machine were different, depending on the effort perception and the number of repetitions performed.

818 Board #73 May 30 3:30 PM - 5:00 PM
High-intensity interval training (HIIT) has been shown to be an effective form of training to improve aerobic fitness. Plasma volume shift has the potential to contribute to acute fatigue via temporary reduction of blood volume. There is a lack of data regarding the acute effects of HIIT on plasma volume shifts over the course of an HIIT protocol.

PURPOSE: The purpose of the study was to determine the effects of a bout of HIIT on changes in plasma volume during and after the protocol.

METHODS: Eight participants (1 female, 7 males) completed a preliminary session to collect anthropometric data and determine cardiorespiratory fitness, followed by an experimental session. During the experimental session, a modified Tabata HIIT protocol on a cycle ergometer was completed: six 15-second sprints at maximum effort against a resistance proportional to lean body mass with two minutes of active recovery between sprints. Hematocrit was determined using a microhematocrit method and hemoglobin was determined using a hemoglobinometer. Plasma volume shifts were determined using hematocrit and hemoglobin concentrations.

RESULTS: A repeated measures ANOVA was performed to determine changes in oxygen consumption (VO2), mean arterial pressure (MAP), heart rate (HR), and minute ventilation (Ve); t-tests were used for post-hoc analysis. Additionally, shifts in plasma volume were compared using a paired t-test. A significant (P < 0.05) change from pre- to mid-HIIT occurred for HR (80.62±5.42 to 173.50±3.78 b/min), VE (26.75±2.87 to 69.85±6.95 L/min), VO2 (11.68±1.45 to 29.35±4.59 ml/kg/min), MAP (93.08±1.65 to 122.75±2.96 mmHg), and plasma volume shift (-12.28±2.14%) with significantly (P < 0.05) greater changes in HR from mid-to post-exercise (173.50±3.78 to 181.00±1.35 b/min) but not VE, VO2, MAP or plasma volume shift (-2.69±1.85%). CONCLUSION: Findings revealed that 13 min of HIIT increases cardiorespiratory stress and results in large plasma volume reductions from pre- to mid-exercise with smaller reductions from mid- to post-exercise. These acute reductions in plasma volume are similar to reductions that have been reported after running a marathon.
and VLL80 [128 (75) ml·min⁻¹]. At 1 minute post, there were no differences in BF between VLL0: 438 (227), VLL40: 470 (248), VLL80: 464 (290), and HL: 364 (239) ml·min⁻¹. CONCLUSIONS: The hemodynamic response to very low load resistance exercise combined with BFR at different pressures is similar to high load resistance exercise when performed in the upper body, although the BF response differs per the cuff pressure.

814 Board #75 May 30 3:30 PM - 5:00 PM
Novel Gene Variant Associated with Exercise Pressor Reflex Responsiveness
Nathan Garvin, John Hayes, David Vandenbergh, James A. Paweleczky, FACSM. Pennsylvania State University, University Park, PA. (Sponsor: James A Paweleczky, FACSM)

(No relevant relationships reported)

PURPOSE: Activation of thinly myelinated and unmyelinated afferents innervating contracting skeletal muscle elicits the exercise pressor reflex. We hypothesized that single nucleotide polymorphisms (SNPs) of genes encoding ionotropic and metabotropic receptors commonly found on skeletal muscle afferents might account for part of the typical variation in blood pressure responses to exercise.

METHODS: 101 healthy, college age, men and women of European ancestry participated. Multivariate modeling of the mean arterial pressure response to post-exercise circulatory arrest following 3-min of static handgrip exercise (30% of maximum) was used to stratify subjects into quartiles. Subjects from the highest (N=33) and lowest (N=25) quartiles provided buccal mucosa cells. DNA was extracted, amplified, and analyzed for common (minor allele frequency >20%), non-synonymous SNPs of genes with functional associations to autonomic disorders. We evaluated selected variants of the TRP (N=18), ASIC (N=3) and P2X (N=6) receptor families (real-time PCR, custom OpenArray™) and used contingency table analysis to compare the frequency of homozygotes and trait allele carriers between the two groups.

RESULTS: Trait allele carriers of rs8065900, a T-to-C missense mutation of TRPV1, were more frequent in the high response group (73% vs 48%, P<0.01). Frequencies of all other SNPs did not differ between groups.

CONCLUSIONS: Data from this pilot investigation suggest that intra-subject variation in mean arterial pressure during post-exercise circulatory arrest may associate with SNPs of genes putatively linked to the metabolic component of the exercise pressor reflex. Additional work is warranted to confirm these observations and explore the mechanistic role of TRP channels in exercise pressor reflex responsiveness.

Supported in part by the Huck Institutes of the Life Sciences and the College of Health and Human Development.

815 Board #76 May 30 3:30 PM - 5:00 PM
Acute Hemodynamic Response to Very Low Load Resistance Exercise With or Without Blood Flow Restriction
Kevin T. Mattocks, J Grant Mouser, Matthew B. Jesse, Scott J. Dankel, Samuel L. Buckner, Zachary W. Bell, Takashi Abe, Jeremy P. Loenneke. The University of Mississippi, University, MS.

(No relevant relationships reported)

Although lifting a load at 30% one-repetition maximum (1RM) to failure elicits an increase in muscle size similar to high load resistance exercise, it is unknown if an individual can reach failure when lifting loads <20% 1RM. Applying blood flow restriction (BFR) can cause blood flow to be artificially reduced which may help create an environment necessary to induce fatigue when exercising with a load <20% 1RM.

PURPOSE: To determine changes in blood pressure and blood flow following exercise with and without different levels of BFR (based on arterial occlusion pressure (AOP)) while using a very low load (15% 1RM) and compare those changes with high load (70% 1RM) exercise.

METHODS: Sixty-nine participants were randomized into one of four conditions: 1) 15% 1RM, no BFR (15/0), 2) 15% 1RM, 40% AOP (15/40), 3) 15% 1RM, 80% AOP (15/80), and 4) 70% 1RM, no BFR (70/0). Following 1RM testing in one leg (randomized) and 10 min of seated rest, resting blood flow of the lower leg was determined using a 10cm wide cuff in the BFR conditions. Participants then exercised for 4 sets to failure (up to 90 repetitions) with 30 (15% 1RM) or 90 (70% 1RM) seconds of rest. Blood flow and blood pressure [Systolic (SBP), Diastolic (DBP)] was determined using a 10cm wide cuff in the BFR conditions. Data was extracted, amplified, and analyzed for common (minor allele frequency >20%), non-synonymous SNPs of genes with functional associations to autonomic disorders. We evaluated selected variants of the TRP (N=18), ASIC (N=3) and P2X (N=4) receptor families (real-time PCR, custom OpenArray™) and used contingency table analysis to compare the frequency of homozygotes and trait allele carriers between the two groups.

RESULTS: Trait allele carriers of rs8065900, a T-to-C missense mutation of TRPV1, were more frequent in the high response group (73% vs 48%, P<0.01). Frequencies of all other SNPs did not differ between groups.

CONCLUSIONS: Data from this pilot investigation suggest that intra-subject variation in mean arterial pressure during post-exercise circulatory arrest may associate with SNPs of genes putatively linked to the metabolic component of the exercise pressor reflex. Additional work is warranted to confirm these observations and explore the mechanistic role of TRP channels in exercise pressor reflex responsiveness.

Supported in part by the Huck Institutes of the Life Sciences and the College of Health and Human Development.
BL and TC were not different for any measures (p>0.05). cPWV increased POST compared with BL and TC (p<0.01). SFA retrograde SR and OSI were reduced POST compared with BL and TC (p<0.001). SFA stiffness was unchanged by exercise (p>0.06). The change in cPWV from pre-exercise to POST was not associated with changes in retrograde SR (r = -0.03, p=0.90), OSI (r = -0.13, p=0.58), β (r = -0.07, p=0.78), or ε (r = -0.08, p=0.73). CONCLUSION: Acute high-intensity exercise increases aortic stiffness while concomitantly reducing oscillatory shear in the SFA. High-intensity exercise-mediated increases in aortic stiffness appear independent from downstream atherogenic shear patterns in the exercised vasculature.

Table 1. Atherosclerotic stiffness and shear patterns before and after high-intensity cycling exercise.

<table>
<thead>
<tr>
<th>Measures</th>
<th>Baseline</th>
<th>Time Control</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aortic cPWV (m/s²)</td>
<td>5.8 ± 0.6</td>
<td>5.7 ± 0.6</td>
<td>6.8 ± 1.3</td>
</tr>
<tr>
<td>SFA β Stiffness (au)</td>
<td>11.2 ± 2.8</td>
<td>13.6 ± 6.0</td>
<td>13.8 ± 4.6</td>
</tr>
<tr>
<td>SFA ε (kPa)</td>
<td>135.1 ± 7.8</td>
<td>157.0 ± 19.9</td>
<td>168.5 ± 12.7</td>
</tr>
<tr>
<td>Shear Patterns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Antegrade Shear Rate (s⁻¹)</td>
<td>216.1 ± 68.7</td>
<td>200 ± 58.7</td>
<td>255.4 ± 55.5</td>
</tr>
<tr>
<td>Retrograde Shear Rate (s⁻¹)</td>
<td>88.4 ± 30.4</td>
<td>89.9 ± 25.5</td>
<td>41.2 ± 25.9*</td>
</tr>
<tr>
<td>Secondary Antegrade Shear Rate (s⁻¹)</td>
<td>43.9 ± 8.8</td>
<td>42.1 ± 7.8</td>
<td>47.4 ± 36.1</td>
</tr>
<tr>
<td>Oscillatory Shear Index</td>
<td>0.25 ± 0.05</td>
<td>0.27 ± 0.04</td>
<td>0.11 ± 0.08*</td>
</tr>
</tbody>
</table>

In conclusion, increases in aortic stiffness were observed following high-intensity exercise, independent of cardiac output.

818 Board #79 May 30 3:30 PM - 5:00 PM Acute Resistance Exercise Effects on Blood Flow in Resistance-Trained Versus Untrained Individuals

Alaina Glasgow, Kathryn Geither, Jason C. Parks, Erica M. Marshall, Leslie Sensibello, Yu Lun Tai, J. Derek Kingsley, FACSM. Kent State University, Kent, OH. (No relevant relationships reported)

Data suggests that an acute bout of resistance exercise (ARE) increases forearm blood flow (FBF) and vasodilatory capacity compared to rest. However, the effects of training status on FBF and vasodilatory capacity at rest and during recovery from exercise are unclear. PURPOSE: To compare the effects of resistance exercise training status on measures of vascular function at rest and recovery from ARE. METHODS: Fifteen resistance-trained (RT) individuals, and seven untrained (UT) individuals volunteered to participate. Measurements were taken after a 10min supine rest and 20min after ARE, or a control. Venous occlusion plethysmography was used to measure FBF and vasodilatory capacity, with 5min of occlusion (220mmHg) to induce reactive hyperemia. Area under the curve (AUC) was utilized to determine differences in blood flow. The ARE consisted of 3 sets of 10 repetitions at 75% 1-repetition maximum (1RM) on the leg press, leg curl, leg extension, lat pulldown, and chest press, with 2min of rest between sets and exercises. A 2x2x2 repeated measures ANOVA was used to evaluate group (RT, UT) across condition (ARE, control) and time (rest, recovery). If the ANOVA was significant, t-tests were used for post-hoc comparisons. RESULTS: Groups were similar (p>0.05) for age, height, and BMI, but not for weight (RT: 74.5±13.0kg; UT: 61.9±10.8kg, p<0.04). The 1RMs for chest press, leg curl, leg press, and lat pulldown were significantly different between groups (p<0.05), but not for leg extension (p>0.26). The total volume of exercise for the ARE was similar between groups (p>0.10). There were no significant (p>0.05) group differences at rest for FBF or vasodilatory capacity. There were no significant differences between groups (p>0.05) 3-way interactions for FBF or vasodilatory capacity. There was a significant condition by time interaction for FBF (RT: rest: 2.9±1.1ml/100ml of tissue/ min, recovery: 8.9±4.0ml/100ml of tissue/ min; UT: rest: 3.1±1.1ml/100ml of tissue/ min, recovery: 8.9±2.9ml/100ml of tissue/ min; p<0.001) and AUC (RT: rest: 56.8±20.2units, recovery: 139.0±66.5units; UT: rest: 53.8±20.2units, recovery: 116.6±25.1units; p<0.001). CONCLUSION: These data demonstrate that acute resistance exercise significantly increases forearm blood flow and vasodilatory capacity regardless of training status. (EndFragment-->

Previous work has shown that a single bout (i.e. 10 min- 3hrs.) of static upright posture decreases lower-limb arterial peak shear rate (PSR). PURPOSE: To examine if long-term replacement of workplace sitting with short (10-30 min) intermittent standing and/or stepping bouts results in PSR adaptations in the popliteal artery. METHODS: Sixty-six sedentary (SED) overweight office workers (mean ± SD; age= 45.3 ± 12.3 years, BMI= 32.4 ± 5.8 kg/m²) were cluster randomized to a sitting control (C), a sit- to-stand desk (D), or a treadmill desk (T) group. Popliteal artery PSR was calculated from Poisseuille’s Law as 4 x (mean blood velocity/internal diameter) using Doppler ultrasonography at baseline (B), and after 3 (M3), 6 (M6) and 12 months (M12). Daily SED, stand, and step time was measured over 7 days at each time-point with an ActivPal. Change (Δ) in PSR and physical behavior (PB) within groups across measurement time points were evaluated using mixed linear models (p<0.05). The PSR model was adjusted for demographics (age, gender, race, ethnicity) and systolic blood pressure, and PB models were adjusted for demographics, avg. daily monitor wear-time and total wear-days. RESULTS: Between B and M3, both the D and T groups significantly reduced SED time [T: mean ± SD of Δ for daily proportion= -8.5% ± 3.0], and increased stand time [T: mean ± SD for Δ for daily proportion= 14.9% ± 3.3%; D: mean ± SD for Δ for daily proportion= 6.7% ± 3.1%]. Neither D nor T groups significantly increased step time. Changes in PB (B to M3) for D and T returned to baseline levels by M6. In conjunction with the PB change (B to M3), popliteal PSR decreased significantly between B and M6 in group D (mean Δ95% CI)= -307.1 ± (478.4 to -135.7) and T (mean Δ95% CI), p= 0.210 ± (378.3 to -41.7). These changes were sustained to M12. CONCLUSIONS: A few months of increasing workplace standing using workstation-based strategies may yield chronic reductions in PSR that extend beyond the duration of the intervention. Pre-syncope signs. Sagittal view images of maximum and minimum IVCD were obtained during the last minute of each stage. The mean HR (ECG), MAP, pulse pressure (PP) and stroke volume (SV) experienced pre-syncopal signs. Ultrasound measurements of the inferior vena cava diameter reductions (IVCD) were used clinically as gross indicators of central hypovolemia. However, it is not known if reductions in IVCD occur prior to changes in traditional vital signs during blood loss. Hemorrhage is a leading cause of trauma deaths. Many of these deaths could be prevented with early detection and appropriate treatment. Traditional vital signs such as heart rate (HR) and mean arterial pressure (MAP) can remain relatively normal despite the central hypovolemia that occurs during blood loss. Ultrasound methods to detect reductions in IVCD may be a useful tool to identify blood loss and guide treatment in patients prior to the development of vital sign abnormalities.
Smoking causes endothelial damage and autonomic dysfunction which leads to decreases in arterial compliance. Similar to changes in arterial compliance with fitness and aging, calf venous compliance improves with higher fitness and declines with increasing age. While previous studies have compared smokers and non-smokers for changes in arterial wall properties, no research to date has investigated the impact of smoking on limb venous compliance. PURPOSE: To determine the calf venous compliance differences in college age smokers (S) versus nonsmokers (NS).

METHODS: 7 S’s (2-12 years of smoking; mean of 4 pack years; age = 22 ± 4 yrs; mass = 83.7 ± 18.4 kg; ht = 181.1 ± 9.5 cm; BMI = 25.4 ± 4.4 kg/m²; calf volume = 2485.4 ± 482.1 ml; VO2 max = 343 ± 7.8 ml/kg/min) and 7 NS’s (age = 23 ± 2 yrs; mass = 76.6 ± 5.8 kg; ht = 176.2 ± 4.7 cm; BMI = 24.7 ± 2.0 kg/m²; calf volume = 2242.1 ± 450.8 ml; VO2 max = 38.0 ± 4.1 ml/kg/min) volunteered for this project. Participants underwent anthropometric assessment, a graded exercise test, and assessment of calf venous compliance. Utilizing venous occlusion plethysmography, calf pressure-volume relations were determined using the quadratic regression equation [Δ limb volume = β0 + β1 (cuff pressure) + β2 (cuff pressure)^2]. Calf venous compliance was calculated as the first derivative of the pressure-volume relation during calf pressure reduction [Compliance = β1 + β2 (2 * β2 * calf pressure)]. Differences in anthropometric, fitness, and compliance variables between S & NS were analyzed with a simple ANOVA. RESULTS: There were no significant differences between S & NS in anthropometric variables or fitness except the smokers were significantly higher in body fat % (19.2 ± 6.5% vs. nonsmokers at 12.3 ± 2.7%). There were no significant differences between S & NS in calf volume or compliance [S, Δ volume = 0.8093 ± 1.401 ± 0.006123 * (cuff pressure) – 0.0010 ± 0.000082* (cuff pressure)^2]; NS, Δ volume = 0.8784 ± 1.39718 ± 0.1211 ± 0.06413 ± 0.0011 ± 0.000609* (cuff pressure)]. CONCLUSIONS: College age male smokers have similar calf venous compliance to non-smokers. It is likely that the chronic effects of smoking that would alter the vessel wall and subsequently decrease venous compliance have not had enough time to influence venous wall structure in men in their early 20’s.

Exposure to hot environments augments cutaneous vasodilation during exercise, whereas exposure to hypoxia can have both direct vasodilator and indirect (reflex) vasconstrictor influences in the skin. PURPOSE: To test the hypothesis that hypobaric hypoxia will have a modulating effect on forearm cutaneous circulation during steady state (SS) exercise in the heat. METHODS: Seven participants (2 F, 5 M) completed 30 min of SS exercise on a cycle ergometer at 50% of respective VO2peak during four separate environmental conditions, 1) Sea Level Thermoneutral (SLTN; 250 meters (m), 20°C, 30-50% RH); 2) Sea Level Hot (SLH; 250 m, 35°C, 30% RH); 3) Altitude thermoneutral (ATN: 3,000 m, 20°C, 30-50% RH), and 4) Altitude Hot (AH: 3,000 m, 35°C, 30% RH). Skin blood flow was recorded using laser-Doppler flowmetry on the ventral forearm. SS cutaneous vascular conductance (CVC = laser-Doppler flow/mean arterial pressure; %max) was calculated as the average of min 20-25 during exercise. After exercise, participants completed 30 min of local warming (42°C) to measure superficial femoral artery (SFA) diameter and retrograde shear rate in 11 exercise-trained men (Division I track athletes; 20 ± 3 years of age, body mass index 21 ± 2 kg/m²) and 18 recreationally active controls (23 ± 5 years of age, body mass index 23 ± 2 kg/m²). Mean blood volume, mean blood velocity, peak blood velocity, and artery diameter were taken for each visit and arterial occlusion pressure was measured. Ultrasound measures of blood flow, mean blood velocity, peak blood velocity, and artery diameter were taken from the posterior tibial artery at rest and during the application of 10% increments of the arterial occlusion pressure. A repeated measures ANOVA was used to examine differences across conditions. RESULTS: There was no significant interaction or overall difference between the 10 cm and 12 cm cuff relating to blood flow [F(4, 50) = 4.951 (7.9 m³/min, p = 0.028)], mean blood velocity [0.168 (1.7 cm/sec^2, p = 0.590)], peak blood velocity [0.586 (11.7 cm/sec^2, p = 0.783), or artery diameter [0.003 (0.02 cm, p = 0.476]. There was a main effect of pressure for blood flow (p < 0.05), mean blood velocity (p < 0.05), peak blood velocity (p < 0.05), and artery diameter (p < 0.05), with each decreasing with increasing pressures. Peak blood velocity increased until 60% of arterial occlusion pressure before decreasing with increased pressure. The 80% and 90% arterial occlusion pressures reduced blood flow by 69.4% and 79.3% respectively when collapsed across the 10 cm and 12 cm cuffs. No other pressures differed significantly between the relative applied pressure and amount of blood flow restricted. CONCLUSIONS: Provided relative pressures are applied, cuff width appears to have little to no effect on the blood flow response at rest. Importantly, relative pressures may not indicate the magnitude of blood flow being reduced (e.g. 80% arterial occlusion may not reduce 80% of blood flow), particularly at higher arterial occlusion pressures.

Blood flow restriction allows individuals to exercise with low loads while producing similar increases in muscle size as high load resistance training. It has been suggested that the pressure should be made relative to the individual (as a percentage of their arterial occlusion pressure), but it remains unknown if a given pressure results in a similar reduction in blood flow, and further, whether this differs based on the width of the cuff being applied. PURPOSE: To examine hemodynamic responses to various relative pressures in the supine position using two commonly used cuffs (10 cm and 12 cm). METHODS: Participants (men=17, women=14) came to the laboratory for two visits. One cuff (10 cm or 12 cm) was randomly applied to the right proximal thigh for each visit and arterial occlusion pressure was measured. Ultrasound measures of blood flow, mean blood velocity, peak blood velocity, and artery diameter were taken from the posterior tibial artery at rest and during the application of 10% increments of the arterial occlusion pressure. A repeated measures ANOVA was used to examine differences across conditions. RESULTS: There was no significant interaction or overall difference between the 10 cm and 12 cm cuff relating to blood flow [F(4, 50) = 4.951 (7.9 m³/min, p = 0.028)], mean blood velocity [0.168 (1.7 cm/sec^2, p = 0.590)], peak blood velocity [0.586 (11.7 cm/sec^2, p = 0.783), or artery diameter [0.003 (0.02 cm, p = 0.476]. There was a main effect of pressure for blood flow (p < 0.05), mean blood velocity (p < 0.05), peak blood velocity (p < 0.05), and artery diameter (p < 0.05), with each decreasing with increasing pressures. Peak blood velocity increased until 60% of arterial occlusion pressure before decreasing with increased pressure. The 80% and 90% arterial occlusion pressures reduced blood flow by 69.4% and 79.3% respectively when collapsed across the 10 cm and 12 cm cuffs. No other pressures differed significantly between the relative applied pressure and amount of blood flow restricted. CONCLUSIONS: Provided relative pressures are applied, cuff width appears to have little to no effect on the blood flow response at rest. Importantly, relative pressures may not indicate the magnitude of blood flow being reduced (e.g. 80% arterial occlusion may not reduce 80% of blood flow), particularly at higher arterial occlusion pressures.
The Effects of Upper- and Lower-body Blood Flow Restriction Exercise on Vascular Function

Leslie Sensibello, Yu Lun Tai, Erica M. Marshall, Alaina Glasgow, Kathryn Geither, Jason C. Parks, Ramon Oliveira, J. Derek Kingsley, FACS/MKent State University, Kent, OH.

Previous studies indicate acute resistance exercise (ARE) improves vascular function, primarily forearm blood flow (FBF) and vasodilatory capacity. However, the effects of acute upper- and lower-body RE with blood flow restriction (BFR) on vascular function are unknown. PURPOSE: To determine the differences between UB and LB ARE with and without BFR on vascular function in resistance-trained individuals.

METHODS: Twelve individuals were assessed on a one-repetition maximum (IRM) for the UB on the lat pulldown and chest press, and for the LB knee extension and knee flexion. Vascular function was assessed using venous occlusion plethysmography with five minutes of occlusion at 220mmHg to induce reactive hyperemia. Forearm blood flow and area under the curve (AUC) were assessed at Rest, and during recovery at 15 (R15) and 45 (R45) min. The BFR protocol consisted of 4 sets of 30 repetitions at 70% 1RM.

A 2x2x3 repeated measures ANOVA was used to examine the effects of condition (BFR, non-BFR) and group (UB, LB) by time (Rest, R15, R45) on vascular function.

RESULTS: There were no 3-way interactions for any variable, and no effect of condition. There was a significant (p=0.001) group by time interaction for FBF (UB: Rest: 2.8±1.2ml/100ml/min; R15: 9.3±3.4ml/100ml/min; R45: 4.2±2.2ml/100ml/min) such that FBF was elevated at R15 compared to Rest, and was higher after UB than LB at R15. There was also a significant (p=0.02) group by time interaction for AUC: (UB: Rest: 65.1±21.6ml/100ml/min; R15: 144.7±50.2ml/100ml/min; R45: 91.0±27.8ml/100ml/min; LB: Rest: 81.9±30.1ml/100ml/min; R15: 113.1±32.4ml/100ml/min; R45: 88.6±32.6ml/100ml/min) such that it was augmented at R15 and R45 compared to Rest, with greater augmentation at R15 after UB compared to LB.

CONCLUSIONS: While there were no differences between BFR and non-BFR, our data demonstrate that acute upper-body resistance exercise has a greater effect than acute lower-body resistance exercise on forearm blood flow and vasodilatory capacity.

826 Board #87
May 30 3:30 PM - 5:00 PM
The Effects of Upper- and Lower-body Blood Flow Restriction Exercise on Vascular Function

827 Board #88
May 30 3:30 PM - 5:00 PM
Examining Peripheral Hemodynamics During Handgrip Exercise in Varsity Rowers

Kevin Decker, Austin Hogwood, Jennifer Weggen, Ruhi Maniyar, Ashley Darling, Austin Michael, Ryan Garten. Virginia Commonwealth University, Richmond, VA.

PURPOSE: This study sought to examine the impact of upper arm aerobic training on peripheral hemodynamics during exercise. METHODS: Seven young male trained rowers (20±1 yrs) and seven male recreationally active controls (24±1 yrs) with no history of upper limb aerobic training were recruited for this study. Subjects performed three minute bouts of progressive rhythmic handgrip exercise (4, 8, and 12 kg). Brachial artery diameter and velocity (Doppler ultrasound), heart rate (ECG), and blood pressure (Tango M2) were continuously measured at rest and during each workload.

RESULTS: Resting values for brachial artery diameter, blood flow rate, mean arterial pressure, and heart rate were not different between rowers and controls (p>0.05). During exercise, the rowers reported significantly reduced brachial artery blood flow [4 kg (146 vs 243 ml/min); 8 kg (249 vs 417 ml/min); 12 kg (356 vs 536 ml/min)] (p<0.05) and shear rate [4 kg (289 vs 470 s^-1); 8 kg (439 vs 720 s^-1) 12 kg (478 vs 797 s^-1)] (p<0.05) across all workloads when compared to controls. Brachial artery dilation, when normalized for shear rate, was significantly greater in rowers than controls during 8 and 12 kg workloads (p<0.05). Exercising heart rate and mean arterial pressure were not different between groups (p>0.05).

CONCLUSIONS: The results from this study revealed rowers have improved vasoreactivity to a given shear rate stimulus when compared to untrained controls. These findings suggest that upper limb aerobic training results in improved efficiency of blood flow regulation during exercise.
In some scenario, exercise can be similar to moderate intensity exercise without BFR.

### Usefulness Of Two-Dimensional Echo Strain In Evaluation Of Cardiac Function In Elite Athletes

Benedetta Tosi, Beatrice Leone, Loira Toncelli, Giorgio Galanti, FACSM. University of Florence, Florence, Italy.

(No relevant relationships reported)

**Purpose:** Cardiovascular adaptation to sport training is influenced by many factors, including the intensity and the kind of sport practiced. The “Morgenthaler hypothesis” asserted that a static exercise is characterized by a high load and dynamic (isometric) exercise which involves a volume load to the heart lead to different myocardial adaptation patterns. More recent studies revisited this hypothesis, showing that left ventricular (LV) remodeling observed in both resistance and endurance trained athletes, presented similar aspects. Although morphological modifications secondary to exercise have been largely studied, less is known on myocardial systolic function in LV remodeling patients in different elite athletes. Two-dimensional strain analysis allows a complete study of the contractile function in different myocardial regions of interest in left and right ventricle. In this study we aim to underline possible differences in contractile myocardial function with strain analysis in two groups of elite athletes, trained with different loads and playing different sports (football and cycling).

**Methods:** We enrolled 47 male athletes: 23 football players and 24 cyclists, belonging to the same football or cycling team (mean age in both groups 18±3 years old). The athletes were evaluated with echocardiography at the beginning of the sports season. We assessed LV contractile function using speckle-tracking echocardiographic global longitudinal strain (GLS) and global circumferential strain (GCS). We also analysed right ventricle contractility.

**RESULTS:**

<table>
<thead>
<tr>
<th>Group</th>
<th>Football</th>
<th>Cyclists</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV mass (g/m²)</td>
<td>30.2±4.1</td>
<td>27.8±3.6</td>
</tr>
<tr>
<td>TAPSE</td>
<td>17.1±2.8</td>
<td>18.0±2.2</td>
</tr>
<tr>
<td>GLS</td>
<td>-21.1±3.7</td>
<td>-19.7±2.4</td>
</tr>
<tr>
<td>GCS</td>
<td>-25.0±3.4</td>
<td>-22.9±3.6</td>
</tr>
</tbody>
</table>

Significant differences were found in all the three pairwise comparisons. CONCLUSIONS: Sex is closely related to HR, %HRmax, %HRR and strain in walking at 2.5 mph and to HRrest as well with males having significant advantage over females. When comparisons are made among the HRrest groups, both male and female university students with lower HRrest have significantly lower HR and %HRmax in walking at 2.5 mph than those with higher HRrest.
Among sober patients, each year of age predicted 0.3 mmHg higher SBP (p<0.001) but no change in DBP (p=0.137). Across the total sample, current intoxication predicted 8.6 mmHg lower SBP (p<0.001), 8.7 bpm higher HR (p<0.001), and 1.0 g/dL higher hemoglobin (p<0.001). Linear regression found patients who tested positive for alcohol to have 4.6 mmHg lower SBP (p<0.002; 95% CI: 1.7 to 1.6) holding confounders constant. Among sober patients, a history of alcohol abuse associated with an elevated HR (p<0.001), lower pulse pressure (p=0.002), lower oximetry (p<0.018), and a trend for lower PAO2 (p=0.06) with linear regression found a history of alcohol abuse to lower pulse pressure (p=0.009) and oxygen saturation (p=0.012) and raise HR (p<0.001). Among sober patients, a history of alcohol abuse did not affect the odds of having a myocardial infarction (p=0.805), congestive heart failure (p=0.712), peripheral vascular disease (p=0.997), stroke (p=0.691), diabetes (p=0.107), or dementia (p=0.905). A history of alcohol abuse associate with a 15-fold increase in the odds of death at 3 years (p=0.001).

CONCLUSIONS: Sobert patients had a history of alcohol abuse mimic the cardiovascular profile of intoxicated patients. This suggests that both short and long-term alcohol ingestion may confer modest cardiovascular benefits.

Athletes (A) conduct intense physical training to attain peak performance. Intense training is associated with cardiac remodeling and electrical abnormalities. Although certain ECG abnormalities are considered benign, these changes have been linked to sudden cardiac death in A. PURPOSE: To investigate cardiac structure-function and electrocardiographic changes relative to aerobic capacity (VO2max).

METHODS: A cross-section of individuals consented for this university IRB approved study. The population consisted of controls (C; n=21; high school sports (n=8 women, 9 men) or active, no organized sports (n=5 women, 1 man), college A (CA; completed career <3 years ago; n=9; 5 women, 4 men), and A (presently competing, n=22, 6 women, 16 men). Measurements included anthropometric assessment (DEXA), resting 12-lead ECG, and graded exercise test (GXT) with echocardiography/Doppler ultrasound performed before and following the GXT. An incremental treadmill GXT was conducted (6 mph) to VO2max with respiratory gas measurements (open-flow, indirect calorimetry). RESULTS: CA and A had greater fat-free mass, but bone density was greater in A. While resting heart rate was lower in A and CA, blood pressure, stroke volume (A=87±19 mL; CA=83±23 mL; C=77±18 mL) and cardiac output (A=4.8±1.3 L/min; C=5.2±1.5 L/min; CA=4.8±1.3 L/min) were similar among groups. Left ventricular (LV) end-diastolic dimension and posterior and septal wall thickness provided detailed information. Exercise training remodeling (eccentric hypertrophy-EH, concentric hypertrophy-CH, concentric remodeling-CHR) in C (EH=5; CR=n=4), CA (EH=1; CR=n=2), and A (EH=2, CH=1, CR=n=4). Overall, ECG analysis showed PVC’s (n=2), and A (EH n=2, CH n=1, CR n=4). CONCLUSION: Given similar, moderate levels of VO2max and cardiac output, presence of cardiac remodeling and ECG abnormalities among each group raises questions regarding the genesis of these changes relative to training history.

Acute resistance exercise (ARE) has a large effect on pulse wave reflection, but these data are limited when examining these responses after free-weight (FW) versus weight-machine (WM) exercises. PURPOSE: To evaluate the acute effects of free-weight and weight-machine exercises on pulse wave reflection after FW exercise compared to WM exercise in resistance-trained individuals. METHODS: Individuals volunteered to participate in either FW (n=25) or WM (n=16) resistance exercises. Data were collected at rest, and 10-15min after ARE. The FW group completed 3 sets of 10 repetitions at 75% 1-repetition maximum (RM) on the squat, bench press and deadlift, while the WM group completed 3 sets of 10 repetitions at 75% 1RM on the leg press, lat pulldown, leg extension, chest press, and the leg curl. A 2x2x2 analysis of covariance (ANCOVA) was used to analyze the effects of group (FW, WM) across condition (ARE, control) and time (rest, recovery) with workload as a covariate. RESULTS: The groups were similar for anthropometrics (p>0.05), but differed in years spent training (FW: 7±4 yrs; WM: 4±2 yrs, p<0.0001). There were no differences at rest for any measures of pulse wave reflection. Neither group nor condition had an effect on brachial or aortic blood pressure. There was a significant 3-way interaction for heart rate (FW: rest: 59±8 bpm; recovery: 88±13 bpm; WM: rest: 65±9 bpm; recovery: 89±13 bpm, p=0.04) such that it was augmented during recovery from resistance exercise in the FW group compared to the WM group. There were also significant 3-way interactions for the augmentation index (FW: rest: 116.3±8.4%; recovery: 121.6±5.2%; WM: rest: 116.8±8.4%; recovery: 113.7±5.5%, p=0.006), augmentation pressure (FW: rest: 5.0±2.9 mmHg; recovery: 8.4±5.9 mmHg; WM: rest: 4.3±4.0 mmHg; recovery: 3.8±3.6 mmHg, p=0.029), and the augmentation index normalized at 75 bpm (FW: rest: 4.9±8.1%; recovery: 24.1±14.5%; WM: rest: 8.7±12.3%; recovery: 16.8±8.2%; p=0.015) such that they were increased in the FW group compared to the WM group during recovery from ARE, which differed from the control group. CONCLUSION: These data demonstrate that recovery from free-weight resistance exercises has significant effects on pulse wave reflection that supersede those of weight machine resistance exercises in resistance-trained individuals, despite no differences in brachial or aortic blood pressures.

Heart rate variability (HRV), a non-invasive measurement of the autonomic nervous system, has been associated with incidence of diseased states to overtraining in athletes. HRV monitoring has become popular due to the ease of measurement with a number of commercially available devices.

PURPOSE: The purpose of the study was to determine the accuracy of a smartphone app (APP) to measure resting HRV versus a commercially available bio-harness (BH). METHODS: Forty-seven females (age = 23.5 ± 4.4 y; height = 1.6 ± 0.5 m; mass = 73.8 ± 18.5 kg) volunteered to participate in the study. After arriving in the laboratory, participants rested in a supine position for 20 minutes. A BH was used to measure indices of HRV during a five-minute interval while the APP was used during the last 3 minutes. Time measurements included R-R interval (NN), standard deviation of the NN intervals (SDNN), root mean square of the successive differences (RMSSD), and percent of NN intervals over 50 ms (pNN50).

RESULTS: There were no significant differences between the BH and APP with respect to NN (883.1 ± 126.1 vs 894.3 ± 129.8 ms; p = .12), SDNN (72.9 ± 29.9 vs 71.8 ± 29.9 ms; p = .77), and pNN50 (38.8 ± 21.9 vs 40.8 ± 20.6%, p = .24). HRM and APP RMSSD were significantly different (66.8 ± 33.0 vs 74.4 ± 30.1 ms; p = .014). Significant correlations were observed between BH and APP for all variables: NN, r = .93, p < .001, SEE = 48.8 ms; SDNN, r = .91, p < .001, SEE = 23.9 ms; RMSSD, r = .79, p < .001, SEE = 18.5 ms; and pNN50, r = .86, p < .001, SEE = 10.6%.

CONCLUSIONS: The APP provided an accurate assessment of HRV when compared to the BH in the supine position. Moderate to strong correlations were observed for all indices of HRV with no statistical differences between the variables with the exception of RMSSD. The APP could provide an economical, valid method of measuring HRV in adult females.
AMPKα and p-ACC protein expression in both WT+EX and KO+EX as compared to their control groups (p<0.05), while AMPKα2 protein expression only significantly increased in WT+EX (p<0.05) and KO+EX (p<0.05) when compared with WT−EX. Exercise training significantly increased cardiac tissue p-Akt protein expression in both WT+EX and KO+EX as compared to their control groups (p<0.05), and in KO+EX was significant decrease as compared with WT+EX group (p<0.05). CONCLUSIONS: 1. Seven weeks treadmill running could induce cardiac hypertrophy in mice with increased heart weight and mouse size. 2. AMPKα2 gene deficiency (p<0.05) significantly amplified exercise-induced cardiac hypertrophy in mice. 3. Seven weeks treadmill running induced cardiac hypertrophy was not founded with cardiac fibrosis. 4. AMPKα2 might play some important role in exercise-induced cardiac hypertrophy through Akt signal pathway.

837 Board #98 May 30 3:30 PM - 5:00 PM Validation Of The Non-Invasive Assessment Of Cardiac Output Via The Closed-circuit Acetylene Rebreathing Technique

Dean Palmer, Ashley Hardin, Justin Lawley, Satyam Sarma, Michinari Hieda, Benjamin Levine, FACSM, IEEM, Dallas, TX. (Sponsor: Benjamin D. Levine, FACSM) (No relevant relationships reported)

Accurate assessment of cardiac output (Qc) is critical to the diagnosis and management of various cardiac disease states; however, the clinical standards of direct Fick and thermodilution (THD) are invasive. Non-invasive alternatives, such as acetylene rebreathing (RB), warrant validation. PURPOSE: Validate the non-invasive, closed-circuit acetylene rebreathing (RB) technique for measuring Qc. METHODS: Acetylene is a inert, soluble gas that enters the blood stream via pulmonary diffusion but, does not bind to hemoglobin and thus its concentration decreases during rebreathing at a rate proportional to Qc. We retrospectively analyzed 10 clinical studies and all available cardiopulmonary exercise stress tests performed in our laboratory that included RB and either direct Fick or THD. Studies included healthy individuals and patients with clinical disease (mostly HFpEF). For accuracy and precision analyses, simultaneous Qc measurements were obtained under normo-, hyper-, and hypervolemic conditions, as well as submaximal and maximal exercise. RESULTS: A total of 3,198 measurements in 519 patients were analyzed (mean age 59 years, 48% women). The RB method was more precise than THD in healthy subjects with nearly half the typical error (TE)=0.34 l/min, Pearson r=0.92, and coefficient of variation (CV)=7.2% vs THD TE=0.67, r=0.70, and CV=13.2%. In healthy subjects during supine rest and upright exercise, RB correlated well with THD (supine r=0.80, TE=1.02, exercise r=0.82, TE=2.36). In patients with clinical disease during supine rest, RB correlated well with THD (r=0.85, TE=1.43). Sensitivity analyses showed the agreement of the RB method was similar to, or better than, THD compared to direct Fick in healthy adults (RB rest r=0.85 and TE=0.84, RB exercise r=0.87 and TE=2.39, THD rest r=0.72 and TE=1.11; THD exercise r=0.73 and TE=2.87). Additionally, RB had an excellent correlation with direct Fick in patients with clinical disease during supine rest exercise (r=0.89, TE=1.14). CONCLUSION: The acetylene rebreathing method is much more precise than, and as accurate as, the THD method in a variety of patients and under a range of conditions. These data support the clinical use of RB derived Qc.

838 Board #99 May 30 3:30 PM - 5:00 PM Holter Ecg In Sports People: 20 Years Of Monitoring

Riccardo Ariani, Alessio Bartoletti, Giorgio Galanti. University of Florence, Florence, Italy. (No relevant relationships reported)

Purpose: Arrhythmias are a common finding in the population that practices sports activity and sometimes their clinical interpretation is not easy. Thus, we aimed to analyze and follow up the recordings in a group of subjects who underwent a 24-hour or weekly Holter ECG monitoring to assess the presence of arrhythmias in a large cohort of sportsmen.

Methods: Since April 1997 to April 2017, 6172 unscreened and consecutive subjects (352,22 years) were enrolled. Revision analysis was performed by Holter Analysis System (Spacelabs Healthcare, LLC, California) on a sample of 10903 Holter ECG registrations, focusing on the ECG features, such as arrhythmias (origin, number, complexity), conduction delays and channellopathies. We then divided the population registrations, focusing on the ECG features, such as arrhythmias (origin, number, complexity), conduction delays and channellopathies. We then divided the population into three age groups: with Fibromyalgia (FM) compared to healthy controls (HC).

METHODS: Participants previously diagnosed with FM (n=37) and HC (n=25) were randomly assigned to an autonomic test. Baseline ECG tests were completed (HIIT/PECO and CPT) and supine rest (HUT). For HIIT/PECO, participants completed 2 minutes of HIIT at 30% maximal voluntary contraction followed by 2 minutes of PECO. For the CPT, circulated cold water hand immersion (10°C) lasted for 2 minutes. For HUT, participants completed 5 minutes of 70-degree head-up tilt followed by 5 minutes of supine recovery. Heart rate variability analyses included normalized low-frequency (LFnu) and normalized high-frequency (HFnu) power and the ratio of LFnu/HFnu (r). For HIIT, LFnu power decreased to 70% at peak exercise compared to rest (p<0.05). For CPT, LFnu decreased to 70% at peak exercise compared to rest (p<0.05). For HUT, LFnu power increased to 70% at peak exercise compared to rest (p<0.05).

CONCLUSION: The present study suggests that the HIIT program improves sympathovagal (InLF/HF ratio) activity following only 8 sessions of HIIT. Health professionals or fitness trainers could consider this time efficient exercise program (HIIT) for improving cardio-autonomic function in adults who are physically inactive.

840 Board #101 May 30 3:30 PM - 5:00 PM Autonomic Modulation in Response to Three Different Autonomic Reflex Tests in Women with Fibromyalgia

J. Derek Kingsley, FACSM, Kathryn Geither, Alaina Glasgow, Erica M. Marshall, Jason C. Parks, Leslie Sensibello, Yu Lun Tai. Kent State University, Kent, OH. (No relevant relationships reported)

PURPOSE: To evaluate autonomic modulation in response to three different autonomic stressors, including isometric handgrip with post-exercise circulatory occlusion (IHG/PECO), the cold pressor test (CPT) and head-up tilt (HUT) in women with Fibromyalgia (FM) compared to healthy controls (HC).

METHODS: Participants were compared with women with FM (n=37) and HC (n=25) and autonomic tests were completed (HIIT/PECO and CPT) and supine rest (HUT). For HIIT/PECO, participants completed 2 minutes of IHG at 30% maximal voluntary contraction followed by 2 minutes of PECO. For HIIT, LFnu/HF ratio significantly decreased in the HIIT group while the MICT group did not change (p<0.05). CONCLUSIONS: The present study suggests that the HIIT program improves sympathovagal (InLF/HF ratio) activity following only 8 sessions of HIIT. Health professionals or fitness trainers could consider this time efficient exercise program (HIIT) for improving cardio-autonomic function in adults who are physically inactive.
Ageing was associated with global and regional alterations in RV myocardial mechanics, while LV function was unaltered. Specifically, ageing resulted in a decrease in RV global strain and an increase in transmural non-uniformity (i.e., increased transmural strain gradients). Differences in LV and RV myocardial architecture and age-related changes in the pulmonary vasculature are possible explanations for opposing LV and RV functional remodelling in response to ageing.

843  Board #104  May 30 3:30 PM - 5:00 PM  Risk Factors of Hypertension Among Different Adult Groups in the Tujiya-Nationality Settlement of China  Xiaoli Liu, Xiangrong Shi, Male, FACSFM. 1HuBei University for Nationalities, Enshi, China. 2UNTHSC, Fort Worth, TX.  

PURPOSE: Hypertension as a well-known major independent risk factor for cardiovascular disease and stroke has had great impact on health outcomes. However, few studies focus on the different risk factors of hypertension among various age groups in the Tujiya-Nationality settlement of China. The study aimed to investigate the different risk factors of hypertension among different adult groups in this area.

METHODS: Demographics questionnaires and fitness tests were utilized to identify the risk factors of hypertension among different adult groups in the years 2010 and 2014 in China’s southwest province of Hubei.

RESULTS: Of the 5,646 individuals aged 20-69 years (age=42.71±13.73 years) people, 1,219 were classified as hypertensive, giving an overall prevalence of hypertension of 21.6%. The prevalence of hypertension was 13.5% in 2010, before doubling to 29.0% by 2014. Over the long term (i.e., 2014) and overweight/obesity were significant factors associated with hypertension. In addition, the risk factors for the young adult group (31.9±7.2 yr, n = 2097) included age, gender (men/women), lower level of education, and lower cardiorespiratory function (CFR, with ORs of 1.214 (CI, 1.116-1.320), 0.365 (CI, 0.285-0.466), 0.720 (CI, 0.625-0.829), and 0.603 (CI, 0.498-0.731)) respectively, and for the middle-aged group (51.7±3.4 yr, n = 1795) included Tujiya nationality, white collar workers, and lower CFR, with ORs of 1.076 (CI, 1.056-1.095), 1.612 (CI, 1.390-1.871), and 0.780 (0.631-0.963), respectively.

CONCLUSIONS: The prevalence of hypertension increased dramatically in this area during 2010-2014. BMI was the common risk factor of hypertension in all adult groups. For both young and middle-aged adults, low CFR was a common risk factor associated with hypertension.

844  Board #105  May 30 3:30 PM - 5:00 PM  Risk of Cardiovascular Disease in American Firefighters: An Intervention is Warranted  Nicholas B. Zachmeier, Hyosung Han, Alexis C. King, J. Mark VanNess, Cynthia Villalobos, Courtney D. Jensen. University of the Pacific, Stockton, CA.

Cardiovascular disease (CVD) is the most common cause of job-related mortality among firefighters in the United States. Although age, family history, and work environments cannot be controlled, other predictors are modifiable. If solutions are to be implemented, it is important to know which health parameters are responsible for the elevated CVD risk in this population. PURPOSE: To examine the cardiovascular health of California firefighters. METHODS: We measured physiological CVD risk factors in 35 firefighters from Northern California. Assessments were age, anthropometry, blood lipids, blood pressure, and blood glucose. Risk factors were summed according to the American College of Sports Medicine guidelines. We evaluated the frequency of individual risk factors and used regression analyses (logistic, negative binomial, and linear as appropriate) to test the effect of age on risk.

RESULTS: Firefighters were 33.5 ± 11.8 years old, had a body mass index (BMI) of 26.6 ± 3.4, body fat percent (BF%) of 21.2 ± 6.0%, waist circumference (WC) of 90.3 ± 10.4 cm, and waist–hip ratio of 0.87 ± 0.10. Systolic blood pressure (SBP) was 122.5 ± 8.0 mmHg, diastolic blood pressure (DBP) was 78.1 ± 10.3 mmHg, fasting blood glucose (FBG) was 98.5 ± 14.3 mg/dL, LDLs were 128.9 ± 40.1 mg/dL, HDLs were 33.6 ± 12.5 mg/dL, triglycerides were 116.8 ± 90.3, and the average number of risk factors was 1.8 ± 1.2. There were 32 firefighters (91.4%) with ≥ 1 risk. The proportion of at-risk firefighters for each variable was: lipid profile (77.1%), obesity (65.7%), FBG (37.1%), blood pressure (34.3%), and age (14.3%). Most of the lipid profile was met by low HDLs (65.7% of all firefighters). Age was a significant predictor of BMI (p=0.003), BF% (p=0.003), WC (p=0.003), and waist–hip ratio (p=0.047), but not SBP (p=0.553), DBP (p=0.959), FBG (p=0.961), LDLs (p=0.369), HDLs (p=0.593), or triglycerides (p=0.688). Increased age significantly predicted an increased number of CVD risk factors (p=0.003). CONCLUSION: As firefighters advanced in age, they experienced elevations in CVD risk, mostly as a consequence of increasing adiposity. Weighs for interventions aimed at improving lipid profile, blood glucose, and blood pressure may help reduce job-related CVD mortality in American firefighters.
**Purpose:** Cardiac adaptation to intense physical training is determined by many factors. Eliminate the fat mass from the indexing of left ventricular parameters seems to better explain some heart modifications, characterizing the so-called “athlete’s heart”. Fat free mass also contains the extracellular mass which does not represent a metabolically active compartment. The aim of this pilot study was to verify a new left ventricular indexation with the metabolically active tissue of the body as body cell mass in elite athletes.

**Methods:** 18 females (F) were matched with 18 elite male (M) soccer players (F=26.2±2.4 yrs, M=26.9±2.5 years; p=NS). An accurate body composition analysis (skinfold and bioimpedance) and an echocardiography were performed. Differences in body composition were indexed for metabolically active mass. The left ventricular and cardiac differences between left ventricular mass and body cell indexation were then indexed to the body surface area formula with the data related to body composition (fat-free mass and cellular mass). The indexing of the left ventricle to the body composition parameters increased the age of onset of the left ventricular hypertrophy in boys and men.

**Results:** For lnRMSSD, all groups increased lnRMSSD from 10 (pre = 3.2 ± 0.8 ms; mid = 2.4 ± 0.6 ms; post = 1.8 ± 0.8 ms; men = 1.9 ± 0.5 ms; p = 0.07) to 25 min (pre = 3.8 ± 0.6 ms; mid = 3.4 ± 0.6 ms; post = 2.8 ± 0.8 ms; men = 2.7 ± 0.8 ms). For lnHF, all groups increased from 10 (pre = 4.9 ± 1.8 ms; mid = 3.4 ± 1.2 ms; post = 2.2 ± 1.8 ms) to 25 min (pre = 6.5 ± 1.3 ms; mid = 5.6 ± 1.5 ms; post = 4.1 ± 1.7 ms); men (2.5 ± 1.0 ms vs 3.9 ± 1.6 ms; p < 0.09). At all points, lnRMSSD and lnHF were greater in pre compared to post and men. Also, mid and post had different lnRMSSD at 15 min (2.9 ± 0.7 ms vs 2.0 ± 0.7 ms) and lnHF at 20 min (5.5 ± 1.4 ms vs 3.7 ± 1.2 ms).

**Conclusions:** The primary findings were PNS withdrawal was reduced in pre-pubertal boys than men during LIE and MIE (HF only). Otherwise, M0 did not affect PNS response from rest to MIE. Throughout recovery, PNS reactivation was greater in pre-pubertal boys compared to post-pubertal boys and men.

**Discussion:** Cardiac adaptation to intense physical training is determined by many factors. Eliminate the fat mass from the indexing of left ventricular parameters seems to better explain some heart modifications, characterizing the so-called “athlete’s heart”. Fat free mass also contains the extracellular mass which does not represent a metabolically active compartment. The aim of this pilot study was to verify a new left ventricular indexation with the metabolically active tissue of the body as body cell mass in elite athletes. The left ventricular and cardiac differences between left ventricular mass and body cell indexation were then indexed to the body surface area formula with the data related to body composition (fat-free mass and cellular mass). The indexing of the left ventricle to the body composition parameters increased the age of onset of the left ventricular hypertrophy in boys and men.

**References:**

Endurance exercise reduces risk for cardiovascular disease. Excessive endurance exercise may be detrimental to cardiovascular health. Interestingly, these detrimental cardiac adaptations may be more prevalent in male marathoners. Sex differences in the effect of marathon training on cardiovascular function may be related to differences in aortic stiffness and blood pressure (BP). PURPOSE: 1) Examine sex differences in aortic stiffness, BP and cardiac function; 2) Explore associations between aortic stiffness, BP and cardiac function in marathoners. METHODS: Sixteen experienced marathoners had peak aerobic capacity, aortic stiffness, BP and cardiac function measured on 3 separate days. Aortic stiffness was measured as carotid-femoral Pulse-Wave Velocity (cPWV) obtained using applanation tonometry. An ambulatory oscillometric blood pressure cuff was used to measure 24-hr systolic blood pressure (BP). Cardiac function was measured using 3-dimensional deformation echocardiography (3DE). Left ventricular (LV), longitudinal, circumferential, area, and radial strain were used as indices of cardiac function. RESULTS: cPWV and 24-hr aortic BP were higher and 3DE longitudinal and area strain were lower in males compared to females (p<0.05). cPWV was associated with longitudinal (r=0.58, p<0.001), circumferential (r=0.71, p<0.01), area (r=0.66, p<0.01), and radial strain (r=-0.66, p<0.01). CONCLUSION: Among marathoners, males have higher aortic stiffness, BP and lower cardiac function was compared to females. Higher aortic stiffness may be associated with lower cardiac function in experienced marathoners.

Supported by: Sydney Young Student Research Award; Syracuse University School of Education, Creative Grant Competition.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Males (n=7)</th>
<th>Females (n=9)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>45±4</td>
<td>43±3</td>
<td>0.53</td>
</tr>
<tr>
<td>VO₂ max (ml/kg/min)</td>
<td>52.8±11.8</td>
<td>47±6.2</td>
<td>0.27</td>
</tr>
<tr>
<td>Resting Heart Rate (bpm)</td>
<td>52±7</td>
<td>56±9</td>
<td>0.31</td>
</tr>
<tr>
<td>Body Mass Index (kg/m²)</td>
<td>29±5</td>
<td>22±3</td>
<td>0.00</td>
</tr>
<tr>
<td>Body Fat (%)</td>
<td>20±7±10</td>
<td>23±6</td>
<td>0.59</td>
</tr>
<tr>
<td>cPWV (m/s)</td>
<td>8.1±1.0</td>
<td>6.5±1.2</td>
<td>0.02</td>
</tr>
<tr>
<td>Brachial 24-hr Systolic BP (mmHg)</td>
<td>124±14</td>
<td>112±7</td>
<td>0.01</td>
</tr>
<tr>
<td>Aortic 24-hr Systolic BP (mmHg)</td>
<td>113±4</td>
<td>104±8</td>
<td>0.05</td>
</tr>
<tr>
<td>3DE Longitudinal Strain (%)</td>
<td>-10±5</td>
<td>-16±4</td>
<td>0.04</td>
</tr>
<tr>
<td>3DE Circumferential Strain (%)</td>
<td>-11.3±2</td>
<td>-15.6±4.3</td>
<td>0.10</td>
</tr>
<tr>
<td>3DE Area Strain (%)</td>
<td>-18.8±7.1</td>
<td>-26.9±6.3</td>
<td>0.05</td>
</tr>
<tr>
<td>3DE Radial Strain (%)</td>
<td>29.2±12.2</td>
<td>46.0±17.1</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Significance level, p<0.05. cPWV, Carotid-femoral Pulse Wave Velocity; BP, Blood Pressure; 3DE, 3-dimensional Echocardiography

**B-63**

**Free Communication/Poster - Cardiac Rehabilitation**

**Wednesday, May 30, 2018, 1:00 PM - 6:00 PM**

**Room: CC-Hall B**

**851 Board #112**

**May 30 3:30 PM - 5:00 PM**

**Does UK Cardiac Rehabilitation Provide An Effective Stimulus For Change?**

Said Ibggazene, Chelsea Moore, Michelle Swainsson, Theocharlis Ispoglou, Costas Tsakirides, Karen Birch, FACSM*.

*University of Leeds, Leeds, United Kingdom. 2 Leeds Beckett University, Leeds, United Kingdom. (Sponsor: Professor Karen Birch, FACSM)

(No relevant relationships reported)

**Purpose:** The efficacy of cardiac rehabilitation (CR) in reducing mortality and rehospitalizations has been questioned. UK CR typically consists of 6 weeks biweekly circuit-type exercise at 40-70% of heart rate (HR) reserve (HRR). This study aims to characterise the exercise performed in UK CR and explore relationships between exercise dose and changes in physiological variables.

**Methods:** 48 patients (35 M/13 F 33-80 y) were recruited following referral to local outpatient CR. HR was recorded continuously during exercise sessions throughout the programme (Table 1). Assessments of incremental shuttle walk test distance (ISWD), blood pressure (BP), brachial artery flow-mediated dilatation (FMD), carotid artery compliance, and habitual physical activity (PA) were measured prior to and following CR completion.

**Results:** ISWD increased following CR (439±116 m vs 632±213 m, p<0.001) and was strongly associated with the change in peak HR achieved between tests (r = 0.56, p<0.001), baseline ISWD (r = 0.51, p<0.001) and age (r = -0.51, p<0.001). Spending >1 min above 55% HRR at the start and middle of the programme was associated with greater change in ISWD (2p ≥ 3.9, p = 0.047; 2p ≥ 4.7, p = 0.03). Time spent exercising >55% HRR increased between the start and end (0.4±14.1 vs 11.5±14.7 min, p = 0.02) but not the middle and end of the programme (11.9±13.6 vs 11.5±14.7 min, p = 0.87). PA, body mass, diastolic BP, FMD and arterial compliance were unchanged following CR (p > 0.05). Systolic BP decreased following CR (129±20 vs 124±20 mmHg, p<0.01), and correlated only with the volume of light activity performed at baseline and following CR (r = 0.34, p = 0.04 & r = 0.41, p = 0.03).

**Conclusion:** Patients in current UK CR may not accumulate sufficient exercise time above 55% HRR to drive health gain. Large improvements in ISWD do not reflect the lack of change in PA, FMD and arterial compliance. Strategies to increase the dose and progression of time spent above 55% HRR are needed to enhance UK CR effectiveness.

| Table 1: % of participants achieving a total of 8 min above threshold |
|----------------|----------------|----------------|----------------|
| HRR threshold | Start (n=84) | Mid (n=40) | End (n=59) |
| 40% | 66 | 77 | 74 |
| 50% | 61 | 60 | 54 |
| 55% | 27 | 42 | 38 |
| 60% | 27 | 22 | 36 |
| 65% | 23 | 22 | 31 |
| 70% | 9 | 20 | 18 |

**850 Board #111**

**May 30 3:30 PM - 5:00 PM**

**Influence of Cuff Pressure on Cardiovascular Responses to Knee Extension Exercise with Blood Flow Restriction**

Sarah G. Kearney, Tyler Singer, Jon Stavres, Steven I. Elmer, Matt A. Kilgus, John McDaniel, Theocharis Ispoglou, Costas Tsakirides, Karen Birch, FACSM*.

*Michigan Technological University, Houghton, MI.

(No relevant relationships reported)

Blood flow restriction (BFR) exercise is a growing exercise modality in which blood flow to the muscle is occluded during low intensity exercise. Recent reports indicate that BFR training leads to increased muscle strength and hypertrophy. However, the acute cardiovascular responses to BFR exercise are not as clear. PURPOSE: The purpose of this study is to examine the effects of various occlusion pressures on cardiac output (CO), mean arterial pressure (MAP), and heart rate (HR) before, during and post exercise. METHODS: Eight healthy male participants completed 4 sets of knee extension exercises. Participants performed 3 repetitions per set at 20% max torque with 15 minutes of recovery between each set. Four different cuff pressures were administered with each set (0%, 60%, 80% and 100% of arterial occlusion pressure). CO, MAP, and HR were analyzed across 5 time points: baseline, after cuff inflation (prior to exercise), last five seconds of exercise, 30 seconds post exercise (prior to cuff deflation), and two minutes post cuff deflation. RESULTS: Repeated measures ANOVA indicated a main effect of time point (p<0.001) and cuff pressure (p=0.018) on HR as well as a significant interaction (p<0.001). HR at the end of exercise was 97±22, 128±27, 135±24, and 148±24 bpm for 0%, 60%, 80% and 100% respectively. The 0% condition was significantly different than the other three occlusion pressures as well as 60% being different than 100%. There was a significant main effect of time point (p<0.001) on CO in that it was greatest during exercise, however there was no main effect of cuff pressure (p=0.805). Finally, MAP also significantly increased with exercise (p<0.001) but there was no main effect of cuff pressure (p=0.058).

**CONCLUSION:** During BFR knee extension exercise greater cuff pressure resulted in greater HR response despite the fact that external workload was the same. This is likely due to the accumulation of metabolic by-products in the limb and greater exercise-pressor reflex with flow occlusion.
PURPOSE: To examine changes in walking distance and hemodynamic responses (HED) following a 12-week exercise-based CR program in Costa Rican cardiac patients. METHODS: Six-min walking distance (6MWD) and HED variables - systolic blood pressure (SBP), diastolic blood pressure (DBP), post-6MW heat rate (FHR), post-6MW recovery heart rate (REC), post-6MW SBP (PSBP), and post-6MW DBP (PDBP) were measured before and after CR in three-hundred and eleven (237 males and 74 females) patients (age = 57.7 ± 13.9 yr.). Using age as a covariate, two by two (gender x measurement) ANCOVAs determined differences in 6MWD and HED variables. Pre-to-post CR intervention changes (Δ) in 6MWD and HED variables were correlated to the number of CR exercise sessions attended by age-quartile (Q) within genders. RESULTS: Patients underwent 33.0 ± 5.1 CR sessions. Males walked a longer distance than females (males = 493.5 ± 5.6 vs. females = 429.0 ± 9.9 mm; p < 0.001) from pre-to-post CR program (males pre = 429.3 ± 6.2 vs. post = 557.6 ± 5.8 mm; p < 0.001; females pre = 374.9 ± 11.2 vs. post = 483.2 ± 10.3 mm; p < 0.001). Both genders reduced DBP following the CR program (males pre = 67.0 ± 0.7 vs. post = 65.6 ± 0.5 mmHg, p = 0.034; females pre = 69.2 ± 1.2 vs. post = 65.0 ± 1.0 mmHg, p = 0.001), and increased FHR following a 6MW test after the CR program (males pre = 97.7 ± 1.2 vs. post = 112.7 ± 1.4 bpm, p < 0.001; females pre = 100.7 ± 2.1 vs. post = 110.2 ± 2.5 bpm, p < 0.001). Participants increased 6MW test distance (pre = 122.8 ± 1.3 vs. post = 133.6 ± 1.3 mmHg; p < 0.001). Significant correlations between CR sessions completed were found in males in Q1 (age < 49.9 yr.) for ΔFHR (r = -0.328; p = 0.013), Q2 (age 50 to 59.9 yr.) for AFFR (r = 0.407; p = 0.001), and ΔREC (r = -0.280; p = 0.030), and Q3 (age ≥ 67 yr.) for ΔREC (r = 0.310; p = 0.016), but none for males in Q4 (age ≤ 59.5 yr.). For females in Q1 (age ≥ 67 yr.), significant correlations were found in ΔREC (r = 0.291; p = 0.040) and Δpost-6MW SBP (r = 0.510; p = 0.022). No significant correlations were found between CR sessions on Q2 (age ≤ 51.9 yr.), Q3 (age < 52 to 59.4 yr.), Q4 (age < 59.5 to 66.9 yr.) for 6MW or any HED variable. CONCLUSION: Both men and women improved functional capacity as observed in the 6MW and HED variable adaptations to exercise following a 12-week CR program.

S160 Board #113 May 30 3:30 PM - 5:00 PM
Comparison of Outcomes Related to Dietary Behavioral Changes in Phase II Cardiac Rehabilitation Jillian N. Turek1, Nathan J. Boehlke1, Teresa M. Corbisiero1, Caitlin M. Stackpool1, Allison B. Haverkate1, Mary S. Meyers2, Cynthia A. Oster1,1 Porter Adventist Hospital/Centura Health, Denver, CO.1Centura Health, Denver, CO.

PURPOSE: Study aim was to compare pre and post dietary survey scores and waist circumference measurements of Phase II Cardiac Rehabilitation (CR) participants receiving an individual, one-hour dietary counseling session from a registered dietitian (RD). METHODS: A retrospective comparative design was used to compare 104 Phase II CR program participants who completed ≥ 12 sessions between May 2015 and August 2017 at a hospital-based nationally certified CR program. The Rate Your Plate (RYP) (target score ≈58), a general dietary assessment survey of usual eating habits prior to cardiac event, was administered to all participants during the initial session and two sessions prior to program discharge. Individual dietary scores were compared among participants receiving and not receiving a one-hour dietary counseling session. A medical record review was conducted to collect completed dietary survey scores, attendance of dietary session, waist circumference, gender, and age. ANOVA, paired t-tests and generalized linear model were used for analysis. RESULTS: 104 participants completed a pre and post RYP survey. Seventy-three males (mean age = 66.4 years) and 31 females (mean age = 66.9 years) participated. 78 participants met with the dietitian and 26 declined. Mean dietary scores for all participants significantly increased post program (mean pre = 54.8, mean post = 60.2, p < 0.001). Participants meeting with the RD significantly increased their RYP scores (mean pre = 54.4, mean post = 60.2, p < 0.001). There was no correlation between dietary score and waist circumference. CONCLUSION: Preliminary data suggest CR participants meeting with a RD are more likely to improve dietary scores. There may be gender differences, but a larger female sample size is needed to further explore these differences. In previous studies, dietitian services are associated with improved diet related patient outcomes. Weight management intervention for male patients with waist circumference >40 inches and >35 inches in women supports a multidisciplinary approach in CR programs to achieve overall cardiovascular risk reduction.

855 Board #116 May 30 3:30 PM - 5:00 PM
Enablers, Barriers, And Intervention Strategies For Maintaining Exercise Following Cardiac Rehabilitation Carmen C. Cuthbertson, Molly S. Miller, Sydney A. Jones, Joseph C. Engeda, Kelly R. Evenson, FACS.M. University of North Carolina at Chapel Hill, Chapel Hill, NC. (No relevant relationships reported)

PURPOSE: A significant proportion of cardiac rehabilitation (CR) patients decline or cease regular exercise following the structured CR program. The purpose of this qualitative study was to identify barriers, enablers, and intervention strategies to maintain exercise post CR. METHODS: We conducted five focus groups (3 to 5 participants in each group) in three North Carolina locations in 2017 with 22 current CR participants. Participants also completed a brief survey. Focus groups were transcribed verbatim and double coded, analyzed, and reconstructed to identify overarching themes using ATLAS.ti software. RESULTS: Focus group participants were referred to CR after experiencing a myoccardial infarction (36%), coronary artery bypass grafting surgery (36%), stents (9%), angiina (5%). Over half of participants were male (55%), the mean age was 72 years (standard deviation=7 years), and 82% were retired. Potential barriers to continuing exercise post CR included lack of motivation to exercise, lack of financial resources to stay active, health conditions, loss of social support, and not enjoying exercise. Potential enablers to continuing exercise post CR included continued contact with CR staff after finishing the CR program, extending the number of weeks of CR, returning for a check-in CR session after discharge, having an exercise plan after finishing CR, and receiving social support from family and friends. The focus group discussion asked participants about their interest in using an activity tracker during and following CR. Most participants were positive about using activity trackers; however, some expressed concern about the complexity of using the tracker. In questions about specific activity tracker features, most participants expressed favorable views about tracking step counts, but had mixed views about sharing their tracking information with peers. Participants were asked about introducing peer support from CR alumni and this feature received positive feedback. CONCLUSION: These findings can be used to design interventions that help CR participants maintain exercise following CR.
PURPOSE: Health literacy (HL) defines the degree to which individuals can obtain, process, and understand basic health information and services needed to make proper health decisions. Low HL (LHL) is associated with reduced adherence to exercise, medications, healthy nutrition, and low utilization of preventive health services. Cardiac Rehabilitation (CR) is a secondary prevention program that improves functional capacity and risk factor profile, leading to improved health status. The purpose of the present study is to assess the how the effectiveness of CR, as measured by functional capacity and cardiac self-efficacy (CSE), may differ between patients with LHL and high HL (HHL) who attend CR.

METHODS: In a quality improvement project, we evaluated the impact of LHL versus HHL on change in functional capacity and CSE measures. HL of patients enrolling in CR was evaluated by the REALM-SF. HL was divided into two groups: LHL was less than 9th grade reading level and HHL was greater than 9th grade reading level. We assessed changes in functional capacity by six-minute walk distance (6MWD) in relation to scores from the 13 question CSE scale that measures controls that are correlated and maintaining cardiac symptoms.

RESULTS: 134 patients that completed CR were assessed: 42 LHL and 92 HHL. LHL patients had lower baseline 6MWD and CSE scores compared to HHL patients (Table 1). There were clinically significant gains in 6MWD (>30 m) and statistically significant improvements for CSE in both groups (Table 2). Additionally, LHL and HHL patients both had significant correlations between 6MWD and CSE (Table 2).

CONCLUSIONS: This work indicates a positive correlation between improvements in functional capacity and CSE over the course of CR for both LHL and HHL groups, highlighting the utility of CR in overcoming some of the risks of diminished functional capacity and CSE associated with LHL. The study also reflects the importance of HL as a criterion of risk and associated management modification.

Table 1

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre</th>
<th>Post</th>
<th>Change</th>
<th>P-Value (P) (PRE vs POST)</th>
<th>[BEETWEEN GROUPS]</th>
</tr>
</thead>
<tbody>
<tr>
<td>LHL</td>
<td>56.2 ± 23</td>
<td>56.2 ± 23</td>
<td>0.00</td>
<td>&lt;0.001</td>
<td>0.47</td>
</tr>
<tr>
<td>HHL</td>
<td>50.2 ± 23</td>
<td>50.2 ± 23</td>
<td>0.00</td>
<td>&lt;0.001</td>
<td>0.47</td>
</tr>
<tr>
<td>6MWD (m)</td>
<td>272 ± 92</td>
<td>333 ± 86</td>
<td>121 ± 32</td>
<td>54 ± 48</td>
<td>0.001</td>
</tr>
<tr>
<td>CSE</td>
<td>32.2 ± 12.9</td>
<td>33.2 ± 11.8</td>
<td>1.0 ± 1.0</td>
<td>8.0 ± 14.4</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre</th>
<th>Post</th>
<th>Correlation Coefficient (R)</th>
<th>P</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>HHL vs. LHL</td>
<td>0.26</td>
<td>&lt;0.0001</td>
<td>0.34108</td>
<td>0.0009</td>
<td></td>
</tr>
<tr>
<td>UHL vs. CSE</td>
<td>0.33</td>
<td>0.0001</td>
<td>0.378</td>
<td>0.01</td>
<td></td>
</tr>
</tbody>
</table>

CONCLUSIONS: This work indicates a positive correlation between improvements in functional capacity and CSE over the course of CR for both LHL and HHL groups, highlighting the utility of CR in overcoming some of the risks of diminished functional capacity and CSE associated with LHL. The study also reflects the importance of HL as a criterion of risk and associated management modification.

Healthy People 2020 has identified improving access to comprehensive, quality health care services, like cardiopulmonary rehabilitation (CR), as essential for reducing cardiovascular disease (CVD) burden in the United States (US). Yet, the utilization of CR programs in the US is low, especially among rural communities where patients experience additional challenges. Low levels of physical activity and higher prevalence of CVD risk factors in the southeastern US further exacerbate these issues.

PURPOSE: To evaluate the efficacy of a newly developed phase II CR program in rural Alabama. METHODS: Medical records of 14 cardiac and pulmonary patients enrolled in CR at a rural hospital were analyzed retrospectively. Patient demographics, cardiometabolic profile, and functional capacity (i.e., 6-minute walk test [6MWT]) were assessed at baseline and upon program completion. RESULTS: Nine of the 14 patients successfully completed CR (64%). On average, patients were (M/SD) overweight (body mass index: 29.3±10.4 kg/m²), middle-aged and older (range: 31-81 yr) adults (66.7% women; 37.5% Black) with dyslipidemia, who were taking ≥1 antihypertensive medication for their high blood pressure (BP). Baseline characteristics were similar among Black and White patients, with the exception of age: Black patients participating in CR tended to be younger than White patients (48±15 yr vs. 68±15 yr, p=0.07). Overall, patients attended the CR facility 1.8±0.2 d/ wk and completed the 36-session program in 19.3±2.1 wk. Patients significantly improved their 6MWT distance post-CR compared to baseline (p<0.007), an estimated increase of 1.61±1.4 kg/m (±12.6%) in peak oxygen consumption. Participation in CR also produced small reductions in body weight (~1 kg, p<0.07). CONCLUSIONS: These preliminary results demonstrate that a newly developed phase II CR program in rural Alabama elicited favorable changes in body weight and functional capacity (i.e., 6MWT). Additional research is warranted to determine how CR programs can be tailored effectively to address challenges unique to rural communities while targeting the disproportionate burden of CVD in the southeastern US.

**Official Journal of the American College of Sports Medicine**

**Vol. 49 No. 5 Supplement**

**S161**

---

**B-64** Free Communication/Poster - Metabolism, Mitochondria and Muscle Physiology

**Wednesday, May 30, 2018, 1:00 PM - 6:00 PM**

**Room: CC-Hall B**

**Board #119** Sedentary Behavior Characteristics in Cardiovascular Patients versus Healthy Controls.

Thijs M. Eijssens, Esme A. Bakker, Esther Meindersma, Maria T. Hopman, FACSM, Dick H. Thijsen. Radboud university medical center, Nijmegen, Netherlands. (Sponsor: Maria T. Hopman, FACSM)

(No relevant relationships reported)

**BACKGROUND:** Time spent sitting is strongly and independently associated with an increased risk for adverse health outcomes, such as incident cardiovascular disease (CVD), diabetes, cancer and all-cause mortality. Previous studies mainly assessed sedentary behavior characteristics in the general population, whereas relatively little is known about this type of behavior in individuals with CVD.

**PURPOSE:** To compare sedentary behavior characteristics between CVD patients and healthy controls.

**METHODS:** Sedentary behavior patterns of 19 CVD patients and 18 age- and gender-matched controls were measured for seven consecutive days using the activPAL micro monitor. We used sedentary time (hours/day) as primary outcome, and the number of sedentary breaks (n/day) and sedentary bout duration (min/bout) as secondary outcomes.

**RESULTS:** CVD patients were sedentary for 11.1±1.5 hours/day, which was significantly more compared to healthy controls who reported 9.1±1.3 hours/day of sedentary behavior (mean difference 2.0 hours/day, 95%CI: 1.0 – 2.9). CVD patients broke up their sedentary behavior 22.7±7 times per day with a mean duration of each sedentary period of 15.5±3.7 minutes. In contrast, healthy controls had 42.8 breaks of sedentary behavior (p=0.016), whilst the average sedentary period only lasted 10.6±2.7 minutes (p=0.001). The mean difference for the number of sedentary breaks was -9.6 (95%CI: -14.5 - -4.7), and for sedentary bout duration 4.9 minutes (95%CI: -2.7 - -7.0).

**CONCLUSIONS:** CVD patients spent more time sedentary during wake hours compared with healthy controls. Specifically, CVD patients had sedentary bouts with a longer duration and less frequently broke up their sedentary behavior compared to healthy controls. These findings stress the importance of specific interventions that target sedentary behavior in CVD patients.

**Seric Musclin is not Increased in Patients with Metabolic Syndrome and Insulin Resistance**

Juan C. Calderón1, Yeliana L. Sánchez1, Leonardo A. Castro-Valencia1, Juan C. Arístizábal1, Mauricio Estrada2, Raúl Narváez-Sánchez1, Jaime A. Gallo-Villegas1, University of Antioquia, Medellín, Colombia. 1Pablo Tobón Urrite Hospital, Medellín, Colombia.

(No relevant relationships reported)

Skeletal muscle has now been recognized as an endocrine tissue, through the production and secretion of myokines. Musclin is a myokine mainly secreted by
Previous studies have shown that a long-chain fatty acid-rich diet as well as endurance exercise induce increase in muscle mitochondria and enhance endurance capacity in rodents. We previously showed that a medium-chain fatty acid (MCFA)-rich diet increases mitochondrial protein levels in the skeletal muscles of non-obese rodents. However, its mechanism remains unclear. Most MCFAs are converted to ketone bodies, which are thereafter released into the blood. PURPOSE: The purpose of this study was to examine whether β-hydroxybutyrate (β-OHB), a ketone body, increases the levels of mitochondrial proteins in muscles. METHODS: We also evaluated the binding of β-OHB to peroxisome proliferator-activated receptors (PPARs), which regulate the levels of mitochondrial proteins in muscles (Exp. 1). We previously showed that a medium-chain fatty acid (MCFA)-rich diet induces mitochondrial protein levels in muscles (Exp. 1). We therefore used C2C12 mouse skeletal muscle cells grown in Dulbecco’s modified Eagle’s medium (DMEM) with 10% fetal bovine serum and 1% penicillin/streptomycin (PS). After 5 days, the cells were treated with different concentrations (0.05, 0.1, 0.25, 0.5, or 1 mM) of β-OHB for 24 h. The levels of voltage-dependent anion channel (VDAC) and complex-IV (COX-IV) expression were then measured by western blotting. EXP: 2 PPARα-ligand-binding domain were incubated with buffer containing either agonists or β-OHB, and then with fluorescein-labeled coactivator peptide and terbium-labeled anti-GST antibodies. The fluorescence intensity was measured using time-resolved fluorescence resonance energy transfer. RESULTS: Exp. 1: Treatment of the cells with 0.25 mM, 0.5 mM, and 1 mM β-OHB increased VDAC levels compared with those in the control (r = 0.46, P < 0.05), between muscle and indexes of total lean mass (kg mg⁻¹, r = 0.51; P < 0.05) and thigh lean mass (kg mg⁻¹, r = 0.54; P < 0.05), between area of skeletal muscle fiber types II (FT-II) and indexes of total lean mass (r = 0.49; P < 0.05). There was no significant trend between total lean mass and HOMA-IR (r = -0.34; P = 0.07). We did not find correlation between HOMA-IR and muscle or area of FT-II. CONCLUSIONS: lean mass seems to determine muscle mass, however, this myokine was not associated to IR in our patients. These results show that the previous results are related to muscle models. COLECIENCIAS 11156263875. CODI 2605. Interinstitutional 2016-1341. Coelciencias doctoral scholarships 727-2015.

Medicine & Science in Sports & Exercise®

680 Board #121
May 30 2:00 PM - 3:30 PM
Ketone Bodies Induce Mitochondrial Biogenesis In Skeletal Muscle Cells
Rie ISHIZAWA,1 Shin TERADA,2 Mitsuru HIGUCHI,3 FACSM,2 Motoko TAGUCHI,2 Kazumi MASUDA4,1 Waseda University, Saitama, Japan. 1The University of Tokyo, Tokyo, Japan. 2Kanazawa University, Ishikawa, Japan.

Ketone Bodies Induce Mitochondrial Biogenesis In Skeletal Muscle Cells
Rie ISHIZAWA, Shin TERADA, Mitsuru HIGUCHI, FACSM, Motoko TAGUCHI, Kazumi MASUDA.

Rie ISHIZAWA, Shin TERADA, Mitsuru HIGUCHI, FACSM, Motoko TAGUCHI, Kazumi MASUDA.

Previous studies have shown that a long-chain fatty acid-rich diet as well as endurance exercise induce increase in muscle mitochondria and enhance endurance capacity in rodents. We previously showed that a medium-chain fatty acid (MCFA)-rich diet increases mitochondrial protein levels in the skeletal muscles of non-obese rodents. However, its mechanism remains unclear. Most MCFAs are converted to ketone bodies, which are thereafter released into the blood. PURPOSE: The purpose of this study was to examine whether β-hydroxybutyrate (β-OHB), a ketone body, increases the levels of mitochondrial proteins in muscles (Exp. 1). We also evaluated the binding of β-OHB to peroxisome proliferator-activated receptors (PPARs), which regulate the levels of mitochondrial proteins in muscles (Exp. 1). We previously showed that a medium-chain fatty acid (MCFA)-rich diet induces mitochondrial protein levels in muscles (Exp. 1). We therefore used C2C12 mouse skeletal muscle cells grown in Dulbecco’s modified Eagle’s medium (DMEM) with 10% fetal bovine serum and 1% penicillin/streptomycin (PS). After 5 days, the cells were treated with different concentrations (0.05, 0.1, 0.25, 0.5, or 1 mM) of β-OHB for 24 h. The levels of voltage-dependent anion channel (VDAC) and complex-IV (COX-IV) were then measured by western blotting. Exp. 2: PPARα-ligand-binding domain were incubated with buffer containing either agonists or β-OHB, and then with fluorescein-labeled coactivator peptide and terbium-labeled anti-GST antibodies. The fluorescence intensity was measured using time-resolved fluorescence resonance energy transfer.

RESULTS: Exp. 1: Treatment of the cells with 0.25 mM, 0.5 mM, and 1 mM β-OHB increased VDAC levels compared with those in the control (3.5-, 2.6-, 3.7-fold, r = 0.05, respectively). Exp. 2: GW7674, an agonist of PPARα (EC50; 6.2±0.4 nM), and GW501516, an agonist of PPARδ (EC50; 10.3±3.6 nM), increased the fluorescence ratio for either PPARα or PPARδ.

CONCLUSION: The results indicate that β-OHB induces the expression of mitochondrial proteins in skeletal muscle cells of mice via a pathway different from the one associated with PPARs.

Medicine & Science in Sports & Exercise®

681 Board #122
May 30 2:00 PM - 3:30 PM
Cancer-Related Fatigue and Mitochondrial Function in Cancer Survivors
Aidan M. Flanagan, Elizabeth M. DePauw, Alexander V. Ng, FACSM. Marquette University, Milwaukee, WI.

Cancer-Related Fatigue (CRF) is a commonly reported symptom of cancer survivors during or after treatment and can contribute to decreased quality of life (QOL). The cause of CRF is largely unknown and is likely multifactorial. CRF has long been hypothesized to result from decreased energy production due to impaired mitochondrial function. PURPOSE: To investigate if impaired mitochondrial function contributes to CRF.

METHODS: Ten cancer survivors (CA, Prostate, Breast, Ovarian), reporting CRF to varying degrees and 5 control subjects with no history of cancer (C), participated in this pilot cross-sectional study. The following measurements were obtained from all subjects: CRF (FACT-F), depression (CES-D), QOL (PROMIS Global Well-Being (GWB)). Physical function was indicated by handgrip strength (HG), 30-Second Sit-to-Stand (SST), timed 5MWT (MSFC). Impaired mitochondrial oxidative capacity of the wrist flexor muscles was indicated by the time constant (Tc) of muscle VO2, recovery measured with near-infrared spectroscopy (NIRS). The upper limb was chosen so to be relatively independent from ambulation and activity. Analyses were by unpaired T-tests. Pearson Correlations were obtained for variables that differed between groups. Sig. P ≤ 0.05. Data are mean (SD). RESULTS: No significant group differences (all ≥ 0.3) were noted in age (CA = 58.3 (10.3), C = 48.6 (10.5) yr), height (CA = 168.7 (7.2) cm, C = 166.9 (6.9) cm), weight (CA = 81.7 (13.2), C = 73.8 (11.6) kg), or body fat (CA = 28.7 (4.45), C = 33.14 (8.6%), biological impedance). Significant differences or trends were noted between CA and C groups (MSFC (MS=54.4(9.8), C=36.0(8.8)s). For all participants, Tc was correlated with MSFC (MS=0.74(0.58), C=2.00(0.55)), and CES-D = 0.74), and CES-D (r = -0.93). Pearson correlation coefficients were obtained for Tc with MS and MSFC: r = 0.74, r = -0.93. Tc was significantly lower in CA than C and the other groups. Further, Tc may mediate QOL through CRF.

Medicine & Science in Sports & Exercise®

682 Board #123
May 30 2:00 PM - 3:30 PM
Impaired Mitochondrial Function May Contribute to Disability and Symptoms of Multiple Sclerosis
Elizabeth M. DePauw, Aidan M. Flanagan, Alexander V. Ng, FACSM. Marquette University, Milwaukee, WI.

Multiple Sclerosis (MS) is a neurological disease of autoimmune origin. Cognitive, physical, and psychosocial symptoms arise which can interfere with activities of daily living and decrease quality of life (QOL) of persons with MS (PwMS). The cause of MS is unknown, but mitochrondia have been implicated in the pathogenesis of the disease and may otherwise affect symptoms of MS including muscle endurance and symptomatic fatigue. Mitochondrial function has been hypothesized to result from decreased energy production due to impaired mitochondrial oxidative capacity (i.e. Tc) may be lower in CA reporting fatigue compared to C and contribute to CRF (i.e. FACT-F). Further, Tc may mediate QOL through

Medicine & Science in Sports & Exercise®

683 Board #124
May 30 2:00 PM - 3:30 PM
Insulin Receptor-WNK1 Signaling Targeting Glut4 Trafficking Are Blunted In Diabetic Skeletal Muscle
In Deok Kong, Ji-Hee Kim, Hanul Kim, Kyu-Hee Hwang, Kyu-Sung Park, Seung-Kyu Cha. Yonsei Univ: Yonsei University College of Medicine, Wonju, Korea, Republic of.

Insulin signaling in skeletal muscle disturbs trafficking of glucose transporter 4 (GLUT4) associated with the onset of type 2 diabetes (T2D). WNK1 is highly
expressed in skeletal muscle and is known to regulate trafficking of transporters including GLUT1. Here, we investigated if and how insulin receptor signaling cascade targeting GLUT1 regulates cell surface abundance of GLUT1 in skeletal muscle and whether this regulation is altered in T2D.

**METHODS:** Insulin receptor-WNK1 signaling cascade targeting GLUT1 regulates cell surface abundance of GLUT1 in skeletal muscle and whether this regulation is altered in T2D.

**RESULTS:** Compared with control mice, T2D db/db mice exhibited significant insulin resistance. WNK1 mRNA expression was downregulated in db/db mice, whereas GLUT1 mRNA expression. Insulin increased phosphorylation of the downstream kinase Akt as well as WNK1 in a PI3K-dependent mechanism. A biotinylation assay demonstrated that insulin stimulates GLUT1 surface expression by promoting its exocytosis suggesting that WNK1 is a novel regulator of insulin-stimulated GLUT1 trafficking in the skeletal muscle.

**CONCLUSIONS:** These results provide a new perspective on WNK1 function beyond regulation of ion homeostasis and offer new insights for pathogenesis of hyperglycemia in T2D. [Supported by NRF-2015R1D1A1A01060454 & 2017R1D1A3B03031760]

---

**Official Journal of the American College of Sports Medicine**
**Vol. 49 No. 5 Supplement** S163

---

**Board #125**
May 30 2:00 PM - 3:30 PM

**ALDH2 Restores Exhaustive Exercise-induced Mitochondrial Dysfunction in Skeletal Muscle**

Qiping Zhang1, Mengwei Sun1, Jianheng Zheng1, Jun Qiu1, Xiaohong Wu1, Yangshuo Xu1, Weiil Shen1, Shanghai Research Institute of Sports Science, Shanghai, China. 2Ruijin Hospital, Shanghai Jiaotong University School of Medicine, Shanghai, China. (No relevant relationships reported)

Mitochondrial aldehyde dehydrogenase 2 (ALDH2) is highly expressed in heart and skeletal muscles, and is the major enzyme that metabolizes acetaldehyde and toxic aldehydes. The cardioprotective effects of ALDH2 during cardiac ischemia/reperfusion injury have been recognized. However, less is known about the function of ALDH2 in skeletal muscle.

**PURPOSE:** This study was designed to evaluate the effect of ALDH2 on exhaustive exercise-induced skeletal muscle injury.

**METHODS:** We created transgenic mice expressing ALDH2 in skeletal muscles. Male wild-type C57BL/6 (WT) and ALDH2 transgenic mice (ALDH2-Tg), 6-weeks old were challenged with exhaustive exercise for 1 week to induce skeletal muscle injury. Animals were sacrificed 24 h post-exercise and muscle tissue was excised.

**RESULTS:** ALDH2-Tg mice displayed significantly increased treadmill exercise capacity compared to WT mice. Exhaustive exercise caused an increase in mRNA levels of the muscle atrophy markers, Atrogin-1 and MuRF1, and reduced mitochondrial biogenesis and fusion in WT skeletal muscles; these effects were attenuated in ALDH2-Tg mice. Exhaustive exercise also enhanced mitochondrial autophagy pathway activity, including increased conversion of LC3-I to LC3-II and greater expression of Beclin1 and Bnip3, the effects of which were mitigated by ALDH2 overexpression.

**CONCLUSIONS:** ALDH2 may reverse skeletal muscle mitochondrial dysfunction due to exhaustive exercise by regulating mitochondria dynamic remodeling and enhancing the quality of mitochondria.

---

**Board #126**
May 30 2:00 PM - 3:30 PM

**Heavy Load Exercise Causes Mitochondrial Dysfunction and Increases Mitophagy**

Hua-yu SHANG1, Sheng-chao BAI2, Bo-ya GU1, Zhi XIA1, Shun-chang LI1, Rui-yuan WANG1. 1Chengdu Sport Institute, Chengdu, China. 2Beijing Sport University, Beijing, China. 3Jinggangshan University, Ji’ an, China. (Sponsor: Tong-jian You, FACSM) (No relevant relationships reported)

**Scientific Abstract**

**PURPOSE:** To observe the effect of heavy load exercise on mitochondrial structure and function in skeletal muscle of rats and analyze the change of mitochondrion protein of PINK1 and Parkin related proteins, and to explore the role of PINK1/Parkin pathway in exercise-induced mitochondrial damage in skeletal muscle.

**METHODS:** Male Sprague-Dawley rats were divided into control group (C group, n=8) and exercise group (E group, n=40). Rats in the E group performed a running on a treadmill down a 16° incline at 16m/min for 90 min, and those were further divided into 0h, 12h, 24h, 48h, and 72h sub-groups (n=8), and at each time point the soleus muscle was collected under anesthesia. Mitochondrial ultrastructural changes in skeletal muscle were observed by a transmission electron microscope. The content of quantitative enzyme citrate synthase (CS) and the activities of mitochondrial respiratory chain Complex II and IV were measured by ELISA. Protein expression of skeletal muscle cytochrome c oxidase subunit I (COX I), P7E1-induced putative kinase 1 (PINK1) and mitochondrial Parkin/microtubule-associated protein 1 light chain 3 (LC3) were determined by western blot. Mitochondrial co-localization with Parkin ubiquitin (Ub) p62/Sequestosome 1 (p62) and LC3 was measured by the immunofluorescence double labeling technique. One-way ANOVA was used to evaluate statistical significance.

**RESULTS:** After heavy load exercise, the mitochondrial structure appeared to be abnormal and formed a lot of mitophagosomes; the CS content and Complex II activity significantly decreased, whereas the Complex IV activity and COX I protein level remained unchanged; the expression of PINK1 (E12=2.55±0.141) and Parkin (E12=2.52±0.141) were significantly decreased (p<0.05 or p<0.01).

**CONCLUSION:** A heavy load exercise may activate the PINK1/Parkin pathway and promote the combination of Ub,p62,LC3 and mitochondria, and result in mitophagy and mitochondrial damage within skeletal muscle.

Supported by Natural Science Foundation of China (31471133).

---

**Board #127**
May 30 2:00 PM - 3:30 PM

**Hypermetabolic Effects of Dietary Ketones are Independent of Changes in Skeletal Muscle Mitochondrial Respiration**


Dietary ketone-mediated increases in energy expenditure (EE) have been attributed to increased adipose thermogenesis; however, little is known regarding the contribution of skeletal muscle to the hypermetabolic phenotype. **Purpose:** Determine if dietary ketone esters increase mitochondrial respiration in skeletal muscle. **Methods:** Thirty 5-wk old male C57BL/6 mice were placed on an ad libium high fat diet (HFD) for 10 weeks. Mice were then randomized to one of three groups (n = 10 per group) for an additional 12 weeks: 1) Control (CON, remain on HFD); 2) Ketone Ester (KE, 22% kcal from KE); 3) Pair-fed (PF, pair-fed to KE group). Body composition was measured during the final week of the study by Quantitative Magnetic Resonance (QMR) and EE was examined by indirect calorimetry. Skeletal muscle mitochondrial respiration was measured by high-resolution respirometry in permeabilized muscle fiber bundles. **Results:** Body weight in the KE group was 27% lower and total adiposity 54% lower than the PF group (p < 0.05 for both) despite comparable energy intake. Differences in body weight and adiposity were attributed to higher resting (REE) and total (TEE) energy expenditure in the KE group (p<0.05). Markers of mitochondrial biogenesis and thermogenesis were increased in brown adipose and a browning phenotype was observed in inguinal white adipose. However, there were no differences in skeletal muscle mitochondrial respiratory capacity between groups. **Conclusions:** These results provide further support that dietary ketone esters increase brown and white adipose thermogenesis but do not appear to have effects on skeletal muscle respiration.

Supported by: UAB NORC Pilot and Feasibility Award (P30DK56336).

---

**Board #128**
May 30 2:00 PM - 3:30 PM

**Mitochondrial Respiratory Capacity and Coupling Control of Skeletal Muscle in Colon-26 Tumor-Induced Cachexia**

Jessica L. Halle, Gabriel S. Pena, Hector G. Paez, Joseph P. Carzoli, Michael C. Zourdos, Michael Whitehurst, FACSM, Andy V. Khamoui. Florida Atlantic University, Boca Raton, FL. (Sponsor: Michael Whitehurst, FACSM) (No relevant relationships reported)

Cachexia is a life-threatening, paraneoplastic syndrome featuring unintended weight loss and skeletal muscle atrophy. Mitochondria, the major providers of cellular energy, couple oxygen consumption to ATP synthesis (i.e. oxidative phosphorylation, OXPHOS). Impaired mitochondrial bioenergetics (e.g. respiration) is associated with the pathophysiology of multiple diseases. The control of mitochondrial respiration in skeletal muscle during the induction and progression of cancer cachexia is not well understood. **Purpose:** To investigate mitochondrial respiratory capacity and coupling control of skeletal muscle in the colon-26 model of cancer cachexia.

**Methods:** Balb/c males (10 wks) were assigned to control or colon-26 (C26). C26 mice were injected with 1x10⁷ tumor cells, and tissue collected on days 7, 14, and 21 post-injection. In addition, male Sprague-Dawley rats were killed 7 days, and cachexia by day 21. Controls were injected with PBS and tissue collected on day 0. Respiration was measured in permeabilized fibers from the medial gastrocnemius via high-resolution respirometry. A substrate-uncoupler-inhibitor titration protocol was used to evaluate Complex I OXPHOS (CI-I), Complex I-III OXPHOS (CI-III), and electron transfer system capacity (ETS). Efficiency of the OXPHOS system was determined from the ratio CI-I/ETS (P/E).

**Results:** CI-I was significantly lower (p<0.05) at day 21 (4.8±1.6 pM/s/mg) in comparison to day 0 (5.3±1.7 μM/s/mg). Day 7 (5.7±4.6 μM/s/mg) and day 14 (6.0±2.9 μM/s/mg) CI-I was significantly lower (p<0.05) at day 21 (22.3±2.3 pM/s/mg)

Supported by: UAB NORC Pilot and Feasibility Award (P30DK56336).
in comparison to day 0 (65.5±7.8), day 7 (69.9±8.5), and day 14 (73.8±4.8). Maximal ETS was significantly lower (p<0.05) at day 21 (24.1 pmol/min) in comparison to day 0 (83.7±13.8), day 7 (84.4±12.3), and day 14 (105.5±7.9). P was significantly different across timepoints (p<0.05). CONCLUSION: Phosphorylating respiration with electron input from Complex I and II, and maximal electron transfer system capacity (i.e. non-coupled respiration) was significantly reduced at day 21 concomitant with cachexia, but not at earlier timepoints, suggesting that changes in oxidative metabolism occurs as a consequence of cachexia rather than having a causal role. Loss of respiratory capacity may compromise whole muscle and physical independence.

PURPOSE: Mitochondria play a principal role for metabolism and have a primary role in regulating respiration and energy expenditure. Recently, we showed that the muscle-specific protein myoglobin (Mb) interacted with complex IV to augment mitochondrial respiratory capacity in skeletal muscles. However, the precise mechanism for the Mb-mediated upregulation remains under debate. The present study has focused on localizing Mb within the mitochondria.

METHODS: Muscle specimen from deep portion of m. Gastrocnemius in Wistar rat was homogenized. Crude mitochondria were isolated by differential centrifugations and washed with the mitochondrial isolation buffer. The isolated mitochondria were treated with proteinase K (PK), cosmetic shock (OS), and SDS (or TrX) in order to digest proteins on the outer membrane and in the intramembrane. The final samples were subjected to SDS-PAGE and immunoblotting using antibodies to localize the protein in the mitochondria.

RESULTS: Western blotting analysis revealed that the PK digests Tom20, which localized on the outer membrane of mitochondria. The Tom20 band intensity decreased with the amount of PK used. Other mitochondria proteins such as cytochrome c (intramembrane space), COX-IV (inner membrane), and PDH (matrix), were not affected by PK treatment. PK treatment did not affect Mb. The results suggested that Mb did not localize on the outer membrane of mitochondria. The combined treatment of PK, OS and SDS or TrX allowed immunoblotting detection of the mitochondrial proteins in specific regions of the mitochondria. For example, cytochrome c disappeared with OS treatment. Timm22 disappeared with PK+OS treatment. However, Mb was detected with either PK or OS treatment. But it cannot be detected with a combined PK+OS treatment. The results suggest that Mb associated with the inner membrane (intermembrane space, not matrix side) of mitochondria.

CONCLUSIONS: We conclude that Mb in muscle cells localizes in the cytosol and in the mitochondrial intermembrane space. Since exercise training increases Mb expressions of skeletal muscle, the increased Mb concentration may play a direct role in modulation skeletal muscle respiration and oxidative phosphorylation capacity.

PURPOSE: In aging skeletal muscle, disrupted mitochondrial homeostasis and lower levels of Irwin were found to accompany with elevated oxidative stress. Recent research indicates that impaired mitochondrial homeostasis may lead to diminished Irwin biosynthesis during aging. In order to gain some insight into the role of Irwin in mitochondrial homeostasis, we investigated the effect of oxidative stress, induced by exogenous H-O, on Irwin and its precursor FND5, as well as key markers of mitochondrial biogenesis and dynamics in C2C12 myoblasts. METHODS: Myoblasts were treated for 24 hours with prepared dilutions of H-O, in culture medium resulting in a final concentration of 10, 20, 40, and 80 mM. Survival rate of cells was detected by MTT to determine the optimal concentration of H-O. Flow cytometry was used to assess mitochondrial membrane potential and reactive oxygen species (ROS) generation. Confocal laser scanning microscopy was used to monitor the morphology of the mitochondrial reticulum. Protein content of Mfn1, Mfn2, OPA1, Dp11, FND5, C2C12, NF-xβ and p38 MAPK were measured with Western blot. Content of Irwin in culture medium was determined by Elisa. RESULTS: Treatment of cells with 80μM H-O caused decrease in mitochondrial membrane potential (~65%, p<0.01), and Mfn1 (~41%, p<0.01), Mfn1 (~49%, p<0.05), OPA1 (~17%, p<0.05), Dp11 (~25%, p<0.05), FND5 (~36%, p<0.01), PGC-1α (~80%, p<0.01), and p38 MAPK (~22%, p<0.05). H-O, exposed elevated at the age of MDA content (~107%, p<0.01), ROS generation (~71%, p<0.01), and NF-xβ activation (~23%, p<0.01), H-O induced visible fragmentation of the mitochondrial reticulum. However, Irwin content showed no significant change. CONCLUSION: H-O-induced oxidative stress impaired Irwin biosynthesis, which may be caused by disruption of mitochondrial homeostasis in muscle cells. Unchanged Irwin levels in the cell might have been from a decreased export under oxidative stress. Supported by NSFC (No. 81370454, 31110013919).

PURPOSE: Aerobic exercise prescription is often based on a linear relationship between pulmonary oxygen consumption (V’O2) and heart rate (HR). The aim of the present study was to test the hypothesis that during constant work rate (CWR) exercises at different intensities the slow component of HR kinetics occurs at lower work rate and is more pronounced that the slow component of V’O2 kinetics, thereby negating the linear relationship mentioned above. METHODS: Seventeen male (age 27±4 yr) subjects performed on a cycle ergometer an incremental exercise to voluntary exhaustion to determine peak O2 uptake [V’O2 peak] and the gas exchange threshold [GET] and several CWR exercises: 1) moderate CWR exercises (MOD), below GET, 2) heavy CWR exercise (HEAVY), at 45% of the difference between GET and V’O2 peak, (Δ) 3) severe CWR exercise (SEVERE), at 95% of Δ “HR controlled” exercise in which work rate was continuously adjusted to maintain a constant HR slightly higher than that determined at GET. Breath-by-breath V’O2, heart rate and other variables were determined. RESULTS: In MOD, no slow component of V’O2 kinetics was observed, whereas a slow component was observed for HR kinetics. During HEAVY, the amplitude of the HR slow component was more pronounced than that for the V’O2 slow component. During the HR-controlled exercise the decrease in work rate needed in order to maintain a constant HR was associated with a decreased V’O2. CONCLUSION: The HR slow component was more pronounced than the V’O2 slow component. The absence of a linear relationship between HR and V’O2 during CWR at different exercise intensities has implications on exercise prescription and tolerance.
Deleterious actions for IL-6 have been proposed, such as provoking aging-associated low-grade inflammation accompanied with pro-inflammatory cytokine TNF-α and IL-1β. However, anti-inflammatory effects of exercise may to some extent be associated with muscle-derived IL-6 through inducing anti-inflammatory cytkines such as IL-1α and IL-10. It is increasingly clear that mitochondria are directly involved in the activation of anti-inflammatory response. PURPOSE: To determine the relationship between mitochondrial homeostasis and biological effects of muscle-derived IL-6 in aging and exercise intervention. METHODS: Male C57BL/6J mice aged 3 months (young) and 16 months (aged) were randomly divided into four groups: young normal (YN), young exercise training (YT), aged normal (AN) and aged exercise training (AT). Trained animals were exercised on a treadmill for 12 weeks. ROS generation, ATP content, mitochondrial homeostasis protein, anti-inflammatory and pro-inflammatory cytokines were examined in gastrocnemius muscle. RESULTS: Aging elevated ROS generation (+175%, p<0.01) and protein content of IL-6 (+104%, p<0.01), TNF-α (+188%, p<0.01), IL-1β (+85%, p<0.01), and NFκB (+77%, p<0.01), when comparing AN vs. YN. Furthermore, AN mice showed decreased ATP content (-26%, p<0.01), protein levels of COX IV (-29%, p<0.05), Beclin1 (-27%, p<0.05), PINK1 (-23%, p<0.05), IL-1α (-26%, p<0.05) and PGC-1α (-43%, p<0.01). Compared with AN, AT increased ATP content (+30%, p<0.05), COX IV (+35%, p<0.01), Beclin1 (+100%, p<0.01), PINK1 (+96%, p<0.01) and PGC-1α (+41%, p<0.05) levels. Moreover, training decreased ROS generation (-55%, p<0.01), IL-6 (-42%, p<0.01), TNF-α (-49%, p<0.01), IL-1β (-28%, p<0.01), and NFκB (-28%, p<0.05) levels. CONCLUSION: Aging increased inflammatory cytokine expression and deteriorated mitochondrial function in mouse muscle. Exercise training promoted mitochondrial biogenesis and mitophagy, suppressed inflammatory cytokine production, and elevated anti-inflammatory cytokines, possibly due to upregulation of PGC-1α and inhibition of NFκB pathway. Supported by NSFNo. 31717120, 81370454, 3111003919.

Mitochondrial dysfunction may contribute to age-related muscle atrophy known as sarcopenia. PGC-1α has been shown to regulate selective mitochondrial autophagy (mitophagy) in skeletal muscles. However, its role in aged skeletal muscle is currently unclear. PURPOSE: To investigate the effect of aging and PGC-1α overexpression on autophagy and mitophagy protein markers, as well as mitochondrial ubiquilination (Ub) and content. METHODS: Male C57BL/6J mice. Aged (16 months) and young (6 months) were randomly divided into four groups: young normal (YN), young exercise training (YT), aged normal (AN) and aged exercise training (AT). Trained animals were exercised on a treadmill for 12 weeks. ROS generation, ATP content, mitochondrial homeostasis protein, anti-inflammatory and pro-inflammatory cytokines were examined in gastrocnemius muscle. RESULTS: Aging increased ROS generation (+175%, p<0.01) and protein content of IL-6 (+104%, p<0.01), TNF-α (+188%, p<0.01), IL-1β (+85%, p<0.01), and NFκB (+77%, p<0.01). Aging increased TNF-α (+188%, p<0.01) and PGC-1α (+77%, p<0.01) and decreased ATP content (-26%, p<0.01), protein levels of COX IV (-29%, p<0.05), Beclin1 (-27%, p<0.05), PINK1 (-23%, p<0.05), IL-1α (-26%, p<0.05) and PGC-1α (-43%, p<0.01). Compared with AN, AT increased ATP content (+30%, p<0.05), COX IV (+35%, p<0.01), Beclin1 (+100%, p<0.01), PINK1 (+96%, p<0.01) and PGC-1α (+41%, p<0.05) levels. Moreover, training decreased ROS generation (-55%, p<0.01), IL-6 (-42%, p<0.01), TNF-α (-49%, p<0.01), IL-1β (-28%, p<0.01), and NFκB (-28%, p<0.05) levels. CONCLUSION: Aging increased inflammatory cytokine expression and deteriorated mitochondrial function in mouse muscle. Exercise training promoted mitochondrial biogenesis and mitophagy, suppressed inflammatory cytokine production, and elevated anti-inflammatory cytokines, possibly due to upregulation of PGC-1α and inhibition of NFκB pathway. Supported by NSFNo. 31717120, 81370454, 3111003919.

Sarcopenia, muscle mass loss due to age, is an important health concern worldwide and is associated with increased risk of falls, poor mobility, and death. PURPOSE: To investigate the effects of testosterone replacement therapy (TRT) with vs. without resistance training (RT) on muscle mass and function in males with complete spinal cord injury (SCI). METHODS: Twenty-two participants were randomly assigned to either TRT+RT (n=11) or TRT only (n=11) for 16 weeks. The TRT+RT group participated in a progressive ankle weight lifting program using NMS twice weekly while sitting in their wheelchairs. The TRT was provided via transdermal testosterone patches (4-6 mg/day) placed on their shoulders. Body composition (lean mass and %FM) using dual energy x-ray absorptiometry and BMR using indirect calorimetry were measured prior to post-training. RESULTS: In the TRT+RT group, ankle weights (P<0.0001) increased over the 16-week period for the right (19±6.6 lbs.) and the left (20±6.1 lbs.) legs. Serum testosterone decanoate decreased significantly (TRT+RT: 413±5147 to 265±183 ng/dl and TRT: 435±177 to 288±258 ng/dl, P= 0.05) following both interventions. Total body (33±11% to 32±11%; P=0.025) and leg (33±11% to 32±9%; P= 0.037) %FM decreased by 1% in the TRT+RT group with no changes in the TRT group. Leg lean mass increased by ~1.8 kg (14.5±3.2 to 16.3±2.7 kg, P>0.037) in the TRT+RT group with a concomitant increase in BMR by 218 kcal/day (P=0.03), but no changes in the TRT group. CONCLUSIONS: TRT combined with RT may help to attenuate the decline in lean mass and BMR years after SCI. At this dose or vehicle of delivery, TRT only is ineffective in restoring lean mass or BMR in men with SCI.
Intracellular Ca\(^2+\) ([Ca\(^2+\)]\_) homeostasis following muscle contractions is profoundly impaired in diabetic skeletal muscle. Because heat stress activates transient receptor potential vanilloid 1 (TRPV1) and promotes Ca\(^2+\) influx from the extracellular space in skeletal muscle we questioned whether TRPV1 might play a role in this pathological response. PURPOSE: To test the hypothesis that impaired muscle Ca\(^2+\) homeostasis in type I diabetic rats is due to attenuated heat stress tolerance (mediated via TRPV1).

**METHODS:** Male Wistar rats were randomly assigned to 1 of 4 groups: 1. diabetes 40\(^\circ\)C (DIA40\(^\circ\)C), 2. diabetes 30\(^\circ\)C, 3. control 40\(^\circ\)C (CONT40\(^\circ\)C), 4. control 30\(^\circ\)C (CONT30\(^\circ\)C). Heat stress of 40\(^\circ\)C was selected because it represents the activation threshold of TRPV1. Spinotrapezius muscles of Wistar rats were exteriorized in vivo and loaded with the fluorescent probe Fura-2 AM. [Ca\(^2+\)]\_ was estimated over 20 min using fluorescence microscopy (340/380 nm ratio) in quiescent muscle held at the required temperature by means of a calibrated heat source applied to the ventral muscle surface. Western blotting was performed to determine the protein expression level of TRPV1 in spinotrapezius muscle.

**RESULTS:** After 20 min heat stress, the CONT40\(^\circ\)C condition induced a 20.0 ± 7 % [Ca\(^2+\)]\_ (P<0.05) elevation that was markedly absent from the DIA40\(^\circ\)C or other conditions. Thus there was no significant differences found over the 20 min observation period between DIA40\(^\circ\)C, DIA30\(^\circ\)C and CONT30\(^\circ\)C (P>0.05). The expression of TRPV1 was significantly decreased 40 ± 7 % in DIA compared with CONT (P<0.05).

**CONCLUSION:** This study revealed that the diabetic condition actually suppresses the expression of TRPV1 and inhibits Ca\(^2+\) influx evoked by heat stress. These findings do not support the notion that impairments of Ca\(^2+\) homeostasis during exercise result from increased Ca\(^2+\) influx due to thermal stress per se.

**P**urpose: There are several methods to examine the morphological properties of spinal motoneurons, but it is difficult to evaluate their functional properties. In this study, we developed a method to evaluate motoneuron plasticity using real-time RT-PCR for the entire spinal cord in rats.

**METHODS:** Male Wistar rats (9 weeks old) were anesthetized and subjected to 100 repeated eccentric contractions (ECC) of their left plantar flexion muscles. The ECC were induced by direct electrical stimuli (45 V, 50 Hz) to the surface of the gastrocnemius muscle and simultaneous dorsal flexion of the ankle joint (150 degrees, 0–40 degrees). The lumbar spinal cord and medial gastrocnemius muscles on both sides were removed at 2 and 4 days after the ECC, and real-time RT-PCR analysis was then performed using the muscle and spinal cord. The right gastrocnemius muscle and right half of spinal cord were used as the non-damaged control. Glyceraldehyde-3-phosphate dehydrogenase and Beta actin in the muscle and spinal cord, respectively, were used as housekeeping genes.

**RESULTS:** The mRNA expression of IL-6 was 50-times higher in the left muscles compared with in the right muscles, indicating marked muscle damage due to the ECC. The mRNA expression of the motoneuron-related factors Choline acetyltransferase, Osteopontin and Estrogen-related receptor gamma was significantly higher in the damaged left half than in the right control of the spinal cord. Furthermore, the mRNA expression of neurotrophic factors and their receptors, Ccalcitonin gene-related peptide and Brain-derived neurotrophic factor, was higher in the left half of the spinal cord. However, the mRNA expression of Nerve growth factor was significantly lower in the left half of the spinal cord. The mRNA expression of oxidative metabolism related factors, PPAR gamma coactivator 1 and Vascular Endothelial Growth Factor, was not significantly different between the left and right spinal cord.

**CONCLUSIONS:** These results indicate that reconstruction of some neuro-muscular systems is facilitated in the muscle and motoneurons by muscle damage induced by ECC. We concluded that this standard method for the spinal cord may be a useful tool to clarify the role of each neurotrophic and myotrophic factor in the muscle regeneration process.
It has long been hypothesized that the physical properties of the muscles are related to motor unit behavior. Indeed, recent investigations have reported a relationship between skeletal muscle phenotype of the vastus lateralis and motor unit (MU) firing parameters during submaximal contractions. However, the nature of this relationship during maximal contractions in unknown and warrants further investigation.

**PURPOSE:** The purpose of the current investigation, therefore, was to examine the relationships between motor unit firing behavior during a maximal voluntary contraction and Myosin Heavy Chain (MHC) isoform content of the vastus lateralis muscle in resistance-trained men. **METHODS:** Ten resistance-trained males (mean ± SD, age = 22 ± 2) completed a maximal ramp contraction up to 100% of their maximal voluntary isometric strength (MVIC). During the contraction, surface electromyography was recorded from the VL using a multi-channel electrode array and decomposed to examine the firing characteristics of individual MUs. A skeletal muscle biopsy of the VL was also collected and the mean fiber area for type I and II muscle fibers was calculated for each individual subject. Regression analyses were performed to identify relationships between type II fiber area and the slopes or intercepts of the mean firing rate (FR_{mean}) vs. recruitment threshold (RT), max firing rate (FR_{max}) vs. RT, and RT vs. MU action potential amplitude (MUAP_{amp}) relationships. **RESULTS:** The mean type II fiber area was 65.8% (± 13.5%). Each subject displayed a significant (p < 0.05) relationship for the FR_{mean} vs. RT (r = -0.95 to -0.82), FR_{max} vs. RT (r = -0.96 to -0.81), and RT vs. MUAP_{amp} (r = 0.64 to 0.91) relationships. There were significant inverse relationships between type II fiber area and the y-intercept of the FR vs. RT relationship (r < 0.05). Additionally, strong relationships (r = 0.30) were found between type II fiber area and FR_{mean}, RT slope and RT vs. MUAP_{amp} slope and intercept. **CONCLUSION:** These data further support the hypothesis that skeletal muscle phenotype is strongly related to MU behavior during isometric contractions. However, our data, in concert with previous investigations, may suggest that these relationships are influenced by the intensity of the contraction.
individuals. In an already very active population measuring grip strength and estimating VO2max using a step test may have short term positive effects on lifestyle activity and resistance training. Wider adoption of these measures could be effective in promoting physical activity and resistance training.

**Purpose:** To determine the utility of the physical activity vital sign (PAVS), and its association with the cardiometabolic disease biomarkers of body mass index (BMI) and blood pressure (BP).

**Methods:** All patients in a high-risk family medicine clinic (>99% Medicare/Medicaid/Uninsured, n = 2710) were assessed via the PAVS (minutes/week), a product of the reported days/week and minutes/day of physical activity. For pediatric patients (5-18 years, n = 255), individuals were categorized into 3 PAVS groups: inactive (PAVS = 0), under-active (1 - 299), and sufficiently active (> 300). Pediatric patients were further classified into youth (5-11 years, n = 118) and adolescents (12-18 years, n = 137).

**Results:** Among pediatric patients, PAVS decreased with increasing age (p = 1x10^-4). The average level of physical activity reported for youth patients was 384.9 ± 218.1 with 72.9% reporting sufficient PA, 24.6% under-activity and 2.5% inactive. Adolescents reported a mean PAVS of 278.3 ± 199.6 with 51.8% reporting sufficient PA, 33.6% under-activity and 15.6% inactive. Using the PAVS, only 24.3% of adults reported sufficient PA of ≥ 150 minutes per week (mean 97.9 ± 149.4). Similar to adults, pediatric males reported a higher PAVS than females (355.1 vs 298.6; p < 0.05). BMI (p = 3.4x10^-10) and systolic BP (p < 0.001) were inversely associated with PAVS in pediatric patients. Similar to adults, patients meeting PA guidelines demonstrated reductions in obesity (p < 0.05) and hypertension (p < 0.05).

In comparison to NHNES data, a greater number of children report meeting PA guidelines through the PAVS (73% vs. 42% for youth, p < 0.0001; 51.8% vs 8% for adolescents, p < 0.0001). PAVS values decline with age and by adulthood the inactivity burden leads to a smaller portion of patients meeting PA guidelines (24% vs 60% in NHANES).

**Conclusion:** The PAVS may under-estimate the burden of physical inactivity in pediatric patients. However, correlations with BMI and BP may suggest a role for the PAVS in identifying youth at risk for obesity and hypertension, which may allow earlier intervention.

**Purpose:** To compare the acute effects of high-intensity aerobic interval training (HIIT), resistance training (RT), or combined exercise training (RT+HIIT) on cognitive inhibition and attentional capacity in overweight inactive men.

**Methods:** Thirty-five Hispanic men (mean age: 41.5 (SD 11.2) yrs.; mean BMI: 34.8 ± 6.6 kg/m²) enrolled in a 12-week GCSWLI. Participants attended weekly in-person individual sessions guided by a trained bilingual Hispanic male lifestyle coach, were prescribed a daily reduced calorie goal, and 225 minutes of moderate-intensity physical activity per week. A free gym membership was provided to facilitate engagement in LTPA.

**Results:** For cognitive inhibition, significant differences were observed in HIIT and RT+HIIT with RT=HIIT for congruent condition (d=1.70). Regarding attention capacity, there were significant differences in HIIT and RT+HIIT for concentration performance domain, and in RT and RT+HIIT with total performance. The largest effect size was found in RT+HIIT for concentration performance domain (d=1.2).

**Conclusions:** Acute RT+HIIT session reported larger effect sizes than RT and HIIT alone for congruent condition. Combined exercise seems to favor acute benefit on executive function and can be particularly recommended in inactive overweight men. Overall, combined RT+HIIT seems to favor acute benefit on executive function in inactive overweight men.

**Clinical trial registration:** ClinicalTrials.gov NCT02915913 (Date: September 22, 2016).
The increase in obesity and sedentary lifestyle has caused many educational bodies to develop intervention programs in an attempt to implement healthier lifestyles. We propose to assess the efficiency of an educational program embedded in a GCWSLI. Acculturation and self-efficacy were not associated with this change. Studies examining additional factors that influence LTPA in this health disparate group are needed.

**PURPOSE:** To assess the efficiency of an educational program embedded in a GCWSLI. Acculturation and self-efficacy were not associated with this change. Studies examining additional factors that influence LTPA in this health disparate group are needed.

**METHODS:** Twenty-three overweight/obese young men (mean age 22.7 ± 2.8 years, BMI 25.5 ± 1.8, percent body fat 22.3 ± 2.2%) were randomly assigned to HIIT group performed 12 bouts of 1-min 30-meter shuttle runs at 90% of heart rate reserve (HRR), interspersed by 1-min of active recovery at 70% of HRR once per week. Participants in control group were instructed to maintain their daily lifestyle for 8 weeks. VO2peak was measured by beep test and body composition was assessed by bio-impedance segmental body composition analyzer before and after the study period.

**RESULTS:** VO2peak was significantly increased after 8 weeks of HIIT intervention (HIIT +17.5% vs. CON -0.3%). Total body fat mass, percent body fat and waist circumference were significantly reduced after 8 weeks of HIIT intervention (fat mass: HIIT -7.9% vs. CON +4.7%, percent body fat: HIIT -7.6% vs. CON +2.9%, waist circumference: HIIT -4.5% vs. CON +0.8%). CONCLUSION: Our results demonstrate that low-frequency HIIT (i.e., performed once per week) improves cardiorespiratory fitness and body composition in overweight/obese men. Supported by HKU Seed Fund for Basic Research

Global obesity rates have reached epidemic proportions. However, it is estimated that 95% of the dieters find difficulty in maintaining weight loss and return to gain it for up to 2 years. The desire for long-lasting behavioral and weight changes motivated health professionals to seek for new approaches to stop the obesity growing rates. Health and wellness coaching (HWC) comes up as a behavioral change approach, based on a client-centered process, without a diet prescription, and seems to be more likely to promote long-lasting changes. The subject of this study had previously tried different diets, all of which failed to achieve lasting weight loss.

**PURPOSE:** The aim of this case report is to present and evaluate HWC in promoting sustainable lifestyle changes especially in body composition, eating pattern and self-assessment of quality of life.

**METHODS:** Body composition, quality of life (WHOQOL-bref) and nutritional intake were assessed at baseline (P1), after 12 weeks of HWC (P2) and 14 weeks after the end of the intervention (P3). 12 HWC sessions were completed, which were held weekly (1 hour each), and 36 physical activity sessions, which were held 3 times a week (1 hour each). No diet was prescribed during the whole process.

**RESULTS:** In P1, HWC and physical activity sessions were associated with reductions in body weight (-5.1 kg), fat mass (-5.2 kg), BMI (from 29.6 (P1) to 27.8 kg/m² (P3)), and waist circumference (-7.1 cm). From P1 to P3, we also observed maintenance of the subject of this study had previously tried different diets, all of which failed to achieve lasting weight loss. HWC and physical activity sessions were associated with reductions in body weight (-5.1 kg), fat mass (-5.2 kg), BMI (from 29.6 (P1) to 27.8 kg/m² (P3)), and waist circumference (-7.1 cm). From P1 to P3, we also observed maintenance of

**CONCLUSIONS:** HWC was effective once the new eating pattern and weight loss achieved during the process were maintained in the medium term after the end of the sessions.
EPIDEMIOLOGY OF SELF-REPORTED PHYSICAL ACTIVITY IN EIGHT LATIN AMERICAN COUNTRIES: FINDINGS FROM ELANS STUDY

Gerson Luís de Moraes Ferrari1, Irina Kovalsky2, Mauro Fishberg2, Georgina Gómez3, Attilio Rigotti3, Liliana Yadiria Cortés4, Martha Cecilia Yépez5, Rossina G. Paraje6, Marianella Herrera-Cuencal7, Ióna Z. Zimberg7, Viviana Guajardo7, Mia Michael Pratt7, Carlos Pires7, Dirceu Soled7. 1CEELAFS - UNIFESP, Itu, Brazil. 2International Life Science Institute, Buenos Aires, Argentina. 3UNIFESP, São Paulo, Brazil. 4Universidad de Costa Rica, San José, Costa Rica. 5Departamento de Nutrición, Diabetes y Metabolismo, Santiago, Chile. 6Pontificia Universidad Javeriana, Bogotá, Colombia. 7Universidad San Francisco de Quito, Quito, Ecuador. 8Vivarium de Investigación Nutricional, Lima, Peru. 9Universidade Central de Venezuela, Venezuela, Venezuela, Bolivarian Republic of. 10Hubert Department of Global Health, Atlanta, GA. 11-Centre for Mathematics of the University of Trás-os-Montes e Alto Douro, Vila Real, Portugal.

BACKGROUND: The prevalence of physical inactivity in Latin America was one of the highest reported worldwide. The purpose of this study was a comparative international study of population PA prevalence across eight countries from Latin American.

METHODS: Data from the Latin American Study of Nutrition and Health (ELANS) were included in the analysis. The sample included 9,218 adolescents and adults aged 15-65 years. PA was assessed using the International Physical Activity Questionnaire. PA was compared among countries, gender, age group, socioeconomic, educational level and different PA domains. In addition to using the MET-minutes/week rank, we also used the rating in active or insufficiently active based in minutes/week.

RESULTS: Individual categories were as active (mean ±150 min/week) or insufficiently active (mean ≤150 min/week). RESULTS: The prevalence of physically active individuals was 52.5%. Men were more active than women in all countries. Only 13.4% of the population had high PA level and 27.4% showed moderate PA level. More than half (59.3%) of subjects exhibited low levels of PA. The prevalence of physically active individuals slightly increased from low to high socioeconomic level. Regarding the educational level, the prevalence of physically active individuals was similar among those who have a lower educational levels, high school studies, and university degrees (52.4, 52.0, and 52.3%). The largest fraction of transportation time was explained by walking time (87%). Vigorous-intensity PA was the one that contributes the most for the total leisure time (52%). Recreation/sport time contributes with 25% to total leisure time. The total of minutes of PA is explained in 55% by leisure time and in 45% by transportation time. Most of the countries more than 80% of total MET-minutes/week were explained by walking (44%) and vigorous-intensity PA (39%). The only exceptions were Ecuador and Chile, the two countries with the highest levels of PA.

CONCLUSIONS: The high percentage of Latin American subjects insufficiently active people and with low levels of PA should be of concern. Measures are needed to promote the practice of PA. If assessment methods are used consistently over time within this world region, trend data will inform countries about the success of their efforts to promote PA.

Efficacy Of A Workplace Wellness Program On The Staff Of A Hemodialysis Clinic

Alana P. Y. Harris, Nicole P. Evans, Brett T. Burrows, Luis M. Perez, Kenneth R. Wilund. University of Illinois at Urbana-Champaign, Urbana, IL. (Sponsor: Jeffrey Woods, FACSM)

Current evidence indicates that health and wellness programs in the workplace provide numerous benefits with respect to altering indices of health. PURPOSE: The purpose of this pilot study was to investigate the effects on physical activity with the utilization of motivational interviewing (MI) on sedentary law enforcement officers (LEOs). In addition, this study considered the reasons why LEOs choose to participate in physical activity to or stay sedentary. The incidence of cardiovascular disease and early mortality are prevalent in LEO, additional behavior change technique research may have a potential impact in their long term health and wellness. METHODS: The LEOS in this study represent veteran officers from the Midwest region of the United States, over the age of 35 years, who were not getting greater than 150 minutes a week of exercise. Of the five officers involved in the study received four MI sessions in 6 weeks. Data collection procedures for this included transcripts from MI sessions, pre/post results from the Self-Efficacy for Exercise (SEE) scale (Bandura, 2006), the Stages of Exercise Behavior Change Scale (SEBC) (Marcus, 1992), and 6 weeks of accelerometer data. A descriptive case study of five law enforcement officers was presented with examples drawn from data, followed by a cross-case comparison of the five officers. RESULTS: Overall, the number of steps for the participants increased a total of 20.6% from the pre-MI (420,044 steps/week) to the post-MI (506,780 steps/week). The SEE score increased by 18%. Positive movement in the SEBC was seen from pre-MI to post-MI in three out of five of the case study participants. The findings from this study also indicated four major themes regarding why officers make the physical activity choices that they make: (1) their life depends on it, (2) competition is key, (3) I’m too tired, who has energy to exercise, and (4) they choose to fail. CONCLUSIONS: Based on this study, sedentary LEOs can increase physical activity, increase SEE and help individuals to move closer to making behavior changes. Motivational interviewing can use an effective behavior change technique in LEOs. It can also be noted that officers have distinct barriers that keep them from participating in physical activity. Allied health care professionals and worksite wellness could benefit from information gained from this study.

EFFECTIVENESS OF A WORKPLACE WELLNESS PROGRAM ON THE STAFF OF A HEMODIALYSIS CLINIC: A PRACTICAL APPLICATION

Barroso, Montserrat G. Vera-Delgado, Carolina Cabrera-de la Barra, Rachele M. Kappler, Ronald Otterstetter, FACSM. The University of Akron, Akron, OH.

PURPOSE: The purpose of this study was to investigate the effects on physical activity in response to WOW. It is a pilot study that examined the potential to improve health indices of the staff of a hemodialysis clinic and may positively impact the health behaviors in the hemodialysis patients under their care.

RESULTS: On average participants lost 2.7±3 kg. (P<0.0002). Waist Circumference changed by -3.2±4 cm (P=0.0001). CONCLUSION: Our data demonstrated that the staff of a hemodialysis clinic improved BMI values in response to WOW. It is a pilot study that examined the potential to improve health indices of the staff of a hemodialysis clinic and may positively impact the health behaviors in the hemodialysis patients under their care.

Health Professionals Trained As Diabetes Educators Are Influential In Their DM2 Patients’ Lifestyle


PURPOSE: To compare lifestyle type in 2 DM2 patients being attended by health professionals trained or not as diabetes educators (HP-DE and HP-nonDE, respectively). METHODS: 160 DM2 patients, receiving health service in public health centers in Central Mexico, signed an informed consent, and answered a validated questionnaire to assess lifestyle in persons living with DM2 (IMEVID). The survey contains 25 items, distributed in seven domains, i.e. Nutrition, Physical Activity, Information on Diabetes, Adherence to Treatment, Alcohol Consumption, Emotion Management and Tobacco Consumption. Descriptive and inferential analysis was done using SPSS v21. RESULTS: 160 DM2 patients (70.6% women and 29.4% men) of 57.7±9.2 years (±sd; n=152) were assigned to two groups: 1) 84 (55.0%) participants being attended by HP-DE; 2) 72 (45.0%) participants being served by HP-nonDE. The IMEVID total scores and the separated dimensions’ scores were analyzed with Kolmogorov-Smirnov Tests. Total scores mean, HP-DE = 78.6±10.0/HP-nonDE = 61.3±12.7 were compared using a Student’s t test for independent samples, resulting statistically different (p<0.001). Six out of the seven dimensions were as well different (U-Mann Whitney): Nutrition, Physical Activity, Diabetes Information, Adherence to Treatment (p=0.001) for the previous four, Alcohol Consumption (p=0.02) and Emotion Management (p=0.04). CONCLUSION: training health professionals as diabetes educators have a positive impact on the lifestyle of their DM2 patients.
For behavioral change, having strong goal intentions does not guarantee goal achievement. Implementation intentions (II) are specific plans of action concerning when, how, and where an intended behavior will be enacted. This self-regulatory skill combined with self-monitoring from daily pedometer use may influence goal achievement. PURPOSE: To examine physical activity (PA) goal achievement between participants that used both II and a pedometer and those that just used a pedometer. METHODS: Sedentary employees (<150 minutes of moderate to vigorous PA/week) (N = 54) at a mid-sized public university were recruited to participate in an 8-week intervention. A 2-A randomized trial was used to compare the effectiveness of: 1) only pedometers (PED) (n = 26) and 2) pedometers and II (PED + II) (n = 28) on goal achievement. All participants were asked to track steps daily. Participants in the PED + II group were asked to write three II for each perceived barrier to meeting their daily step goal that day which (YES) or not (NO). RESULTS: For Time 1, at least one day/week goal achievement was higher in the PED group (97.4% , 25 ± 1) compared to the PED-II group (83.3% , 23.3 ± 5), as well as for Time 2 (7.5% , 22.8 ± 1) than the PED group (70.0% ; 20 ± 5). For 3-day/week goal achievement, the PED group again had higher goal achievement Time 1 (75.6% ; 20 ± 2) and for Time 2 (57.1% ; 16 ± 4) compared to the PED-II group (42.3% ; 11 ± 3) and (35.5% ; 10 ± 5), respectively. CONCLUSIONS: The PED group had higher goal achievement at both time points compared to the participants in the PED-II. Implementation Intentions have been promoted as a behavioral strategy to bridge the gap between intention and behavior, with specific emphasis on improving goal achievement (Gollwitzer & Sheeran, 2006). These results question the utility of II to enhance goal achievement. Further research is needed to examine if this contradictory finding is unique to worksite pedometer-based II.

**PURPOSE:** The purpose of this study was to evaluate the influence of the installation of bike fix-it stations on active transportation (AT) awareness and behaviors among middle school students. Self-reported barriers to active transportation (AT) were also recorded. **METHODS:** Three suburban middle schools in Colorado (USA) installed bike fix-it stations on school property that were available for students to use to perform minor repairs to their bikes. A questionnaire was developed by the school district that inquired about AT behaviors (e.g., day wk1 biking to school) and awareness and use of the fix-it station. The questionnaire was administered before installation of fix-it stations (pre-survey) at the various schools between October 2015 and October 2016. Approximately one semester after installation of the fix-it station at each school, post-surveys were collected. Survey results from individual schools were aggregated at the district-level. Descriptive statistics were calculated for variables of interest and nonparametric tests were used to determine if the differences existed, pre- to post. **RESULTS:** The vast majority (80%) of respondents had not used their school’s fix-it station at the time of the post-survey. There was no significant difference in the number of days respondents biked to school each week, pre-to post-survey. Both those who were aware of the station and those who said they did not need training on its use were more likely to ride their bikes to school, though these relationships were not statistically significant. The most commonly selected barriers to active transportation were time (43%), distance (42%), weather (36%), and having things to carry (38%). Between genders, boys were more likely commute via AT than girls (p < 0.05). **CONCLUSIONS:** Installation of bike-stations alone does not appear to increase AT, although the students in this survey were often not aware of or trained to use the station which may have affected these results. Other barriers should be addressed to make AT a more feasible choice for students.
**MEDICINE & SCIENCE IN SPORTS & EXERCISE®**

900 Board #161 May 30 3:30 PM - 5:00 PM **Comparison of Caloric Expenditure in a Smart Watch and Portable Metabolic Cart**
Andrew Riveiros, Evan Glashen, Antoinette Domingo, Taylor Pennafiori, Brian Palaniugh, Jochen Kressler. San Diego State University, San Diego, CA.

(No relevant relationships reported)

**Purpose:** To validate a Smart Watch (SW) for wheelchair users by comparing caloric energy expenditure (EE) against expired gas analysis. Valid activity tracking will be helpful for clinicians, patients and consumers and may help increase physical activity levels among wheelchair users.

**Methods:** Five wheelchair users (age=50.0(5.6)) and three able-bodied (age=25.3(3.2)) participants completed series of exercises including wheelchair treadmill propulsion at 30, 45, and 60 strokes per minute (spm) and arm cycle ergometry at 45, 60, and 80rpm. They were equipped with a SW on their dominant hand, heart rate monitor, and a portable metabolic tracking cart. The bundled workout app was used for each task. Caloric expenditure data was extracted from both devices and compared by Bland-Altman analysis. **Results:** For treadmill tasks, the SW reported the average EE at 30, 45, and 60rpm frequencies were 7(2.0), 8(2.3), and 9(2.0) kcaIs, respectively. At the same frequencies, the metabolic cart expenditures read 10(3.9), 12.5(3.5), and 15(6.7). Bland-Altman analysis showed relatively poor agreement between the cart and watch at 30rpm (mean difference 3 with limits of agreement (LoA) 4 – 9). Mean absolute percent error (MAPE) was 21.56%. Agreement worsened at higher stroke frequencies, 45rpm (4(4–12)) and 60rpm (6(4–10)). MAPE was 29.11% and 35.88%, respectively. For arm ergometry, the average EE reported by the watch was at 45, 60, and 80rpm were 7(1.0), 9(1.5), and 11(1.4). Metabolic cart expenditures were 6(3.0), 7(2.4), and 8(2.8) at the same frequencies. Bland-Altman analysis showed good agreement at 45rpm (-0.6(-6–5)) with a MAPE of 32.69%. Agreement worsened at higher stroke frequencies, 60rpm (3(-6–5)) and 80rpm (2(-7–2)). MAPE was 58.57% and 48.54%, respectively. **Conclusion:** While performing a treadmill task, the SW underestimated caloric expenditure, but overestimated for arm ergometry. The activity tracker records EE with good validity only at lower frequency tasks.

---

**B-67 Free Communication/Poster - Older Adults and Aging**
Wednesday, May 30, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

901 Board #162 May 30 3:30 PM - 5:00 PM **Weight Loss Involving Exercise Increases Older Women’s Perceived Ability To Accomplish Their Physical Roles**
R.E. Salyer1, G.M. Frederick1, R.A. Reed1, A.C. Berg1, C.R. Straught2, M.A. Johnson1, P.J. O’Connor, FACSM1, E.M. Evans, FACSM1. 1University of Georgia, Athens, GA. 2University of Massachusetts, Amherst, MA. (Sponsor: Ellen Evans, FACSM)

(No relevant relationships reported)

**Purpose:** Older women are known to be at higher risk for both obesity and physical disability compared to their male counterparts. Reductions in perceived physical function (P-PFx) contribute to a decreased health-related quality of life (HRQoL). Weight loss can improve HRQoL in the domain of P-PFx, but the weight loss method that elicits the greatest improvements in both P-PFx and physical role limitations (PRL), such as difficulties or limitations in habitual daily physical activities, is less well characterized in older women. Thus, this study aimed to evaluate the relative efficacy of a weight loss program, with or without exercise, on changes in P-PFx and PRL in inactive overweight and obese older women.

**Methods:** Women (n=53; 64.77 & 69.3(6.0) y; 31.0(4.8) kg/m2) were randomized to either diet only (D; n=19) or diet-exercise (D+EX; n=34) treatment groups for 6 months. The diet component involved reductions of ~500 kcal/day and was designed to elicit ~10% weight loss. The EX program was comprised of 3 x 75-minute sessions/week with cardiovascular, resistance, flexibility, and balance modes. Outcomes of the intervention were compared to the population average. There was a significantly smaller percent improvement for TUG than MES (p < .001). There was no significant difference in percent improvement between RCS and MES. **Conclusions:** The positive changes in RCS and MES indicate similar improvements inecentric and functional strength following the 8 week eccentric training program. The smaller percent change on the TUG may be attributable to the higher baseline performance. Further investigation using other assessments of general function and dynamic balance should be considered for samples with above average TUG performance.

902 Board #163 May 30 3:30 PM - 5:00 PM **A Comparison of Changes in Strength And Dynamic Balance Following 8 Weeks of Eccentric Training in Older Adults**
Samantha Johnson1, Corey Gray2, Bunny Donnelly1, Dana Fuller1, Jennifer Caputo1. 1Middle Tennessee State University, Murfreesboro, TN. 2University of Kansas Medical Center, Kansas City, KS. (No relevant relationships reported)

**Purpose:** To compare changes in leg strength and dynamic balance following training on an eccentric step trainer. **Methods:** Participants (N = 14; 63.5 ± 2 years) completed 2 training sessions per week across 8 weeks, with session duration ≤ 10 minutes. Pre- and post-assessments included a 30-second repeated chair stand (RCS), the timed-up-and-go (TUG), and maximal eccentric strength (MES). Pre-test values for the sample were compared to population averages for the RCS and the TUG, to characterize the sample. Percent change was calculated using: [(Pre-test - Post-test)/ Pre-test] x 100 and paired sample t-tests were conducted to compare changes on RCS, TUG, and MES. **Results:** All participants met or exceeded the population average on the TUG and, overall, the sample began at a higher level on the TUG relative to this average (p = .031). In contrast, the sample for RCS began training below the population average (p = .041) and only 4 of 14 initiated training at or exceeding the population average. There was a significantly smaller percent improvement for TUG than MES (p < .001 and RCS (p < .001). There was no significant difference in percent improvement between RCS and MES. **Conclusions:** The positive changes in RCS and MES indicate similar improvements in eccentric and functional strength following the 8 week eccentric training program. The smaller percent change on the TUG may be attributable to the higher baseline performance. Further investigation using other assessments of general function and dynamic balance should be considered for samples with above average TUG performance.

903 Board #164 May 30 3:30 PM - 5:00 PM **Changes In Cortical Gray Matter Following A 12-month Physical Activity Intervention In Older Adults**
Chelsea Stillman1, Jamie Cohen1, Edward McAuley2, Art Kramer2, Kirk Erickson3. 1University of Pittsburgh School of Medicine, Pittsburgh, PA. 2Northeastern University, Boston, MA. 3University of Pittsburgh, Pittsburgh, PA.

(No relevant relationships reported)

Changes in cortical gray matter following a 12-month physical activity intervention in older adults
Chelsea Stillman1, Jamie Cohen1, Arthur F. Kramer2, Edward McAuley2, Kirk Erickson3
1University of Pittsburgh; 2Northeastern University; 3University of Illinois *dual first authors

**Purpose:** Aging is characterized by reductions in gray matter volume. Cardiorespiratory fitness is associated with higher cortical and subcortical gray matter volume in older adults, and several interventions have indicated that some brain areas might increase in volume after the intervention. However, volumetric changes in cortical regions have been under-examined in the context of controlled interventions. In the present study, we examined whether a 12-month randomized, controlled aerobic exercise intervention in older adults would change cortical gray matter volume. **Methods:** 116 participants were assigned to either an aerobic walking or control (stretching and toning) group. All participants completed MRI sessions before and after the intervention, which included high resolution structural scans. Our initial analyses focused on participants who maintained at least 75% adherence (N = 79 total; mean age = 66.94; 31 males). Thus, our primary analyses include 43 participants from the walking and 36 from the control groups. **Results:** Cardiorespiratory fitness is associated with higher cortical and subcortical gray matter volume in older adults, and several interventions have indicated that some brain areas might increase in volume after the intervention. However, volumetric changes in cortical regions have been under-examined in the context of controlled interventions. In the present study, we examined whether a 12-month randomized, controlled aerobic exercise intervention in older adults would change cortical gray matter volume.

**Conclusions:** The positive changes in RCS and MES indicate similar improvements in eccentric and functional strength following the 8 week eccentric training program. The smaller percent change on the TUG may be attributable to the higher baseline performance. Further investigation using other assessments of general function and dynamic balance should be considered for samples with above average TUG performance.
Impact Of BAILAMOS® Dance Program On Self-reported Physical Activity In Older Latinos

Guilherme M. Balbin1, Isabela G. Marques2, Jaqueline Guzman1, Susan Aguilagana, Priscilla M. Vasquez1, David X. Marquez, FACSMA.1 University of Illinois at Chicago, Chicago, IL. 2University of Illinois at Urbana-Champaign, Champaign, IL.

(No relevant relationships reported)

By 2050, 20% of the older population in the US will be comprised of Latinos. However, Latino health is often poorer than that of non-Latinos whites, with a higher prevalence of chronic diseases and Alzheimer’s disease. In addition, Latinos engage in lower leisure-time physical activity (LTPA) levels. PURPOSE: Test the impact of the BAILAMOS® dance program on lifestyle PA at 4 months and BAILAMOS® maintenance activities on lifestyle PA at 8 months. METHODS: Older Latino adults (N=333; M_0 = 64.89±7.08) were randomized into the dance (n=167) or health education (HE) (n=166) groups. Inclusion criteria were: (1) aged ≥55 years old; (2) self-identification as Latino/Hispanic; (3) Spanish speaker; (4) participation in ≥2 days/week of aerobic exercise; (5) at risk for disability; (6) Mini-Mental State Examination >14; (7) Danced <2 times/month over past year. The dance group participated in 4 months of Latin dancing, two times per week, plus a 4-month maintenance program. The HE group participated in health education classes once per week for 4 months. The Community Healthy Activities Model Program for Seniors (CHAMPS) Physical Activity Questionnaire was administered. A random-intertact mixed model with data imputation was performed, adjusting for baseline covariates of age, sex, education, income, and health status. RESULTS: Total PA significantly increased at 4-months in both dance (M-899.3 ± 336.8) and HE groups (M=704.0 ± 355.5) compared to baseline (Dance, M=718.2 ± 529.4; HE, M=702.1± 337.9; Estimate=137.08, SE=57.52, p=0.017). It was also observed that total LTPA increased in the dance (M=578 ± 433.2) and HE group (M=464 ± 394.6) at 4 months compared to baseline (Dance, M=385 ± 416.9; HE, M=364.8 ± 332.7; Estimate=89.89, SE=43.81, p=0.04); and from baseline to 8 months (Dance, M=536 ± 470.6; HE, M=436.3 ± 336.5; Estimate=104.09, SE=47.36, p=0.028). The mean change in LTPA between dance and HE at 4-months was statistically significant (M=114.24, SE=48.84, p=0.019). However, there was no group*time interaction (p > 0.05). CONCLUSION: The results demonstrated that both study groups increased their self-reported total and leisure-time PA after 4 and 8 months, suggesting a positive impact of both dance and the HE program on PA levels in older Latinos. Supported by NIH Grant 1R01NR013151-01.

Effects Of Lower-leg Training With CLX Bands On Balance, Strength, And Mobility In Older Women

Michael E. Rogers, FACSMA, Nicole Rogers. Wichita State University, Wichita, KS.

(No relevant relationships reported)

Weakness in the lower-leg, particularly the tibialis anterior, can negatively impact balance and mobility, and thus exacerbate the risk for falls. Although a variety of interventions have been shown to improve strength and balance, such programs often require extensive time and trained professionals. Furthermore, targeting the muscles of the lower-leg is difficult using traditional resistance exercises. The advent of CLX elastic bands with their continuous-loop design has made it easier to perform such exercises. However, the efficacy of such training is unknown. PURPOSE: The purpose of this study was to determine if performing two lower-leg exercises using CLX bands for short periods of time (10 min) each in a home-based setting improves strength, balance, and mobility in older women. METHODS: Eleven women (age=78.8±4.5yr) participated in exercise training and 10 women (age=77.7±4.5yr) served as controls. All participants were sedentary retirement community residents. Training consisted of chair-based dorsiflexion and plantar flexion exercises using CLX bands performed in the residents’ apartments for 3 sets of 10 repetitions on 5 d/wk for 8 wk. Performance was assessed before and after the intervention. Isometric dorsiflexion and plantar flexion strength was assessed using a hand-held dynamometer. The Limits of Stability (LoS) test, performed on a force platform, was used to assess dynamic balance. Mobility was assessed by the Timed Up-and-Go (TUG) test. RESULTS: Compared to controls, CLX band training improved (p<0.05) both dorsiflexion and plantar flexion by approximately 20%. LoS improved in the forward and backward (but not other) directions by 7% and 9%, respectively. TUG performance did not change in either group. CONCLUSIONS: Lower-leg training with CLX bands appears to improve dorsiflexion and plantar flexion strength as well as LoS in the forward and backward directions, but not mobility, in older women. These improvements may reduce the risk of falls.

Combined Aerobic And Resistance Training In The Elderly: Effects Of Exercise Order On Arterial Stiffness

Yoko Shiosuto, Masahiko Yanagita. Doshisha University, Kyotanabe, Japan.

(No relevant relationships reported)

PURPOSE: Prescribing aerobic and resistance training in conjunction is proposed as an optimum strategy to target cardiovascular as well as musclekeletal functions in the elderly. However, few studies have examined the effects of intra-session exercise order on arterial stiffness in the elderly. This study investigated the effects of aerobic exercise before and after resistance training on arterial stiffness, body composition, and muscle strength in older men. METHODS: Forty-five older men (70.5±3.5 years) were randomly assigned to one of three groups that performed aerobic exercise first (AR: 10-15 min, moderate intensity), resistance exercise first (RA: 10-15 min, moderate intensity), or both exercises back-to-back (BE: 10-15 min, moderate intensity each) for 10-15 min. Body composition was evaluated by bioelectrical impedance analysis, height, weight, body fat percentage, lean body mass and waist circumference. Muscle strength was measured by isometric knee extension and was calibrated using a constant-external resistance machine (cPWR). Pre- and post-intervention group comparisons were analyzed using a two-way ANOVA with repeated measures. RESULTS: A significant group difference was observed in cPWR (F=3.464, P<0.042). cPWR significantly increased in the RA group (9.3±2.1 m/s to 8.2±1.9 m/s, P<0.05), while did not change in the AR group (8.4±2.1 m/s to 8.7±1.5 m/s, P=0.413). Significant group differences were observed in all exercise types (leg press: F=9.814, P<0.001; leg curl: F=26.667, P<0.001; chest press: F=17.225, P<0.001; seated row: F=15.648, P<0.001; shoulder press: F=13.244, P<0.001), and waist circumference (F=10.516, P=0.001). However, there were no significant differences between AR and RA. CONCLUSION: Based on our results, aerobic exercise after resistance training reduced arterial stiffness and a difference of intra-session exercise order was observed.
Muscle quality has been determined the fat tissue content within a skeletal muscle (i.e. intramuscular fat content). Muscle quality become worse with aging and disuse as a result of increasing of intramuscular fat and/or decreasing of muscle tissue. Intramuscular fat content is known as a negative contributor to force production and physical functions. We have reported the unique change of muscle quality by the 12 months resistance and endurance training in elderly; however, it is not well understood how the muscle quality, quantity and physical functions change by further 12 months (totally 24 months) trainings. **PURPOSE:** The purpose of this study was to assess the effects of 24 months training on muscle quality, quantity and physical functions in elderly who need long term-care. **METHODS:** Ten elderly men and women (6 women and 4 men, age, 77±6 years; height, 154±7 cm; weight, 54±9 kg) participated in this study, and they needed long-term care while they could do almost all activities of daily living. They performed physical training consisting of resistive exercises, stretching, and aerobic exercises as a part of rehabilitation program once or twice a week for 24 months. B-mode transverse ultrasonographic images were taken from rectus femoris (RF) and biceps femoris (BF). Echo intensity (EI) as an index of muscle quality and muscle thickness as an index of muscle quantity was calculated from these muscles. We measured their physical performance tests, i.e. isometric knee extension peak torque (PT), one-leg stand, chair stand, handgrip strength, 5-m normal/maximal walk, and timed up and go before and after the training. **RESULTS:** EI in RF and BF did not change through the intervention, but BF thickness was significantly increased after the training. PT, 5-m normal/maximal walk, and timed up and go were improved after the 24 months training. Percent change of PT was the only independent variable to explain the percent change of EI in RF (regression coefficient = 1.24, R = 0.91, adjusted R² = 0.82, P < 0.001), implying that improvement of PT could be induced increasing EI in RF. **CONCLUSIONS:** Twenty-four months concurrent training induced muscle hypertrophy with the improvement of physical functions. Furthermore, in this type of long-term training, the increase of EI RF could be a key to improve PT.

**Advanced age is often accompanied by deterioration of body composition and physical function. These alterations can lead to reduced performance of activities of daily living and autonomy. It has been purported that regular aerobic exercise may enhance physical function in older adults. **

**PURPOSE:** To determine the effects of habitual physical activity on physical function (5m gait time, 5m gait speed, and total gait time), cardiorespiratory fitness (VO2 max), and body composition (body fat percentage, total lean mass, and bone mineral density) outcomes in older adults. **METHODS:** 27 active and 35 inactive older adults (70±5 yrs, 73±4±15.0 kgs, 170±8.0 cm, 30.7±0.7% body fat) were recruited for this study. The perceptually-regulated treadmill exercise test was used to estimate VO2 max. Body composition was determined by a whole body DXA scan. Gait variables were assessed via the 400m walking test. The Yale Physical Activity Survey (YPAS) was used to determine self-reported activity. **RESULTS:** Active individuals had better 5m gait time (2.78±0.24 vs 3.02±0.48 seconds, p<0.05), gait speed (1.81±0.15 vs 1.68±0.24 m/s, p<0.05), total gait time (273±31 vs 297±4.34 seconds, p<0.05), VO2max (/3.1±1.9 vs 26±0.4 1.4 kg/m²/min, p<0.01), and reduced body fat (25.8±6.6 vs 34.1±6.2 %, p<0.01) compared to sedentary individuals. Age was positively correlated with 5m gait time (r=0.39 P < 0.01) and negatively correlated with gait speed (r=-0.40, p<0.01), but was not a determining variable for any other physical function or body composition outcome. Exercise time (7.9±5.8 hrs/week) was positively correlated with gait speed (r=0.27, p<0.05) and negatively correlated with 5m gait time (r=-0.30, p<0.05), total gait time (r=-0.30, p<0.05), and body fat percentage (r=-0.33, p<0.01). VO2max was negatively correlated with gait time (r=-0.25, p<0.05) and body fat percentage (r=-0.580, p<0.01).

**CONCLUSION:** While aging is considered a main determinant for decrements in physical function, these data suggest that habitual exercise, low body fat percentage, and increased cardiorespiratory fitness are better determinants of improved physical performance in active older men and women. Substantial evidence suggest that the prevention and improvement were a crucial factor of the early stage of dementia. Although the exercise programs were found to improve positive effects of cognitive function, there is a lack of research on the impacts of their use in multidimensional exercise program design on functional fitness on mild cognitive impairment for older adults. **PURPOSE:** To examine the impacts of multidimensional functional fitness program design on mild cognitive impairment for older adults. **METHODS:** A pre -post one group experimental design for this study. The pool of available participants in this study were 25 volunteer with mild cognitive impairment (on age 65 or above) enrolled in a multi-exercise prescription program. For random reasons were not available for 10 subjects. The final analysis was performed on a sample of 15 volunteer participants. (age: 78.76±7.06 years; height: 150±9.2 cm; weight: 56±4.7 kg). The material as measurement on cognitive function for participants was a Mini Mental State Examination, MMSE. The study was implemented during ten- weeks period. Each week was performed 90 min. on a multi-exercise prescription program. A multidimensional functional physical and mental fitness platform designed were performed on the program. Data analysis were applied to each of the dependent variables. A- test was use for pre -post one group experimental design. After participants completed 10 weeks of training program, a post-test was delivered. Calculations were made using the Statistical Package for the Social Sciences(SPSS). All tests of significance adopted an alpha level of 0.05. **RESULTS:** The participants demonstrated positive increased cognitive function in three dimensions: total score of MMSE (17.07±3.127 vs 21.93±3.845), reaching a significant difference (p<0.01, p < .05). The average score increased from 17.07 before the intervention to 21.93 after the intervention. The results also revealed that two variables among MMSE score were significantly different for cognitive function performance including short-term memory (p<0.00, p < .05) and understanding (p<0.002, p < .05). **CONCLUSIONS:** The multidimensional functional fitness program intervention on mild cognitive impairment may result in older adults processing cognitive function more effective.
Aging is associated with greater fatigability and reduced participation in physical activity. Exercise training in older adults has been associated with a number of health benefits; however, less is known about the effects of self-managed exercise on perceived and objectively measured fatigability. PURPOSE: To examine older Latinos’ perceptions of the impact of technology on PA and sedentary behavior (SB) were specifically asked if these themes did not emerge from the analysis. Directed content analysis was conducted.

Previous research has shown that the health benefits of participating in LTPA, and the majority of those who engage in PA participate in culturally-appropriate types of PA. Participants were aware of the negative changes in lifestyle PA with the advances of technologies on a daily basis; however, most of them were interested in using wearables as motivators for PA. Using wearables in PA interventions targeting older Latinos might be feasible.

The Latino community in the U.S. experiences a high prevalence of chronic diseases that can be prevented or improved by physical activity (PA), yet Latinos engage less frequently in leisure-time PA (LTPA) than non-Latino whites. Technology can impact exercise perceptions and participation. PURPOSE: To examine older Latinos’ motivations and barriers for LTPA engagement and their perceptions on how technology can influence LTPA participation. METHODS: Six focus groups were conducted with 27 middle-aged and older Latinos, 55+ years old, who speak Spanish, and own a cell phone. Participants were recruited from a primarily Latino neighborhood in Chicago. Participants were asked about their overall perceptions and experiences with PA and technology. Participants’ perceptions of the impact of technology on PA and sedentary behavior (SB) were specifically asked if these themes did not emerge from the discussion. Discussions were recorded, transcribed verbatim in Spanish, and translated to English. Directed content analysis was conducted. RESULTS: Participants reported improved health in the US as the main motivator for PA engagement. Participants reported walking and dancing as the most common types of PA they participated in. Common barriers to engaging in LTPA were distance to facilities, and the need for companionship and extrinsic motivators. Participants mentioned that technology can both decrease and increase their PA levels. It was stated that the convenience of companionship and extrinsic motivators. Participants mentioned that technology in. Common barriers to engaging in LTPA were distance to facilities, and the need for companionship and extrinsic motivators. Participants mentioned that technology in. Common barriers to engaging in LTPA were distance to facilities, and the need for companionship and extrinsic motivators.

Older adults spend 60-70% of their waking hours sedentary, increasing their risk for negative health outcomes. Thus, interventions that reduce sedentary behavior (SB) are needed. PURPOSE: Three pilot studies were conducted. The first two studies tested a small group intervention to reduce SB and improve physical function in older adults. The third study used a focus group to assess how to engage African American (AA) older adults in similar trials. METHODS: The interventions were based on self-regulation theory and consisted of 4 wkly sessions involving group discussions, goal setting, action plans, self-monitoring, and problem solving. SB and physical function were measured via self-report (SB questionnaire & SF-36) and objective measures (accelerometry & the Short Physical Performance Battery). Study 1 participants (N = 12; mean age=69 ± 5 yrs) completed assessments pre- and post-intervention; study 2 participants (N = 9; mean age=68 ± 2 yrs) completed assessments pre- to post-intervention and at a 4 wk follow up. Due to the pilot nature of this research, data was analyzed with effect sizes (Cohen’s d), a 90-min focus group was then conducted with 10 AA women (mean age=71 ± 6 yrs). The session was recorded, transcribed, and summarized. RESULTS: Study 1: There were moderate to large reductions in SB (self-report d = 0.95; accelerometers d = 0.53) and a moderate improvement in physical function (self-report d = 0.41; SF-36). Post-intervention, there were small to moderate improvements in SB (self-report d = 0.49; accelerometers d = 0.15) and gait speed (d = 0.22) with further improvements at follow up (SB self-report d = 0.85; accelerometers d = 0.57; gait speed d = 1.16). Results from the focus group revealed positive attitudes towards the intervention, potential barriers for participation.
As a country under increasing financial pressure and with the largest aging population, China has launched a series of policies to promote the health of older adults through physical activities (PA). The purpose of this study was to analyze those policies. METHOD: An effort was made first to collect all related policies enacted between 1960 and 2017. The taxonomy of innovation policy proposed by Rothwell and Zegveld (1981) was then used to build the analysis framework for this study. Accordingly, 3 policy groups and 5 influencing factors classifications were derived to textually analyze policies collected. RESULT: A total of 44 related policies were identified. It was found that the Chinese government took an active role in environmental related policies (58%), followed by demand (14%) and supply (28%) related policies as figure 1. Specifically, the government focused more on launching strategies, developing infrastructure, and setting objectives for implementation. While the government still plays a key role in facilitating PA promotion for older adults, it also started to increase efforts to promote organizational participation. However, PA policies to support older adults’ individual needs and PA in more scientific way in different settings, such as communities, workplace, and senior centers, were overlooked as figure 2. CONCLUSION: Presently, the policy for promoting PA among older adults by the Chinese government has been focused on environmental aspects. Future policy should recognize the diversity of older adults by taking into consideration of their health conditions so as to promote PA at a variety of ability levels. Finally, more scientific evidence-based health promotion programs should be developed and promoted through multi-sector and collaborative partnerships along with all related governmental offices.

**B-68** Free Communication/Poster - Chronic Disease

Wednesday, May 30, 2018, 1:00 PM - 6:00 PM

**Room: CC-Hall B**

**919 Board #180 May 30 2:00 PM - 3:30 PM**

**MVPA And DXA-derived Adiposity In Adolescents With And Without Down Syndrome**

E. Andrew Pitchford, Chelsea Adkins, Joseph E. Hornyak, Rebecca E. Hasson, FACSM. Iowa State University, Ames, IA. University of Michigan, Ann Arbor, MI.

(Paper presented) (No related relationships reported)

**PURPOSE:** Obesity is a highly prevalent secondary health condition among adolescents with Down syndrome (DS). It is thought that low levels of physical activity may promote excess adiposity in this population. However, reported associations between body mass index (BMI) and moderate-to-vigorous physical activity (MVPA) have been small and non-significant. The purpose of this study was to compare group differences in adiposity derived from dual-energy x-ray absorptiometry (DXA) and accelerometer-measured physical activity between adolescents with and without DS and then examine associations within each group.

**METHODS:** Thirty-nine adolescents (22 with DS and 17 typically developing (TD) controls), aged 12-18 years participated in the study. Groups had similar distributions of age, sex, and Tanner pubertal stage. Body composition was assessed by DXA, BMI, and BMI percentile. MVPA was measured with Actigraph GT3X+ accelerometers over 7 days. Group differences were analyzed with multivariate analysis of covariance (MANCOVA) while controlling for age, sex, Tanner pubertal stage, and accelerometer wear-time. Pearson product-moment correlation coefficients and linear regression were used to examine the associations between MVPA and adiposity among adolescents with DS and TD.

**RESULTS:** Adolescents with DS had significantly higher BMI, BMI percentile, and DXA-derived percent body fat (%BF), as well as lower minutes of MVPA compared to TD controls (p < .05). Associations between MVPA and %BF in adolescents with DS were moderate (r = -.39, p = .07), but substantially stronger than BMI (r = -.19, p = .40). However, linear regression analyses identified Tanner stage (β = -.77, p < .001) and Activity Type (β = -.52, p = .008) as significant variables in the models. Further research is needed to elucidate the mechanisms that contribute to the changes in body weight and lipid profile.
One negative side effect of cancer that dramatically affects cancer prognosis is the development of cancer cachexia. Cancer cachexia is defined as cancer-associated muscle wasting. This is thought to be at least partially mediated by increased energy expenditure and is responsible for the death of 20-40% of all cancer patients. Although the liver is known to be the predominant regulator of whole body metabolism, there is little known about its relationship to the development of cancer cachexia. PURPOSE: The purpose of this exploratory study was to investigate alterations in liver metabolism by examining measures of glycogen storage throughout the progression of Lewis Lung Carcinoma (LLC) induced cancer cachexia. METHODS: C57BL/6J mice were injected with 1×10^7 LLC Cells in the left posterior leg, and the control group with phosphate buffered saline (PBS). The experimental groups included PBS, 1wk, 2wk, 3wk, and 4wk of cancer progression with 10-16 in each group. Sections of liver (n=8/group) were cut and periodic acid-Schiff (PAS) stain for glycogen was completed. Images were analyzed for total area of stain as well as intensity of stain using NIS-Elements imaging software. A Welch’s one-way analysis of variance was used to determine differences between groups, a Tukey post hoc was used to determine differences between means. Significance was denoted at p<0.05. RESULTS: 4wk animals had ~30% larger livers compared to all other groups with no other differences detected (~1000mg compared to ~1300mg, p<0.05). However, there were no statistical differences detected between groups on either PAS area stained (~50% across groups, p=0.05). Furthermore, neither glycogen area nor intensity correlated with liver size (r = 0.12 and r = 0.16 respectively). CONCLUSION: Differences in liver sizes are not attributable to glycogen storage. Though there were no differences in glycogen content, the increase in liver size suggests disruption of other processes in the liver. For future projects, we will further investigate mechanisms for liver hypertrophy in order to determine the relationship between the liver and cancer cachexia progression.

The purpose of this exploratory study was to determine if increased dietary fat consumption predicts aortic stiffness independent of physical activity. METHODS: Men and women 18-60 years of age were recruited for this cross-sectional study. Body mass index, body fat percentage (by 5-frequency bioelectrical impedance analysis), aortic stiffness (carotid-femoral Pulse Wave Velocity; cPWV), habitual diet intake (NIH’s validated Dietary History Questionnaire-II; DHQ-II), and physical activity (International Physical Activity Questionnaire; IPAQ) were assessed for all subjects. Univariate linear regression analyses were implemented to determine dietary correlations with cPWV, and partial correlations were employed to adjust for traditional risk factors using SAS 9.4. RESULTS: The study population consisted of predominately young men and women (23.5 ± 7.9 years, 70.0% female) with a normal body mass index (BMI = 23.6 ± 4.3 kg/m^2) and mean cPWV of 5.8 ± 0.9 meters/second. Weekly physical activity was estimated at 5,547.6 ± 5,478.2 MET-minutes/week. Habitual daily caloric intake was 1,921 ± 798.9 calories, consisting of 46.0 ± 0.1% carbohydrate, 36.8 ± 0.1% fat, and 16.3 ± 0.0% protein. Greater consumption of total discretionary solid fat was associated with increased cPWV (R² = 0.155, P = 0.031). However, total calories from dietary fat (R² = 0.093, P = 0.101), total grams of fat (R² = 0.047, P = 0.248), and discretionary oil fat (R² = 0.008, P = 0.650) were not associated with cPWV. The correlation between discretionary solid fat and cPWV remained after adjustment for age, body fat percentage, BMI, and physical activity (R² = 0.160, P = 0.043). Among food choices contributing to the increased discretionary calories from solid fat, cheese intake was positively correlated with cPWV (R² = 0.134, P = 0.047). Additionally, specific fatty acids that predicted cPWV included trans fatty acid, trans-hexadecenoic acid (R² = 0.179, P = 0.020), and monounsaturated fatty acids, hexadecenoic acid (R² = 0.145, P = 0.036) and myristoleic acid (R² = 0.206, P = 0.012). CONCLUSIONS: Increased dietary discretionary fat consumption within the habitual diet predicts aortic stiffness independent of physical activity. Cheese consumption and specific fatty acids may be novel contributors to increased aortic stiffness independent of regular physical activity.

Weight loss has been shown to adversely affect body composition due to the loss of fat free mass that accompanies fat mass loss during negative energy balance. Exercise has been recommended as a therapy to ameliorate fat free mass loss during weight loss interventions. PURPOSE: The primary purpose of this study was to compare the effectiveness of high-intensity circuit training (HICT) versus moderate strength training (ST) on body composition in obese adults. METHODS: Obese adults (n=26; 10 women and 16 men) completing a medically supervised weight loss program were randomized into one of two 12-week exercise training groups: HICT (n=5) or ST (n=6). Baseline (BL) testing included height, weight, and DXA scans to assess total and regional body composition. Each group underwent a supervised exercise training program of upper and lower body exercises (30 minute sessions; 3 times per week for 12 weeks); follow-up (FU) testing was performed after 12 weeks. The HICT consisted of 8-12 exercises of 2-3 sets, with rest periods of approximately 30 seconds. Exercise intensity corresponded to 80-95% of their VO2peak. The ST group completed progressive resistance training which included 2-3 sets of 10-12 repetitions.
of each exercise. RESULTS: When examining changes in body mass index (BMI), total fat mass (FM), total fat free mass (FFM), trunk fat mass (TFM), and estimated visceral fat mass (VAT), there was a significant linear interaction (p<0.05) or a main group effect (p<0.05) for the variables. However, there was significant time (BL vs FU) main effect for BMI (38.7± 1.5 vs. 33.7± 1.7, respectively, p<0.001); FM (48.4± 4.0 vs 38.7 ± 3.8 kg, respectively, p<0.001); TFM (26.1± 2.1 vs 19.6 ± 1.8 kg, respectively, p<0.001); and VFM (1.5± 1.9 vs 10.± 13 kg, respectively, p<0.001).

CONCLUSION: Both the 12-week HICT and ST program in conjunction with the medical weight loss program produced successful weight loss and FM changes. Furthermore, FFM was retained in both groups, suggesting both programs are viable options to improve or maintain body composition through substantial weight loss.

925 Board #186
May 30 2:00 PM - 3:30 PM
Continuous Exercise Training Reduces Arterial Stiffness In An Exercise-Dependent Dose Manner in Adults With Prediabetes
Mahnoor Khurshid, Natalie Z.M. Eichner, Julian M. Gaitan, Nicole M. Gilbertson, Eugene J. Barrett, Arthur Weltman, FACSM, Steve K. Malin, FACSM. University of Virginia, Charlottesville, VA.

No relevant relationships reported

PURPOSE: Although prior work highlights an exercise dose-response relationship for glucose regulation, no study has assessed if exercise energy expenditure is related to reductions in arterial stiffness in an intensity based manner. We tested the hypothesis that increased exercise dose would correlate with reduced arterial stiffness in obese adults with prediabetes. METHODS: In this randomized trial, 26 adults (Age: 61.4±2.5 y; BMI: 32.1±1.0 kg/m²) were screened for prehabilitation using American Diabetes Association criteria (75g OGTT and/or HbA1c). Aerobic fitness (VO2peak) was measured on a cycle ergometer by indirect calorimetry. Subjects performed either supervised continuous exercise (CONT; n=13) at 70% of HRpeak or underwent interval training (INT; n=13) for 3 min at 50% HRpeak and 3 min at 90% HRpeak for 60 min/d over 2-weeks. Arterial stiffness (augmentation index; AI) and glucose tolerance were determined during a 75g OGTT and analyzed by total area under the curve (AUC) before and after training. Exercise dose was assessed using VO2 heart rate derived linear regression equations.

RESULTS: Mean energy expenditure during CONT and INT training was 312.5±12.0 and 399.9±19.6 kcal/session, respectively (p<0.001). Exercise training had no effect on body weight, but it did significantly improve VO2peak (P<0.001), independent of intensity. Both CONT and INT intervention reduced VO2peak (P<0.001) and AI AUCmax (P=0.01) and AI AUCmax (P=0.03). However, this reduced arterial stiffness was associated with increased exercise energy expenditure from CONT (r=-0.53, P=0.06) but not INT (r=-0.005, P=0.98) training. Improved VO2peak was also related to reduced AI AUCmax (r=-0.63, P=0.02) only after CONT exercise. CONCLUSIONS: Short-term exercise training reduces arterial stiffness independent of intensity. However, only CONT training improves arterial stiffness in an energy dose-dependent manner. These findings suggest that intensity of exercise may exert different mechanisms for enhancing vascular function in adults with prediabetes to lower diabetes and cardiovascular risk.

926 Board #187
May 30 2:00 PM - 3:30 PM
Influence Of Sex On The Relationship Between Two Estimates Of Visceral Adipose Tissue
Gregory L. Nuckols, Kara C. Anderson, Austin M. Peterjohn, Arthur Weltman, FACSM, Eugene J. Barrett, Arthur Weltman, FACSM, Steve K. Malin, FACSM. University of Virginia, Charlottesville, VA.

No relevant relationships reported

Magnetic resonance imaging (MRI) is the gold standard for estimating visceral adipose tissue (VAT) area. However, MRI machines are not available to all laboratories, and their relationship has yet to be evaluated. PURPOSE: To determine the relationship between estimates of VAT derived from DXA and US in college-aged females and males. METHODS: Eight male (Age= 19.3 ± 1.6 yrs; Height= 1.79 ± 0.09m; Weight= 71.6 ± 9.9kg; %Fat= 15.6±2.4) and 29 female (Age= 19.3 ± 1.6 yrs; Height= 1.69 ± 0.09m; Weight= 64.8 ± 9.3kg; %Fat= 29.8±9.5) college-aged subjects identified in the 12-week HICT and ST program were randomized to treatment. The distance between the posterior surfaces of the linea alba and the descending aorta was measured 2 cm above the umbilicus, and VAT depth (cm) was estimated by measuring the distance between the posterior surfaces of the linea alba and the descending aorta.

RESULTS: There was no significant correlation between VAT estimates derived from DXA and US (R=0.77, p=0.001) in females. However, there was a significant correlation in males (R=0.77, p=0.001). Furthermore, there was a significant relationship when combining males and females (R=0.45, p=0.001). CONCLUSIONS: There was no relationship between the two estimates of VAT quantity in females in this population, but there was a significant relationship in males and in the combined sample. This highlights the importance of considering sex as an important moderating variable when selecting an instrument to assess body composition.

927 Board #188
May 30 2:00 PM - 3:30 PM
The Effect Of Single Stair-Climbing/Descending Bouts Of Varying Lengths On Postprandial Glycemic Responses
Eric Bartholomae, Jeff Moore, Kathryn Ward, Zach Johnson, Jochen Kressler, San Diego State University, San Diego, CA.

No relevant relationships reported

Impaired glucose tolerance is strongly associated with cardiometabolic disease risk. Single bouts of exercise can improve insulin sensitivity and attenuate the rise in postprandial glucose.

PURPOSE: To investigate the effects of moderate intensity stair climbing of various durations on postprandial glycemic responses in healthy men and women.

METHODS: Eight males (27.1±5.9y) and seven females (27.5±5.4y) completed a 75g oral glucose tolerance test (OGTT). On three subsequent visits, participants completed an OGTT combined with either 1min, 3min, or 10min of stair-climbing, all ending 28 min after completion of glucose consumption in a randomized order. Blood measurements were taken at baseline and thirty minutes post-glucose consumption and analyzed for glucose and insulin as well as insulin resistance and sensitivity.

RESULTS: All stair-climbing trials reduced peak (30 min) postprandial glucose levels compared to control, however the 10 min bout yielded a significant difference (30.5±5.9mg/dL, p<0.001), whereas neither the 1 min bout (8.6±5.9mg/dL, p=0.147) nor the 3 min bout (6.3±4.9mg/dL, p=0.221) were significant. Insulin concentration was also significantly reduced following the 10 min trial (5.18±1.68µIU/mL, p<0.010), however there were no significant differences for the 1 min trial (0.62±0.94µIU/mL, p=0.524) or the 3 min trial (1.41±0.3µIU/mL, p=0.113) compared to control. There was a significant decrease in HOMA-IR following the 10 min bout (1.96±0.79, p<0.001) compared to control. No significant differences in HOMA-IR were seen for the 1 min (0.82±0.64, p=0.222) or 3 min (0.89±0.46, p=0.077) trials. Insulin sensitivity index values increased significantly following the 10 min trial (2.24±0.71, p<0.007), while no significant differences were seen for 1 min (0.35±0.62, p=0.584) or 3 min (0.12±0.07, p=0.980) trials compared to control.

CONCLUSIONS: Ten minutes of moderate intensity stair-climbing/descending exercise is effective at improving postprandial glycemic responses in healthy adults while shorter bouts of 1 and 3 min were not.

928 Board #189
May 30 2:00 PM - 3:30 PM
Self-Regulation in Early Childhood Predicts Adolescent Metabolic Syndrome Profile Membership
Laurie Wideman, FACSM1, Jessica Dollar2, Lenka Shriver2, Susan D. Calkins3, Susan P. Keane4, Lilly Shanahan1,2, UNC-Greensboro, Greensboro, NC. ‘University of Zurich, Zurich, Switzerland.

No relevant relationships reported

The prevalence of full-blown clinical metabolic syndrome (MetS) in adolescence ranges between 5-9%. Many adolescents fail to meet the rigid criterion thresholds for MetS but may still have an increased risk for chronic disease. Thus, a continuous MetS score has been used to circumvent these issues. Recent research suggests, however, that other factors, such as self-regulation, may influence chronic disease through a variety of processes and may be critical for identifying cardiometabolic risk in younger populations. PURPOSE: To determine if self-regulation in early childhood predicts MetS profile membership in adolescence. METHODS: As part of a large longitudinal study, adolescent participants visited a lab (N=117, 59% female) and completed anthropometric measures, resting blood pressure, each of the blood lipid panel, and the Insulinogenic Index. All measures were assessed using colorimetric assay techniques using commercially available items or a multiplex system. All dimensions of self-regulation were assessed at age 5 using age-appropriate, laboratory-based tasks and parent-report measures. Latent profile analysis (LPA) and one-way analysis of variance (ANOVA) were employed to address the study aims. RESULTS: The best-fitting LPA model for the 3 groups (BIC=6597.12, Entropy=92, Adj p LMR-LRT=81.65, r=0.58); a low risk group (LRG; n=48) had low leptin (L), glucose (G), and non-HDL, but high HDL, a moderate risk or dyslipidemic group (DLG; n=58) had high G and non-HDL, but low HDL, L, waist circumference (WC), mean arterial pressure (MAP), and C-reactive protein (CRP), and a high-risk group (HRG; n=11) had high L, G, WC, MAP, CRP, and moderate non-HDL. Adolescents in the HRG showed lower emotion regulation (F= 5.19, p<.01), attentional focusing (F= 6.39, p<.01), and inhibitory control (F= 2.66, p<.05), at age 5 compared to adolescents in LRG. Physiological self-regulation (assessed by vagal withdrawal or RSA) at age 5 was higher (greater self-regulation) in LRG.
Changes In Liver And Skeletal Muscle Sensitivity In Response To Acute And Chronic Calorie Restriction On A Low Carbohydrate Diet

Erik Kirk, FACSM<sup>1</sup>, Dominic Reeds<sup>2</sup>, Samuel Klein<sup>1</sup>, <sup>1</sup>Southern Illinois University Edwardsville, Edwardsville, IL. <sup>2</sup>Washington University in St. Louis School of Medicine, St. Louis, MO. <sup>*</sup>Washington University in St. Louis School of Medicine, Saint Louis, MO.

<sup>(No relevant relationships reported)</sup>

**PURPOSE:** We determined the effects of acute and chronic calorie restriction with a low-carbohydrate diet on hepatic and skeletal muscle insulin sensitivity. **METHODS:** Twelve obese subjects (body-mass index, 36.1±1.0kg/m²) followed a low-carbohydrate (>60g/d) energy-deficit diet (1,200kcals/day). Magnetic resonance spectroscopy, muscle biopsies, and a euglycemic-hyperinsulinemic (120g Glucose) clamp were used to determine insulin action, cellular insulin signaling and intrahepatic triglyceride content before, after 48 h, and after 72 h (7% weight loss) of diet therapy. **RESULTS:** Intrahepatic triglyceride content significantly decreased at both 48h (28.6±3.8%, p<0.05) and 7% weight loss (-38.0±4.5%, p<0.05) compared to baseline. Basal glucose production rate significantly decreased at 48 h (21.8±2.2%, p<0.05) and after 7% weight loss (-20.6±3.4%, p<0.001). Insulin-mediated glucose uptake did not significantly increase at 48 h (4.4±12.7%, p>0.05) but did significantly increase at 7% weight loss (35.2±8.4%, p<0.05). Insulin-stimulated phosphorylation of Jun N-terminal kinase decreased by (-15.4±18.1%, p<0.05) and (-41.3±19.5, p<0.05) and phosphorylation of Akt increased by 19.2±26.9% (p<0.05) and 36.1±12.4% (p<0.05), after 48 h and 7% weight loss respectively. **CONCLUSIONS:** A low carbohydrate diet acutely reduced intrahepatic triglyceride content and improved hepatic insulin sensitivity whereas moderate weight loss is necessary to improve insulin sensitivity in the skeletal muscle.

### Abstracts were prepared by the authors and printed as submitted. Overweight and obesity are the main risk factors for cardiovascular diseases, which are the leading causes of death worldwide. As a consequence of this, it is indispensable to apply a nutritional intervention involving both a healthy diet adjustment and to promote an active lifestyle, since they are effective in preventing and reducing weight gain and excessive accumulation of body fat.

**PURPOSE:** To determine the independent and synergistic effect of a systematic physical exercise program and/or Spirulina maxima supplementation on body composition in overweight and obese subjects.

**METHODS:** Through a randomized, double-blind, placebo-controlled, counterbalanced crossover study design, overweight and obese adults (N= 52, 25.12 ± 4.88 y, 1.71 ± 0.11 m, 88.14 ± 16.99 kg) were evaluated during a 12 wk of 4.5 g a day of supplementation (6 wk Spirulina maxima and 6 wk placebo) and/or a systematic physical exercise program (three days a week 20 to 30 min of aerobic exercise with intensities between 50% and 80% of maximum heart rate (HR max ) and two days 20 to 30 min between 80% and 90% of HR max using high-intensity interval training (HIT) intervention); the participants were divided in four groups: exercise and Spirulina maxima supplementation (ES), exercise and placebo supplementation (E), Spirulina maxima supplementation without exercise (S), and the control one, placebo without exercise (C). Body weight, body mass index (BMI) and body fat percentage (BF%) were assessed. Differences between treatments comparisons in all response variables were made using ANOVA test. The present study was approved by bioethics committee of Universidad Autónoma de Ciudad Juárez.

**RESULTS:** The differences between individuals usually are of wide range, for that reason the results are shown like differences between final and initial evaluations. All the treatments showed statistical differences compared with the control in body weight (kg) (ES= -2.36 ± 0.84, E= -0.89 ± 0.68, S= -0.91 ± 0.73, C= 0.04 ± 1.28), BMI (kg.m<sup>-2</sup> ) (ES= -0.72 ± 0.41, E= -0.26 ± 0.29, S= -0.31 ± 0.48, C= 0.01 ± 0.44), and BFP (%) (ES= -1.15 ± 0.20, E= -0.49 ± 0.21 S= -1.46 ± 0.45, C= -0.04 ± 0.15).

**CONCLUSION:** Spirulina maxima intake joint a HIT have an individual and a synergistic effect on body composition (decrease of body weight, BMI and BFP) in overweight and obese adults.
\( \pm 1.4, 1.4 \pm 1.7 \), and increases adiponectin by \(+33.7\% \) and \(+38\%\) (6.18 \pm 2.8, 6.89 \pm 3.9 {mg/dl}) respectively, when compared to baseline. CONCLUSION: RCPD-Sed and RCPD-Ex were able to improve cognitive and metabolic factors, while RCPD-Ex outperformed RCPD-Sed in all measured factors. These effects may be dependent on BDNF as a metabotrophin mediator.

**933 Board #196** May 30 2:00 PM - 3:00 PM

The Acute Effect of Moderate Intensity Stair-Climbing on Postprandial Blood Glucose

Jeff Moore, Eric Bartholomae, Kathryn Ward, Zach Johnson, Jochen Kressler. San Diego State University, San Diego, CA.

(No relevant relationships reported)

**PURPOSE:** To investigate the effects of moderate intensity stair-climbing of various durations on postprandial glucose response in healthy men and women. The postprandial glucose response is strongly associated with cardiometabolic disease risk.

**METHODS:** Twenty (26.8\pm6.0) years and fourteen females (24.8\pm4.5) years completed a 75 g oral glucose tolerance test (OGTT). On three subsequent visits, participants completed an OGTT combined with either 1min, 3min, or 10min of stair-climbing, starting 28 min after subjects finished the drink. Fingerstick blood glucose measurements were taken at baseline and every fifteen minutes thereafter for one hour.

**RESULTS:** All stair-climbing trials reduced peak (30 min) postprandial blood glucose levels compared to the control (12\pm3 to 35\pm30{mg/dL}, \(p_{<0.001}\) - \(p_{<0.038}\)). At the 45min time point, there were significant reductions compared to the control for the 3 and 10min trials (11\pm29 and 23\pm30{mg/dL}, \(p_{<0.037}\) and \(p_{<0.001}\), but not between 1min and control (1\pm3 mg/dL, \(p_{=0.701}\)). No significant differences exist in BG between any trials at baseline, 15, or 60min time point (A\(-0.3\) - 5{mg/dL}, \(p_{=391.882}\)).

**CONCLUSIONS:** Moderate intensity stair-climbing bouts as short as one minute in duration are effective at attenuating peak postprandial blood glucose with longer bouts producing more substantial benefits.

**936 Board #197** May 30 2:00 PM - 3:30 PM

Increase In Beta-hydroxybutyrate After High-fat Meal In Metabolically Healthy Overweight/obese Adults

Ryan Davies, Stephanie Wilson, Sarah Bronsky, Seth Walk, Carl Yeoman, Mary P. Miles, FACSM. Montana State University, Bozeman, MT.

(No relevant relationships reported)

Ketone synthesis is of interest for several clinical purposes including obesity, weight loss and diabetes. Beta-hydroxybutyrate (BHBA) is the predominant ketone found in the blood and an indicator of ketone synthesis, which is elevated when carbohydrate availability is low. However, little is known about ketone synthesis in metabolically healthy overweight/obese (MHO) adults with mixed diets.

**PURPOSE:** To investigate BHBA concentrations and responses to a high-fat meal in MHO adults.

**METHODS:** Adults (n=23), 23-54 y of age with BMI 27.3-35 kg\(\cdot\)m\(^{-2}\) were assessed for body composition, self-reported physical activity level, and VO\(_{max}\). After Fasting blood collection, a high-fat meal (50g fat, 54g carbohydrate, and 12g protein) was consumed and blood was collected hourly for 4 hours for measurement of glucose, insulin, triglycerides, and BHBA.

**RESULTS:**

<table>
<thead>
<tr>
<th>Time (h)</th>
<th>Metabolic Responses to High-Fat Meal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BHB (mmol/L)</td>
</tr>
<tr>
<td>0</td>
<td>.23 (.01)</td>
</tr>
<tr>
<td>1</td>
<td>.23 (.01)</td>
</tr>
<tr>
<td>2</td>
<td>.22 (.01)*</td>
</tr>
<tr>
<td>3</td>
<td>.25 (.01)</td>
</tr>
<tr>
<td>4</td>
<td>.31 (.02)*</td>
</tr>
</tbody>
</table>

Values = mean (SEM); \( * \) \( p_{<0.05} \) compared to time 0

Glucose and insulin both increased 1 hour after a high-fat meal. At 0 hours post meal, insulin was still elevated and BHB decreased. At 3 and 4 hours post-meal, glucose decreased below fasting levels and BHB elevated above fasting levels. These data indicate that there was an inverse relationship between BHB with blood glucose and insulin levels, and that a potential rebound increase in BHB occurred when blood glucose dropped below fasting levels and insulin returned to baseline. Blood TG increased at each measurement over the course of 4 hours.

**CONCLUSION:** These findings support a pattern in the sequence of metabolic responses to a high-fat meal of increased then decreased blood glucose and insulin levels followed by increased BHB. An unexpected increase in blood BHB 4 hours after a single high-fat meal containing a significant amount of carbohydrate warrants additional research.
**Conclusions:** The expected lifespan of persons living with human immunodeficiency virus (PLWH) has increased significantly due to improved treatment options. However, an unintended consequence has been an increased prevalence of chronic diseases such as type 2 diabetes mellitus (T2D). It is therefore important to explore underlying biological mechanisms for this increased risk of T2D among PLWH as it is not yet well understood. Investigation of specific biomarkers may help define the pathogenesis of T2D in PLWH and yield positive outcomes including the detection of at-risk individuals as targets of early interventional strategies along with identification of new diagnostic criteria. **Purpose:** The aim of this research was to identify specific biomarkers which differentiate PLWH and those comorbid with HIV and T2D (PLWH+T2D). **Methods:** 16 PLWH patients (53.6±1.4 y/o; 10 male) and 16 controls (PLWH+T2D). **Results:** 1) Animal study: Swimming exercise significantly inhibited weight gain (final body weight 36.61±0.61 vs. 29.46±0.56g, p<0.001) and visceral fat accumulation on high fat diet in mice. Increased serum leptin levels on high fat diet were diminished on exercise intervention (41.5±6.3 vs. 28.1±4.5ng/mL, p<0.001). Hepatic Angptl6 expression profile showed same trend of leptin (relative expression 1.00±0.06 vs. 0.72±0.04, p<0.01). 2) Human study: After training program, there was a significant increase in maximal exercise capacity (VO2max 31.25±1.18 vs. 35.51±1.17mL/min/kg, p<0.001) with decreased body mass index (24.80±0.66 vs. 24.05±0.64kg/m2, p<0.001). Serum leptin (7.49±1.24 vs. 5.22±0.69ng/mL, p<0.02) and Angptl6 (414.02±24.93 vs. 348.25±18.45ng/ml, p<0.05) concentrations were significantly decreased by exercise intervention. **Conclusions:** Our study shows that habitual exercise significantly decreases Angptl6 expression in mice and humans. As alterations of leptin were accompanied with Angptl6 changes, regulation of Angptl6 might be related to leptin signaling.
population. The significant increase in WF and fibrinogen in PLWH+T2D suggests that pathways involving coagulation may be further altered in the transition to this comorbid state.

### Antibiotics Reduce While Forced-Exercise Increases Inflammation in the Small Intestine

Paul J. Wisniewski 1, Laurie B. Joseph PhD2, Stanley A. Lightfoot MD 3, Robert A. Dowden MS 4, John Guers PhD5, Stephen F. Vatner MD6, Sara C. Campbell PhD, FACSM7.

1Rutgers University, New Brunswick, NJ. 2 Ernest Mario School of Pharmacy, Piscataway, NJ. 3 Oklahoma City VA Health Care System, Oklahoma City, OK. 4 Rutgers New Jersey Medical School, Cardiovascular Research Center, Newark, NJ. (Sponsor: Sara C. Campbell, PhD, FACSM). (No relevant relationships reported)

Risk of metabolic and intestinal inflammatory disorder development increases significantly with age. In contrast, exercise has shown to reduce disease risk and promote longevity. Interestingly, adenylyl cyclase 5 knockout (AC5KO) mice demonstrate an enhanced exercise capacity and improved longevity. PURPOSE: We aimed to examine the inflammatory status along the gastrointestinal tract of AC5KO mice compared to Wild type (WT) mice. METHODS: 21 C57BL WT and AC5KO male mice were randomly assigned to one of 2 groups: (1) sedentary and (2) exercise for 12 weeks. Mice had ad libitum access to food and water. Exercised mice were trained for 4 weeks at 60-70% max speed for 1 hr each session, 5 days/wk. WT sedentary and exercised groups were given antibiotics via oral gavage during the last 7 days of the exercise protocol. At the end of 4 weeks, mice were sacrificed and intestinal tissues were fixed for histological analysis and immunohistochemistry for cyclooxygenase-2 (COX-2), a marker of inflammation. Group means of staining score were analyzed with a two-way ANOVA and LSD post hoc tests. A difference of mean with a p value of ≤ 0.05 was considered statistically significant. RESULTS: In the duodenum, COX-2 expression was isolated in the lamina propria and staining occurred predominantly within macrophages. COX-2 expression in the duodenum was less in sedentary animals given antibiotics (p ≤ 0.015). In the ileum, COX-2 expression was localized to both the crypts and lamina propria. Expression in ileal crypts was less in sedentary animals given antibiotics compared to WT exercised animals (p = 0.02) whereas expression in the ileal lamina propria was increased in WT exercised animals (0.001 ≤ p ≤ 0.009). CONCLUSIONS: Antibiotics reduce small intestinal inflammation. COX-2 expression localizes differently in the mucosa along the small intestine. Forced-exercise increases inflammation to a greater degree in the lamina propria of the distal small intestine.

### Anti-apoptosis Effects Of Diosgenin In D-galactose-induced Aging Brains

Shin-Da Lee 1, Yi-Yuan Lin 1, Shiu-Min Cheng 1, Chih-Yang Huang 1, ‘China Medical University, Taichung, Taiwan. 2Asia University, Taichung, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM). (No relevant relationships reported)

Undernourishment in early life has been shown to impair cardiovascular function, which could potentially influence maximum exercise capacity in adulthood. PURPOSE: To determine the effects of early life undernutrition on maximum exercise capacity in adulthood. METHODS: Using a cross fostering model, pups were undernourished either during gestation (GUN) or lactation (PUN; PN1-21) by feeding the dam a low-protein diet (8% protein) to decrease milk production. Control pups were born and suckled to dams fed an isocaloric diet with 20% protein content. At the dam a low-protein diet (8% protein) to decrease milk production. Control pups were born and suckled to dams fed an isocaloric diet with 20% protein content. At PN61, mice underwent a treadmill test to determine maximal oxygen uptake (VO2max) and maximal exercise performance (i.e. running distance). Mice were exercised for 12 weeks. Mice had ad libitum access to food and water. Exercised mice were trained for 4 weeks at 60-70% max speed for 1 hr each session, 5 days/wk. WT sedentary and exercised groups were given antibiotics via oral gavage during the last 7 days of the exercise protocol. At the end of 4 weeks, mice were sacrificed and intestinal tissues were fixed for histological analysis and immunohistochemistry for cyclooxygenase-2 (COX-2), a marker of inflammation. Group means of staining score were analyzed with a two-way ANOVA and LSD post hoc tests. A difference of mean with a p value of ≤ 0.05 was considered statistically significant. RESULTS: In the duodenum, COX-2 expression was isolated in the lamina propria and staining occurred predominately within macrophages. COX-2 expression in the duodenum was less in sedentary animals given antibiotics (p ≤ 0.015). In the ileum, COX-2 expression was localized to both the crypts and lamina propria. Expression in ileal crypts was less in sedentary animals given antibiotics compared to WT exercised animals (p = 0.02) whereas expression in the ileal lamina propria was increased in WT exercised animals (0.001 ≤ p ≤ 0.009). CONCLUSIONS: Antibiotics reduce small intestinal inflammation. COX-2 expression localizes differently in the mucosa along the small intestine. Forced-exercise increases inflammation to a greater degree in the lamina propria of the distal small intestine.

### Metabolic and Microbial Responses to Exercise in C57 Wild-type and Adenylyl Cyclase 5 KO Mice

Robert A. Dowden 1, Paul. J. Wisnieski 2, John Guers 2, Macro Oydanicli 1, Stephen F. Vatner 1, Lora McGuinness 1, Lee Kerkhof 1, Sara Campbell, FACSM 1. Rutgers, The State University of New Jersey, New Brunswick, NJ. 2Rutgers, New Jersey Medical School, Cardiovascular Research Center, Newark, NJ. (Sponsor: Dr. Sara Campbell, FACSM). (No relevant relationships reported)

Healthy aging has been observed in our adenylyl cyclase type 5 knockout (AC5KO) model. Aging is also associated with alterations in composition and diversity of the gut microbiota. The extent to which the microbiota contributes to the healthy aging phenotype is unknown. PURPOSE: To examine the role of the microbiota in diabetes and exercise tolerance in AC5KO mice compared to wild type (WT). METHODS: 17 (n=6/group) 6-week old C57BL/6j male WT and AC5KO mice were randomly assigned to one of the following four groups: (1) wild type-exercise (WT-EX), (2) wild type-sedentary (WT-CON), (3) AC5-exercise (AC5-EX) and (4) AC5-sedentary (AC5-CON). Mice underwent a treadmill test to determine maximal oxygen uptake (VO2max) and max exercise performance (i.e. running distance). Mice were exercised via forced treadmill running at 60-70% VO2max for 60-minutes 5 days/week, for 5 weeks. Following exercise training, mice were given oral antibiotics for five days to eliminate gut microbiota. Measurements were taken: 1- prior to exercise, 2- post training/pre-antibiotic and 3- post antibiotic. Fecal samples underwent phenol-chloroform extraction and ribosomal operons were amplified with 10 ng of genomic DNA using the universal 16S rRNA-27Forward primer, 23S rRNA-2241Reverse primer and a High Fidelity/Proofreading Taq polymerase. The MinION was used for library preparation and we used Poretools and Geneious sequence analysis software for sequencing. Finally, fasted glucose tolerance (i.p; 2 ul/kg [BW]) and insulin tolerance (i.p; 1 ul/kg [BW]) were measured. RESULTS: AC5KO mice have a unique microbiota with Helicobacter typhlonius & Bacteroides sartorii spp. being dominant in AC5KO and not in WT mice. Furthermore, AC5-EX mice showed altered glucose tolerance (33325 vs. 23025 AUC, p<0.05) and reduced exercise performance (517m vs. 258m, p<0.05) following antibiotic treatment. Post antibiotic AC5-EX mice showed insulin sensitivity following antibiotic treatment. CONCLUSION: AC5KO mice have a unique microbiota compared to WT mice and their insulin/glucose control phenotype may be dependent on the microbiota.

### Effects of Early Life Undernutrition on Maximum Treadmill Running Capacity in Mice

Logan A. Pendergrast, Joe R. Visker, Ashley N. Tripllett, Eric C. Leszczynski. Michigan State University, East Lansing, MI. (No relevant relationships reported)

Undernourishment in early life has been shown to impact cardiovascular function, which could potentially influence maximum exercise capacity in adulthood. PURPOSE: To determine the effects of early life undernutrition on maximum exercise capacity in adulthood. METHODS: Using a cross fostering model, pups were undernourished either during gestation (GUN) or lactation (PUN; PN1-21) by feeding the dam a low-protein diet (8% protein) to decrease milk production. Control pups were born and suckled to dams fed an isocaloric diet with 20% protein content. At postnatal day 21 (PN21), all mice were weaned and switched to a control diet. To assess exercise capacity, mice began a 5-day treadmill acclimation protocol at PN61. At PN67, mice underwent a maximum work test, which began at 10 meters/minute with a 10% grade. Speed was increased every two minutes until exhaustion. The amount of work completed by each mouse was calculated as: Maximum Work[kJ]= 9.8 x Maximum Speed (m/min) x grade (radians) x Time (min) x Weight (kg). A two-way ANOVA was used to determine differences in maximal work and cardiac parameters between groups with the effects of gender and diet. RESULTS: GUN (0.3312±0.037 J) mice performed higher than PUN (0.2527±0.050 J) and CON (0.2674±0.030 J) mice on a maximum work test (p<0.05). There was no gender effect. CONCLUSION: Undernourishment during lactation leads to lower work capacity, indicating that developmental programming during the first 21 days of life impacts work capacity during adulthood.
While normal weight obesity (NWO) has become an important health topic, to date no data exist describing physiological characteristics among this group. PURPOSE: The primary aim was to characterize NWO in college-age males and females through body composition and cardiometabolic measures. The secondary aim was to observe the relationship between waist to hip ratio (WHR) and body mass index (BMI) with body fat percentage (BF%). METHODS: Ninety-two college students (Mean ± SD; Age: 19.5 ± 1.4 yrs.; Height: 171.9 ± 9.4 cm; Weight: 67.9 ± 8.2 kg; BF%: 26.0 ± 6.2 %; males:n=29; females:n=63) participated in this study. NWO was defined being above NHANES body fat 25th percentile based on age and sex. Body composition variables including BF%, lean mass (LM), and visceral adipose tissue (VAT) were assessed by dual energy x-ray absorptiometry. The same technician measured waist and hip circumferences. Mean arterial pressure (MAP) and metabolic biomarkers (total cholesterol (TC), high density lipoproteins (HDL), non-high density lipoproteins (NHDL), and glucose (GLU)) were evaluated for cardiometabolic health. Blood pressure was measured in a seated position with an automated cuff; biomarkers were assessed by a fasted blood draw. RESULTS: Forty percent of the sample (n=37) was identified as NWO, with 31% of the females (n=19) being NWO, whereas 62% of males (n=18) were NWO. NWO individuals had significantly higher BF% (28.4 ± 6.7 % vs. 24.4 ± 5.2 %, p<0.001), VAT (0.20 ± 0.15 kg vs. 0.07 ± 0.10 kg, p<0.002), and larger WHR (0.76 ± 0.40 cm vs. 0.72 ± 0.41 cm, p=0.02) compared to normal weight (NW) (NWO vs. NW). Although not significant, NWO had higher LM (46.2 ± 8.5 kg; NWL: 41.7 ± 10.3 kg, p<0.05) and MAP (NWO: 84.4 ± 6.8 mmHg; NWL: 82.5 ± 7.0 mmHg, p<0.05) compared to NWL. NWO also had higher levels of GLU, and lower levels of TC, HDL, and NHDL, however, biomarkers were not significantly different between groups (p>0.05). While WHR was significantly correlated with BF% (R=−0.293, p<0.05), BMI was not (p>0.05). CONCLUSION: The occurrence of NWO among otherwise healthy college students is high. Identification of these individuals may be an effective approach to obesity prevention and treatment. Determining effective methods to measure both body fat and abdominal obesity in this population is essential, as BMI may mask obesity in a young adult population.

Metabolically healthy overweight or obese (MHO) individuals may be studied to better understand the relationship of low-level inflammation to physical activity (PA) and fitness, metabolic syndrome, glycemic control, and postprandial responses. It was hypothesized that individuals with lower inflammation would have greater volume of PA, cardiorespiratory fitness (VO2max), and metabolic health. PURPOSE: To compare PA, VO2max, glycosylated hemoglobin (HbA1c), metabolic syndrome criteria, and metabolic responses to a high-fat meal between low (LO) and high (HI) inflammation phenotypes within a group of MHO adults. METHODS: Adults (n=25), 23-54 yrs of age with BMI from 27-35 kg/m2 were assessed for body composition, self-reported PA, VO2max, and fasting/resting concentrations of interleukin (IL)-1β, IL-6, IL-17, IL-23, tumor necrosis factor-α (TNF-α), and granulocyte-macrophage colony stimulating factor (GM-CSF). LO (n=11) were below the group median for ≥ 4 of the cytokines; HI (n=14) above for ≥ 4. Two participants were between phenotypes. After fasting blood collection, a high fat meal (50 g fat, 54 g carbohydrate, and 12 g protein) was consumed and 4 hours, postprandial blood samples were collected for measurement of glucose, insulin, and triglycerides (TG).

RESULTS: Mean cytokine concentrations were 1.8 to 4.3-fold higher (p<0.05) in HI compared to LO for IL-1β, IL-6, IL-17, IL-23, TNF-α, but not (p>0.12) GM-CSF. The frequency of aerobic activity was higher (p<0.05; mean ± SEM; 5.2 ± 0.5 vs 3.1 ± 0.4

No relevant relationships reported
Reduced Insulin Sensitivity in Young, Normoglycemic Subjects, Alters Tissue Oxygenation During Post Occlusive Reactive Hyperemia

Esther E. Wu, Thomas J. Barstow, FACSMD, Dana K. Townsend, Wheaton College, Wheaton, IL; Kansas State University, Manhattan, KS; (Sponsor: Thomas J. Barstow, FACSMD)

No relevant relationships reported

INTRODUCTION: Near-infrared spectroscopy (NIRS) measures of the tissue oxygen saturation ([StO2]) during post occlusive reactive hyperemia (PORH) has recently been correlated with flow mediated dilation (%FMD) of the popliteal artery (McLay et al. 2016). Cardiovascular disease is associated with reductions in %FMD. Reduced insulin sensitivity may negatively affect the vascular system for many years prior to a pre-diabetic/diabetic diagnosis. PURPOSE: To determine if static and dynamic, [StO2] parameters during PORH are correlated with metabolic markers in healthy, young, normoglycemic subjects. METHODS: Glucose (G) and insulin (I), both in fasting (F) conditions and during an oral glucose tolerance test (OGTT), were measured in twenty-three, young (18-26y), healthy subjects (12M/11F). Each subject underwent upper arm, PORH with oxy-[O2 HB] and deoxy- [hemoglobin + myoglobin], ([HHb]) measured in the skeletal muscle of the antebraconium by NIRS. [StO2] was calculated ([O2 HB]/ Total hemoglobin ([O2 HB] + [HHb]) at rest, during the cuff, and during PORH. Parameters describing the amplitude and time course of the response were measured. Hepatic insulin sensitivity (ISI_h), whole body insulin sensitivity ( Matsuda Index), area under the curve for I and Glu, and FG and 2-HR Glu were measured. RESULTS: FI (range 2.43 - 12.51 μM/L) was significantly negatively correlated (r=-0.43, P<0.02) with the amount of change of [StO2] during reperfusion (Δ [StO2]) (range 13.94 - 38.66%) and significantly positively correlated (r=0.52, P=0.005) with the minimum [StO2], a measure of extraction, during the cuff (Min [StO2]) (range 35.97 - 61.87%). ISI_h (range 0.37-2.07) was significantly positively correlated (r=0.57, P=0.002) with Δ [StO2] and significantly negatively correlated (r=-0.56, P=0.006) with Min [StO2]. There was no significant correlation between any metabolic parameter and [StO2] slope, initial slope of [StO2], following cuff release. CONCLUSIONS: Δ [StO2], a measure of the amount of reperfusion, and Min [StO2], a measure of extraction during the cuff, were correlated with FI and ISI_h, two of the longest used markers of metabolic function. NIRS-derived [StO2] may be a useful tool for assessing levels of reduced insulin sensitivity in normoglycemic, young adults.

Lower Glucose Tolerance in Normoglycemic, Healthy Hispanics with a Family History of Type 2 Diabetes

Cesar Meza1, Manuel Amador2, Mario Garcia1, Christopher Figueroa1, Andrew McAinch2, Sudip Bajpeyi1, Mario Garcia1, Rachel A. Tinius1, Donald L. Hoover2, Kevin J. Pearson3, Todd Cadie3, Jill M. Maples1, Western Kentucky University, Bowling Green, KY; Western Michigan University, Kalamazoo, MI; University of Kentucky, Lexington, KY; Washington University School of Medicine, St. Louis, MO.

No relevant relationships reported

Obesity and type 2 diabetes are associated with impaired glucose homeostasis and blood lipid profiles. Further, a family history of diabetes (FH) increases the risk for development of insulin resistance. However, it is unclear whether differences in glucose tolerance, glucose blood lipid profiles exist between individuals with/ without a FH.

PURPOSE: To investigate whether a FH impairs glucose tolerance and blood lipid profile in healthy, sedentary Hispanic males.

METHODS: 22 sedentary, normoglycemic, Mexican American males (mean±SEM: age: 23.6±0.56 yrs; BMI: 26.9±0.9 kg/m2) with/without FH participated in the study. Glucose tolerance was assessed by calculating glucose area under the curve (AUC) following an oral glucose tolerance test. Participants were fed a 5-day standardized diet (55:15:30 Carbohydrate:Protein:Fat) before testing. Serum was collected for analysis of blood glucose and lipid panels by a diagnostic lab corp. (Lab Corp. Burlington, NC).

RESULTS: AUC was significantly greater in individuals with a FH compared to those without. There was no difference in fasting insulin between groups. Lastly, no differences in total cholesterol (p=0.18), triglycerides (p=0.28) or LDL cholesterol (p=0.24) were detected regardless of FH.

CONCLUSION: Fasting glucose, insulin, insulin resistance measure by HOMA-IR, and lipid profiles were not different between individuals with and without a FH. However, glucose AUC may be an early indicator of risk for developing insulin resistance in young adults with a family history of type 2 diabetes, despite an otherwise normal clinical health status.

Restricted Carbohydrate Diet and Exercise Improves Metabolic and Inflammatory Profiles in Metabolic Syndrome

Lauren Mintz1, Alex Eason1, Mark Baker2, Deborah Lowin1, Amy M. Gyorjko3, University of Calgary, Calgary, AB, Canada. 1Grand Valley State University, Allendale, MI. (Sponsor: Timothy J. Michael, FACSMD)

No relevant relationships reported

One approach to slow the pandemic of obesity and chronic disease is to look to our evolutionary past, as the behaviors contributing to the emergence of ‘diseases of civilization’. Diet and exercise that resemble our ancestral behaviors independently reduce risk factors for the development of chronic disease. To date, little research has examined the effects of combining a Paleolithic diet with high intensity exercise.

PURPOSE: The purpose of this study was to investigate the effects of diet and exercise in a group of individuals that more closely resemble those of our evolutionary past on inflammatory and metabolic profiles in individuals characterized as having Metabolic Syndrome (MetS).

METHODS: Eleven subjects with MetS followed a crossover design with two 4wk interventions, including a restricted carbohydrate Paleolithic-based diet (RCPD; ≥50CHO) with high intensity interval training (RCPD-Ex) and a RCPD diet with sedentary activity (RCPD-Sed) separated by a 4-wk washout period. A two-way analysis of variance with repeated measures was performed with post-hoc analysis using simple effects analysis with a Bonferroni adjustment. The level of statistical significance was established a priori as P < 0.05. Values are reported as means ± SD. RESULTS: Compared to baseline, RCPD-Sed and RCPD-Ex improves VO2 max by 22.6% and 29% (28.5 ± 5.1 to 6.1 mL·kg·min-1), respectively and improves metabolic markers including waist adiposity (-15%, -18%), weight loss (-3%, -5%), body fat % (BF%: -7%, -12%), fasting plasma glucose (GLU: -20%, -27%), triglycerides (TG: -47%, -52%), HDL-C (-22%, -36%), mean arterial pressure (MAP; -28%, -34%), fasting insulin (-34%, -39%), HOMA-IR (-37%, -41%), adiponectin (+33.7%, +38%), and leptin (+33.7%, +38%), levels, respectively when compared to baseline. RCPD-Sed and RCPD-Ex also improves inflammatory markers reducing hsCRP by -32% and -36% (2.8 ± 1.4, 2.5 ± 1.4 mg/mL), TNF-alpha by -35% and -41% (2.3 ± 0.6, 1.9 ± 0.4 mg/mL), and IL-6 by -29% and -40% (2.7 ± 0.8, 2.1 ± 0.6 mg/mL), respectively, when compared to baseline.

CONCLUSION: Adopting behaviors from our evolutionary past, including diet and exercise, shows favorable metabolic and inflammatory profiles in those that characterize with MetS.
Blood glucose was monitored at baseline, 5 minutes post meal, 30 minutes post meal, as well as at 95.13 ± 20.46 at baseline with a significant increase at 30 min post meal (112.73 ± 20.37). No significant effect was found for diet (P = 0.305) or interaction of diet by exercise (P = 0.386). Post hoc analysis further revealed that the only true exercise effect was found at 5 min post meal, which was disregarded due to no true exercise effect.

**Conclusion:** The finding suggests that a 10-min short bout of exercise significantly lowered post-prandial blood glucose among healthy individuals during midday. The types of the meal consumed and exercise performed made no difference on glycemic responses.

Short bouts of exercise can better fit into a busy schedule and have been shown health benefits for glycemic control. However, postprandial glycemic response to a short bout of exercise during mid-day remains to be explored.

This study was to examine glucose responses to short bouts of exercise following different meals at lunch time among healthy adults. **Methods:** Ten healthy young adults (28.2±7.7 yrs) participated in the study with a 2-2 factorial design. Each participant completed four different trials on nonconsecutive days with a different meal and exercise combination. The meal offered was either a standard burger, approximately 740 calories or a prepacked Mediterranean Sandwich, approximately 560 calories. Thirty minutes after the meal, the participants performed either a 10-min treadmill walking at 3 mph or a 10-min stair stepping on a 7-inch step at a cadence of 92 steps per minute. The combination of meal and exercise was randomized for each trial. Blood glucose was monitored at baseline, 5 minutes post meal, 30 minutes post meal, 5 minutes during exercise, immediately post exercise and 15 minutes post exercise. Blood pressure, heart rate, RER, and VO2 were also monitored at the corresponding time points. **Results:** Statistical analysis was performed to determine the effect of diet and exercise on glycemic response. Blood glucose (mg/dL) was measured as 95.13 ± 20.46 at baseline with a significant increase at 30 min post meal (112.73 ± 20.54, P = 0.000). Blood glucose was significantly reduced at 5 min during exercise (105.43 ± 20.06, P = 0.024), immediately post exercise (94.51 ± 23.6, P = 0.00) and 15 min post exercise (102.97 ± 17.34, P = 0.0005) compared with 30-min post-prandial blood glucose. Multivariate analysis shows a significant main effect for exercise (P = 0.037). No significant effect was found for diet (P = 0.305) or interaction of diet by exercise (P = 0.386). The main effect for exercise was found at 5 min post meal, which was disregarded due to no true exercise effect.

**Conclusion:** The finding suggests that a 10-min short bout of exercise significantly lowered post-prandial blood glucose among healthy individuals during midday. The types of the meal consumed and exercise performed made no difference on glycemic responses.

The study was to explore if even a short bout of exercise (i.e. 10 min) during lunchtime could reduce postprandial glucose levels. **Methods:** Ten healthy young adult males (28.2±7.7 yrs) participated in the study. Each participant completed four different trials on nonconsecutive days with a different meal and exercise combination. The meal offered was either a standard burger, approximately 740 calories or a prepacked Mediterranean Sandwich, approximately 560 calories. Thirty minutes after the meal, the participants performed either a 10-min treadmill walking at 3 mph or a 10-min stair stepping on a 7-inch step at a cadence of 92 steps per minute. The combination of meal and exercise was randomized for each trial. Blood glucose was monitored at baseline, 5 minutes post meal, 30 minutes post meal, as well as at 95.13 ± 20.46 at baseline with a significant increase at 30 min post meal (112.73 ± 20.54, P = 0.000). Blood glucose was significantly reduced at 5 min during exercise (105.43 ± 20.06, P = 0.024), immediately post exercise (94.51 ± 23.6, P = 0.00) and 15 min post exercise (102.97 ± 17.34, P = 0.0005) compared with 30-min post-prandial blood glucose. Multivariate analysis shows a significant main effect for exercise (P = 0.037). No significant effect was found for diet (P = 0.305) or interaction of diet by exercise (P = 0.386). Post hoc analysis further revealed that the only true exercise effect was found at 5 min post meal, which was disregarded due to no true exercise effect.

**Conclusion:** The finding suggests that a 10-min short bout of exercise significantly lowered post-prandial blood glucose among healthy individuals during midday. The types of the meal consumed and exercise performed made no difference on glycemic responses.
Regarding the effect of aging on insulin action, the area under the GTT curve was significantly higher in AG males (95,102±6,818 vs 64,005±3,201; P=0.002) but not AG female mice (50,168±2,434 vs 47,369±0,409, P=0.55). SUMMARY: Our findings indicate that C57BL/6J female mice, unlike male mice, are protected from age-related obesity and insulin resistance. The mechanism responsible for this protection is yet to be identified.

**B-69 Free Communication/Poster - Nutrition and Immunology**

**Wednesday, May 30, 2018, 1:00 PM - 6:00 PM**

**Room: CC-Hall B**

**957 Board #218 May 30 3:30 PM - 5:00 PM**

**Bovine Colostrum Has No Effect on Mucosal Immunity Before or After Exercise in a Hot and Humid Environment**

Trevor Gillum, Zachary McKenna, Quint Berkemeier, Ashley Naylor, Austin Kleint, Felipe Corini. California Baptist University, Riverside, CA.

(No relevant relationships reported)

**Intro:** It is known that strenuous or prolonged exercise can lead to exercise-induced immune impairments in mucosal immunity. Further, exercise in the heat reduces salivary lysozyme (Lys). Bovine Colostrum (BC) can enhance mucosal immunity associated with strenuous exercise. However, the effects of BC remain unclear during exercise in hot and humid conditions.

**Purpose:** The purpose of this study was to quantify the effects of BC supplementation on salivary lactoferrin (Lac) and Lys following exercise in a hot and humid environment.

**Methods:** 10 males (20±2 years, VO\(_{2}\)\(_{max}\): 11.0±1.7 L/min, 55.6±8.2 kg) and 10 females (20±2 years, VO\(_{2}\)\(_{max}\): 35.9±1.1 L/min, 75.1±5.7 kg) participated in the present study. Subjects completed a 60-min bout of cycling at 65% of VO\(_{2}\)\(_{max}\) after a 3 week washout period before the groups were switched and the procedures repeated. Core temperature, skin temperature, heart rate, and rating of perceived exertion were recorded every 5 min during exercise. Unstimulated saliva was collected pre, post, 1 h, and 4 h post exercise. Lac and Lys concentrations were quantified via ELISA.

**Results:** Exercise resulted in an immediate increase in concentration and secretion rate for Lac and Lys (p<0.05), but BC had no effect. Mean body temperature was similar between groups (beginning: 36.1±0.3°C, ending: 39.5±0.28°C, P=0.01). Lac and Lys concentrations were quantified via ELISA.

Two trials and time, P > 0.05).

**Conclusions:** Contrary to previous work, exercise in the heat did not reduce mucosal immunity. Further, despite similar supplementation protocols that showed enhanced immunity, BC provided no benefit, either at baseline or in response to exercise.

**RESULTS:**

1. A 3 week washout period before the groups were switched and the procedures repeated.

2. Lac and Lys concentrations were quantified via ELISA.

3. Mean body temperature was similar between groups (beginning: 36.1±0.3°C, ending: 39.5±0.28°C, P=0.01).

**CONCLUSION:** Exercise in the heat did not reduce mucosal immunity.

**Purposes:**

1. To examine the effects of diet before endurance exercise on hepcidin response in young female subjects.

2. To study the effects of diet before endurance exercise on hepcidin response in young female subjects.

3. To investigate the effects of diet before endurance exercise on hepcidin response in young female subjects.

4. To determine the effects of diet before endurance exercise on hepcidin response in young female subjects.

**Methods:** Ten young, untrained female subjects [age 20.6±0.8 years; height 157.5±1.0 cm; weight 54.4±1.5 kg; peak oxygen uptake (VO\(_{2}\)max) 35.9±1.1 L/min/kg] participated in the present study. Subjects completed a 60-min bout of cycling at 65% of VO\(_{2}\)max after consuming a meal (BED) or not consuming (CON) a meal before exercise. Two experimental sessions were conducted with a crossover design.

**RESULTS:**

1. Blood samples were collected before exercise, immediately after exercise and 3-h after exercise.

2. Blood samples were collected before exercise, immediately after exercise and 3-h after exercise.

3. Blood samples were collected before exercise, immediately after exercise and 3-h after exercise.

4. Blood samples were collected before exercise, immediately after exercise and 3-h after exercise.

**CONCLUSIONS:**

1. Diet before endurance exercise did not affect exercise-induced hepcidin elevation in young females.

2. Diet before endurance exercise did not affect exercise-induced hepcidin elevation in young females.

3. Diet before endurance exercise did not affect exercise-induced hepcidin elevation in young females.

4. Diet before endurance exercise did not affect exercise-induced hepcidin elevation in young females.

**Purposes:**

1. To examine the effects of diet before endurance exercise on hepcidin response in young female subjects.

2. To study the effects of diet before endurance exercise on hepcidin response in young female subjects.

3. To investigate the effects of diet before endurance exercise on hepcidin response in young female subjects.

4. To determine the effects of diet before endurance exercise on hepcidin response in young female subjects.

**Methods:** Ten young, untrained female subjects [age 20.6±0.8 years; height 157.5±1.0 cm; weight 54.4±1.5 kg; peak oxygen uptake (VO\(_{2}\)max) 35.9±1.1 L/min/kg] participated in the present study. Subjects completed a 60-min bout of cycling at 65% of VO\(_{2}\)max after consuming a meal (BED) or not consuming (CON) a meal before exercise. Two experimental sessions were conducted with a crossover design.

**RESULTS:**

1. Blood samples were collected before exercise, immediately after exercise and 3-h after exercise.

2. Blood samples were collected before exercise, immediately after exercise and 3-h after exercise.

3. Blood samples were collected before exercise, immediately after exercise and 3-h after exercise.

4. Blood samples were collected before exercise, immediately after exercise and 3-h after exercise.

**CONCLUSIONS:**

1. Diet before endurance exercise did not affect exercise-induced hepcidin elevation in young females.

2. Diet before endurance exercise did not affect exercise-induced hepcidin elevation in young females.

3. Diet before endurance exercise did not affect exercise-induced hepcidin elevation in young females.

4. Diet before endurance exercise did not affect exercise-induced hepcidin elevation in young females.

**Purposes:**

1. To examine the effects of diet before endurance exercise on hepcidin response in young female subjects.

2. To study the effects of diet before endurance exercise on hepcidin response in young female subjects.

3. To investigate the effects of diet before endurance exercise on hepcidin response in young female subjects.

4. To determine the effects of diet before endurance exercise on hepcidin response in young female subjects.

**Methods:** Ten young, untrained female subjects [age 20.6±0.8 years; height 157.5±1.0 cm; weight 54.4±1.5 kg; peak oxygen uptake (VO\(_{2}\)max) 35.9±1.1 L/min/kg] participated in the present study. Subjects completed a 60-min bout of cycling at 65% of VO\(_{2}\)max after consuming a meal (BED) or not consuming (CON) a meal before exercise. Two experimental sessions were conducted with a crossover design.

**RESULTS:**

1. Blood samples were collected before exercise, immediately after exercise and 3-h after exercise.

2. Blood samples were collected before exercise, immediately after exercise and 3-h after exercise.

3. Blood samples were collected before exercise, immediately after exercise and 3-h after exercise.

4. Blood samples were collected before exercise, immediately after exercise and 3-h after exercise.

**CONCLUSIONS:**

1. Diet before endurance exercise did not affect exercise-induced hepcidin elevation in young females.

2. Diet before endurance exercise did not affect exercise-induced hepcidin elevation in young females.

3. Diet before endurance exercise did not affect exercise-induced hepcidin elevation in young females.

4. Diet before endurance exercise did not affect exercise-induced hepcidin elevation in young females.
METHODS: Fifteen Tr and 15 UTr participated in an acute bout of maximal exercise to examine ex vivo PTX3 production from whole blood (WB) and isolated peripheral blood mononuclear cells (PBMCs) exposed to LPS or palmitate. The capacity of PTX3 to regulate the ex vivo production of inflammatory cytokines was also examined in isolated PBMCs.

RESULTS: Elevated plasma PTX3 concentrations prior to exercise were positively associated with the percent change (pre to post exercise) in plasma PTX3 concentrations following acute exercise (r = 0.428, p = 0.018), independent of training status and cardiorespiratory fitness (VO_{2max}). In response to acute exercise, while ex vivo PTX3 production from LPS stimulated WB was unaltered following acute exercise in all subjects, the production of PTX3 from LPS stimulated PBMCs tended to be lower in Tr compared to UTr subjects (p = 0.098). Likewise, PTX3 production from palmitate-stimulated PBMCs was reduced in Tr compared to UTr subjects (p = 0.017). In PTX3 concentrations in Tr, but not UTr, subjects were positively associated with the LPS- and palmitate-mediated production of PTX3 from PBMCs at rest and in response to acute exercise (p ≤ 0.050). Next, isolated PBMCs were stimulated with PTX3. As a result, PTX3-mediated production of the anti-inflammatory cytokines IL-10 and TGF-B1 decreased following acute exercise in both Tr and UTr subjects (p = 0.004, p < 0.001, respectively). To the contrary, although PTX3-mediated IL-6 production was unaltered following acute exercise, the percent change in IL-6 production was positively associated with elevated plasma PTX3 concentrations at rest and in response to acute exercise in Tr subjects only (p < 0.050).

CONCLUSIONS: Aerobic exercise training may enhance the utility of plasma PTX3 concentrations to serve as a biomarker of the PTX3-mediated innate immune response to acute exercise.

HIV-1 can efficiently infect and replicate in activated CD4+ cells, including T cells and macrophages. Quiescent CD4+ T cells are susceptible to virus binding and entry, but infect poorly due to a lack of transcriptional and metabolic factors. We previously showed that circulating T cell populations undergo significant functional changes after short episodes of intense exercise. We hypothesize these changes can prime T cells for HIV-1 infection and possibly facilitate the development of latent infection.

PURPOSE: To identify if exercise-induced changes in CD4+ T cell physiology alter susceptibility to HIV-1 infection. METHODS: Subjects participated in both a control (no exercise) and exercise session. Venous blood samples were obtained at baseline (Pre) and immediately after each session (Post) in sodium heparin vacutainers. Blood samples were immediately processed and CD4+ T cells isolated from a human CD4+ T cell enrichment kit. A subset of cells was activated by stimulation with anti-CD3 and -CD28 antibodies. Unstimulated cells were immediately inoculated with NLX HIV-1 at a multiplicity of infection (MOI) of ~0.1 for 4 h, washed, and cultured in XF T Cell media supplemented with 50 U/mL IL-2. After 3 d of stimulation, the activated cells were similarly infected and cultured. Cultures were incubated for 17 d and supernatants collected, clarified by centrifugation, and stored at -20°C every 3-4 d for measurement of virus replication. At 14 d post infection, the resting cells were activated for 3 days with human CD3/CD28/CD2 T cell activator beads to test for latent infection (activated cell group was not restimulated). Virus replication was quantified by HIV reverse transcription assay. RESULTS: Preliminary data from the initial subjects suggests there is not a statistically significant change in viral replication levels between baseline and post exercise cells. In one subject however, a 1702% increase was observed in viral replication after reactivation of control resting cells compared to a 55% increase in reactivated exercise cells. CONCLUSIONS: While evidence suggests acute exercise alters the phenotypic state of T cells, it may not alter levels between baseline and post exercise cells. In one subject however, a 1702%

Purpose: Appetite is influenced by gut-derived hormones and behavioral factors. Caloric restriction is suggested to reduce satiation and increase hunger, thereby contributing to challenges in long-term weight loss. Although intense exercise is suggested to attenuate appetite, no data exist testing the effects of interval exercise (INT) during a low-calorie diet (LCD) on appetite regulation. We hypothesized that LCD+INT would favorably influence satiety when compared with LCD in obese adults. Methods: Seventeen obese adults (50.5 ± 3.0 yr; 35.9 ± 1.4 kg/m²) were randomized to either LCD (n = 8; mixed meals of ~1200 kcal/d) or LCD+INT (n = 9; 60 min/d of supervised interval exercise at 90% HRmax for 3 min and 50% HRmax for 3 min). An additional 350kcal (shake) was provided to LCD+INT individuals post-exercise to equate energy availability between groups. Total PYY, acyl ghrelin (AG) and des-acyl ghrelin (dAG) were measured at 0, 30 and 60 min of a 75° OGTT before and after the intervention. Visual analog scales were also administered at 0 and 120 min of the OGTT to assess subjective appetite. Food logs were recorded prior to and during the intervention to evaluate caloric intake. Results: Both interventions decreased food intake (P < 0.001) and body fat (P < 0.001). LCD+INT decreased fasting PYY (P < 0.001) and increased post-prandial PYY stimulation (27.0 ± 7.0 vs. 37.0 ± 11.0% when compared with LCD (20.1 ± 11.6 vs. 15.8 ± 3.4%, P = 0.11)). LCD+INT increased fasting AG (P < 0.001) and increased suppression (6.8 ± 5.1%) compared to LCD (8.3 ± 5.9%, P = 0.08). Both interventions increased circulating DAG following the OGTT (P = 0.06). Interestingly, LCD+INT attenuated the rise in fasting hunger seen with LCD (P < 0.05). Conclusion: Interval exercise favorably influences PYY, AG and perceived hunger during a LCD in obese adults. Further research is warranted to determine how adding interval exercise to long-term caloric restriction may mitigate obesity and related cardiometabolic disease.

Radiation-induced leukemia is a serious late effect of radiation therapy partially due to long-term alterations in the bone marrow (BM) environment. Obesity and sedentary lifestyles, two host factors that remodel the bone marrow, are common amongst cancer survivors and linked to increased leukemia risk. Whether alterations to the bone marrow environment induced by obesity and physical activity alter leukemia risk following ionizing radiation (IR) exposure remains unknown. PURPOSE: Determine how exercise training and obesity modulate the BM environment and leukemia blast viability following sub-lethal IR exposure. METHODS: 4 week old CBA mice were fed a control (CON; n = 20) or 45% high fat diet (HF; n = 20). At 9 weeks old, CON and HF mice were divided into sedentary (SED, n = 10) or exercise groups (EX,
Obesity-induced inflammation promotes type 2 diabetes and cardiovascular disease (CVD). A causative link between adaptive immunity and pathogenesis of obesity-associated diseases has been established.

**PURPOSE:** To examine the effects of exercise on circulating T-helper (Th) 17 lymphocytes in overweight/obese post-menopausal women.

**METHODS:** Twenty-seven overweight/obese women (BMI 32.7 ± 5.1 kg·m⁻², 55-75 yr) were randomly assigned to either the exercise (EX, n=13) or control (CON, n=12) group. EX performed 2 sets of 8 resistance exercises and a 25-min treadmill walk at 70-80% HRR. Blood was obtained pre-exercise (PRE), post-exercise (PO), and two hours post-exercise (2HR). Blood samples were obtained at the same time points in CON. Whole blood was stained using the extracellular markers CD4, CD163, CD19, CD26, and CD161 to identify Th17 lymphocytes via flow cytometry.

**RESULTS:** Acute exercise increased lymphocyte number (p = 0.0001), but decreased percent of CD4⁺ cells (p = 0.019) at PO. We observed a diurnal response (main effect) where CD26 expression was significantly lower by 2H compared to PRE (PR: 10631 ± 208; 2H: 9961 ± 271 MFI). There was a main effect (p = 0.024) of group for CD26 expression (EX: 10745 ± 251; ED: 9880 ± 260 MFI). The difference may have been driven by the apparent exercise-induced plateau of CD26 expression at 2H, which minimized the diurnal reduction observed in ED (p > 0.05). There was a tendency (p = 0.09) for a group x time interaction in Th17 cell number at 1HR (EX: 25.3 ± 4.8; ED = 37.2 ± 5.2 x 10⁶ cells·ml⁻¹). BMI was significantly correlated with Th17% (r = 0.5, p = 0.008). HbA1c was positively correlated with Th17 number and percentage (r = 0.59, p = 0.003; r = 0.614, p = 0.001, respectively), as well as CCR4+ Th17 cells (r = 0.421, p = 0.036). Multiple regression analysis revealed that BMI and HbA1c were significant predictors (50%, r² = 0.497) of Th17 cell %.

**CONCLUSION:** Exercise reduced CD26 expression, the receptor responsible for Th17 cell migration, but did not significantly alter Th17 concentration (p = 0.09). CD26 upregulation may indicate that Th17 cells, via chemokine release, promote the stress-dependent migratory response of Th-helper cells (CD4+). Obese individuals may experience a preferential differentiation of Th17 cells, based on their association with adiposity (BMI) and HbA1c.

Inactivity-related diseases such as cardiovascular disease (CVD) are linked to chronic low-grade, systemic inflammation. Platelet-monocyte complexes (PMCs) are markers of in vivo platelet activation and atherosclerosis, and may be early indicators of subclinical inflammation.

**PURPOSE:** To examine the effects of a single exercise bout on PMCs in those at risk for CVD.

**METHODS:** Twenty-five overweight-obese (BMI 32.7 ± 5.2 kg·m⁻², 55-75 yr) women were randomly assigned to either the exercise (EX, n=13) or non-exercise control (CON, n=12) group. EX performed 2 sets of 8 resistance exercises and a 25-min treadmill walk at 70-80% HRR. Blood was obtained pre-exercise (PRE), post-exercise (PO), and two hours post-exercise (2HR). Blood was obtained at the same time points in CON. PMCs were identified via flow cytometry and analyzed in each monocyte phenotype. Monocyte phenotypes were defined as: Mon1 (CD14⁺ CD16⁻CCR2⁺), Mon2 (CD14⁺ CD16⁺CCR2⁺), and Mon3 (CD14⁺ CD16⁻CCR2⁺). All events positive for both CD14 and CD42a (marker for platelets) were considered PMCs.

**RESULTS:** A main effect for time revealed an increase in total PMC number at PO (p<0.036). This increase appears to have been driven by EX (EX = 61.5%; CON = 33.8% increase). Mon1 and Mon2 PMC responses were similar. A significant time x group interaction for Mon3 PMCs (p<0.002) indicated an increase from PR to PO (PR = 5218±1170 cells·ml⁻¹; PO = 8195±1152 cells·ml⁻¹), and a decrease from PO to 1HR and 2HR (1HR = 3767±820 cells·ml⁻¹; 2HR = 3818±814 cells·ml⁻¹). PMC number remained constant for CON at all timepoints. Estimated VO2max was negatively correlated with CD42a MFI (a marker of platelet density per monocyte) (r = −0.583, p = 0.003). Systolic blood pressure (SBP) positively correlated with percent PMC (r = 0.458, p = 0.042).

**CONCLUSIONS:** Aerobic fitness appears to reduce platelet activation indicated by the negative relationship between VO2max and CD42a MFI. Chronic elevations in resting SBP are linked to PMC percentage, possibly due to shear stress-induced platelet activation. It is possible that PMC elevation at PO is at least partially driven by exercise-induced increases in BP. These results support previous literature, indicating that PMCs are a marker CVD risk and may elucidate one mechanism by which physical fitness reduces risk for CVD.

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

**Acute Exercise-Induced Response of Platelet-Monocyte Complexes in Obese Postmenopausal Women**

Michael M. Levitt¹, Maria A. Cardenas¹, Bryan Richie², Carmen A. Cook¹, Kara Steck³, Shaohao Lu³, Jay Haynes⁴, Andreas Kreutzer¹, Joel B. Mitchell, FACSM⁵, Melody D. Phillips, FACSM⁵, Texas Christian University, Fort Worth, TX. John Peter Smith Health Network, Fort Worth, TX. (Sponsor: Melody D. Phillips, FACSM)

(No relevant relationships reported)
were randomly counterbalanced. A series of one-way repeated measures analysis of variance (ANOAs) were performed on CCT composite outcome and symptom scores. Statistical significance was set at a Bonferroni-corrected \( p \leq .01 \). RESULTS: There was a significant within-subjects effect for prescribed post-exertion recovery intervals on total symptom scores (Wilks' \( \lambda = .62, F \{3, 23\} = 4.64, p = .01, n^2 = .38 \). Total symptom scores were significantly higher at the immediate (\( p < .001 \)), 10-min (\( p = .02 \)), and 20-min (\( p = .05 \)) post-exertion recovery intervals compared to baseline. There were no significant differences for processing speed (\( p = .95 \)), visual memory (\( p = .07 \)), verbal memory (\( p = .36 \)), or reaction time (\( p = .40 \)). CONCLUSION: Baseline symptom scores were negatively influenced by maximal exertion, and continued to be elevated 20 minutes post-exertion. However, cognitive performance was unaffected. Sports medicine professionals should wait at least 20 minutes following maximal exertion to obtain a more accurate representation of symptoms.

PURPOSE: An increase in female participation in contact sports has resulted in an increase in female athletes presenting with sport-related concussion (SRC). It has been theorized that females have longer SRC recovery time related to lower neck strength compared to males, which may also relate to concomitant neck injury. We proposed that female athletes with SRC have a higher incidence of acute cervical strain, resulting in a longer duration of SRC symptoms. Additionally, we investigated if athletes with acute cervical injury were more likely referred to a neuropsychologist in the post-SRC period compared to those without neck injury. METHODS: This retrospective study assessed male and female youth, high school, and collegiate athletes (n=431; ages=12-21 years old) for post-SRC symptoms. We analyzed whether females who suffer a SRC are more prone to having an accompanying neck injury in comparison to males. Additionally, we assessed whether athletes who suffer an SRC with a neck injury display longer post-SRC recovery times, leading to increased referrals to a neuropsychologist; Statistical analyses were conducted using chi-square tests. RESULTS: Of the 431 SRC cases, 92 reported concomitant acute neck strain. When comparing recovery time between male and female athletes, a significant difference was seen with females requiring more time to recover (\( p<0.001 \)). However, when comparing recovery time in males and females with SRC and acute cervical strain, no significant differences were found (\( p=0.416 \)). Additionally, when comparing the initial symptom burden using the post-concussion symptom scale in athletes with acute neck injury, females have a non-significant increased number of symptoms compared to males (\( p=0.157 \)). Athletes with an SRC and neck injury are more likely to need a neuropsychology referral compared to those without a neck injury (\( p=0.027 \)). CONCLUSION: Evidence has been established that females have an extended recovery time following SRC when compared to males. A sex-based difference in regards to neck injury affecting the recovery time were not found in our study. However, a concomitant neck injury with an SRC increases the likelihood of a neuropsychology referral. Further research is warranted to determine etiologic factors contributing to more prolonged SRC recovery in females versus males.

PURPOSE: To compare differences in neurocognitive performance following SRC with and without a concomitant neck injury. Specifically, we sought to determine if female athletes who sustained SRC with a concomitant neck injury were at higher risk of prolonged SRC recovery compared to female athletes who did not suffer a neck injury. METHODS: Of the 431 SRC cases, 92 reported concomitant acute neck strain. When comparing recovery time between male and female athletes, a significant difference was seen with females requiring more time to recover (\( p<0.001 \)). However, when comparing recovery time in males and females with SRC and acute cervical strain, no significant differences were found (\( p=0.416 \)). Additionally, when comparing the initial symptom burden using the post-concussion symptom scale in athletes with acute neck injury, females have a non-significant increased number of symptoms compared to males (\( p=0.157 \)). Athletes with an SRC and neck injury are more likely to need a neuropsychology referral compared to those without a neck injury (\( p=0.027 \)).

PURPOSE: To evaluate memory and reaction time as markers of SRC severity among patients experiencing prolonged recovery. METHODS: We retrospectively analyzed student-athletes admitted to a Midwestern outpatient clinic for neuropsychological evaluation; 78 patients had relatively comprehensive profiles and were included in the analysis. We conducted a health history, a 22-item post-concussion symptom inventory, and the ImPACT computerized test, which evaluates memory and reaction time. Pearson's and point-biserial correlation coefficients tested the direction and strength of association between memory, reaction time, and markers of injury severity. Logistic, negative binomial, and linear regressions tested memory and reaction time as predictors of whether symptoms were worse.
were reported, the number of reported symptoms, and the severity of symptoms. **RESULTS:** Patients were 16.0 ± 2.6 years of age, 56.3% were male, and they had experienced 1.2 ± 1.5 previous concussions. Reaction time was 0.64 ± 0.13 seconds; visual motor speed score was 44.7 ± 34.6; visual memory score was 92.0 ± 69.3; verbal memory score was 98.0 ± 80.9; cognitive efficiency score was 0.34 ± 0.12. Reaction time was a significant predictor (p < 0.05) of balance problems, dizziness, mental fogginess, and sensitivity to light and noise; it was a trending predictor (p = 0.061) of the summed severity of symptoms. Verbal memory was a significant predictor (p < 0.05) of balance problems, sleeping problems, and fatigue. Visual memory, visual motor speed, and cognitive efficiency index were poor predictors of injury severity. **CONCLUSIONS:** Reaction time and memory are common components of testing batteries for concussed athletes. In our sample, reaction time and verbal memory emerged as useful predictors of severity among patients suffering long-term symptoms of TBI. It may be of value for coaches and athletic trainers to establish baseline values at the onset of a competitive season.

A growing body of literature suggests athletes are at increased risk for acute musculoskeletal injury following return to play after concussion. The association between concussion and musculoskeletal injury has yet to be explored in this population. **PURPOSE:** To compare the proportion of acute lower extremity injuries between youth football players follow concussion and upper extremity injury. **METHODS:** Injury surveillance was conducted on 19 youth tackle football leagues (336 teams; 5,177 unique athletes; 6,799 athlete-seasons) from 2012-2015. Athletic trainers entered injury information into an electronic medical record, from data were de-identified and aggregated for analysis. Musculoskeletal injuries to the lower (at and distal to the hip joint) and upper (at and distal to the shoulder joint) extremities and concussions were identified. The proportion of subsequent acute lower extremity injuries was compared between athletes suffering one of two initial injuries: 1) Concussion, or 2) Time-loss (sport participation loss > 24 hours) upper extremity injury. Only musculoskeletal injuries in the same season as the index injury were analyzed. **RESULTS:** Of the 299 unique athletes who suffered a concussion, 14 had a subsequent same-season acute lower extremity injury (6.7%; 95% CI: 3.2%, 10.2%). Of the 141 unique athletes sustaining a time-loss upper extremity, 10 sustained a subsequent same-season acute lower extremity injury (7.1%; 95% CI: 2.7%, 11.5%). There was no difference in the proportion of youth athletes who sustained an acute lower extremity injury after concussion or time-loss upper extremity injury (p = 0.89; mean diff = -0.4%, 95% CI: -4.4%, 6.5%). **CONCLUSIONS:** This is the first study to examine musculoskeletal injury risk in youth football athletes following concussion. Although evidence suggests that high school, college, and professional athletes are at increased risk for musculoskeletal injury following concussion, no increased risk was observed in this sample of youth football players. Our findings may be limited by the short time span of the youth football season, providing limited opportunity for recovery. Despite these null findings, further research is needed to clarify the relationship between concussion and subsequent musculoskeletal injury in youth football athletes.

During a five-year span (2012-2016), head impact exposure of thirty middle school football players (12.6 ± 0.4 yr) was assessed during their 7th and 8th grade seasons while participating in a community tackle football program. Subjects played on the same team during their 7th and 8th grade seasons. Head impact frequency, severity (linear acceleration [LA]; rotational acceleration [RA]) and location during each practice and game were measured using the Head Impact Telemetry (HIT) system, consisting of a helmet-mounted accelerometry array. **RESULTS:** Mean head impacts per player were significantly higher in practices (7.4 vs. 5.8 impacts/ player; P = 0.035) but not significantly different in games (10.1 vs. 12.4 impacts/ player; P = 0.134) comparing the 7th to 8th grade seasons, respectively. Furthermore, from the 7th to 8th grade season, mean LA (25.30 ± 23.95 g; P = 0.345), median LA (20.77 ± 21.39 g; P = 0.225), mean RA (1741 rad • sec • g; P = 0.225) and median RA (1481 rad • sec • g; P = 0.538) did not differ significantly. Finally, no differences in distribution of head impacts by location (Front: 46% vs. 48%; P = 0.382; Top: 10% vs. 11%; P = 0.607; Back: 26% vs. 23%; P = 0.159; Right: 9% vs. 10%; P = 0.382; Left: 8% vs. 8%; P = 0.717) were found between the 7th and 8th grade seasons, respectively. **CONCLUSIONS:** Individual head impact exposure was similar during two consecutive seasons of youth football, despite increased age and playing experience during the second season. Thus, extrinsic factors such as game rules, practice structure and coaching style may have a greater influence on head impact exposure from year to year in youth football, making these aspects of play key targets for strategies aimed at reducing repetitive head impacts in this population.

Concussion may inflict widespread disturbance throughout the brain, including visual network impairments. The King-Devick (KD) test is a rapid number naming test of oculomotor functioning, however, it is limited to evaluating networks involved with saccadic eye movements and vergence. Recently, the Mobile Universal Lexicon Evaluating system (MULES), which requires object identification and color perception, was developed to encompass additional networks which may be a beneficial addition to concussion assessment. However, no published data describes MULES scores in an athlete-specific cohort. **PURPOSE:** To compare the relationship between KD and MULES scores in an athletic population. **Methods:** Twenty-nine ice hockey players (17.1 ± 3.3 years old, 27M/2F) completed both tests at baseline. The MULES consists of two cards, totaling 54 color recognition. These findings support the use of MULES in a clinical concussion testing battery, as it is also easy to administer and takes a short time to complete. Future studies should focus on MULES scores through concussion recovery.

Nearly 70% of US football players are younger than high school age, yet little is known about the potentially damaging effects of repetitive head impacts in this population. Cross-sectional studies indicate that head impact exposure increases with older levels of play; however little is known about changes in the same group of players from year to year. **PURPOSE:** To evaluate changes in head impact exposure among youth football players between their 7th and 8th grade seasons. **METHODS:** During a five-year span (2012-2016), head impact exposure of thirty middle school football players (12.6 ± 0.4 yr) was assessed during their 7th and 8th grade seasons while
Official Journal of the American College of Sports Medicine

Board #236 May 30 3:30 PM - 5:00 PM
Concussion recovery trajectories among U.S. Service Academy Members
Kathryn L. O’Connor1, C. Dain Allred2, Kenneth L. Cameron3, Darren E. Campbell4, Christopher J. D’Lauro5, Megan N. Houston6, Jonathan Jackson7, Brian R. Johnson8, Tim Kelly4, Gerald McGinty9, Patrick G. O’Donnell9, Karen Y. Peck10, Steven J. Svoboda11, Paul Pasquina12, Thomas McAllister13, Michael McCrea1, Steven P. Broglio, FACSIM, 1University of Michigan, Ann Arbor, MI; 2United States Air Force Academy, Colorado Springs, CO; 3United States Military Academy, West Point, NY; 4United States Coast Guard Academy, New London, CT; 5Unifomed Services University of the Health Sciences, Bethesda, MD; 6Indiana University, Indianapolis, IN; Medical College of Wisconsin, Milwaukee, WI. (Sponsor: Steven F. Broglio, FACSIM)

(no relevant relationships reported)

Purpose: Describe concussion/mild traumatic brain injury (mTBI) recovery durations by sex and injury-related activities in US Service Academy cadets.

Methods: Injury data (2014-2017) from three US Military Service Academies were analyzed to describe concussion/mild traumatic brain injury characteristics (n=800 injuries, 301 female). Of the documented injuries, there were 738 injured individuals, of which, 679 had one injury, 56 individuals had two injuries and three individuals had three injuries. The recovery trajectories for all injuries were examined across sex and injury activity. Three durations were examined: days until asymptomatic, duration of return to activity (RTA) protocol, and days of total time lost. Baroreflex sensitivity (BRS) was assessed at rest within 48 hours (48H) of concussion and 1 week (Wk1) later. Fast-Fourier transform was performed and power calculated from HR and SBP components across three trials (measured in centimeters) and the Senaptec Sensory Station scores were used to examine differences in baseline visual assessment measures in high school football players.

RESULTS: Data are presented as group mean ± 1 standard deviation (SD).

Table 1. Comparison of Clinical Variables Between the Control and Concussion Group

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control (n=100)</th>
<th>Concussion (n=64)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>17.4 ± 1.4 yrs</td>
<td>17.6 ± 1.3 yrs</td>
<td>0.796</td>
</tr>
<tr>
<td>Height</td>
<td>171.2 ± 6.4 cm</td>
<td>171.1 ± 6.2 cm</td>
<td>0.894</td>
</tr>
<tr>
<td>Weight</td>
<td>77.9 ± 12.4 kg</td>
<td>79.3 ± 11.1 kg</td>
<td>0.476</td>
</tr>
<tr>
<td>Head injuries</td>
<td>50%</td>
<td>56%</td>
<td>0.54</td>
</tr>
<tr>
<td>Time to asymptomatic</td>
<td>10 ± 3 days</td>
<td>12 ± 4 days</td>
<td>0.60</td>
</tr>
<tr>
<td>Duration of RTA protocol</td>
<td>9 ± 2 days</td>
<td>10 ± 3 days</td>
<td>0.49</td>
</tr>
<tr>
<td>Days of total time lost</td>
<td>18 ± 9 days</td>
<td>22 ± 11 days</td>
<td>0.16</td>
</tr>
<tr>
<td>Baroreflex sensitivity (BRS)</td>
<td>0.85 ± 0.16</td>
<td>0.81 ± 0.14</td>
<td>0.33</td>
</tr>
<tr>
<td>Visual impairments</td>
<td>10%</td>
<td>15%</td>
<td>0.35</td>
</tr>
</tbody>
</table>

Conclusion: There were no group differences in demographics, HR, SBP, LF-BP, LF-HR or MW HR at 48H or Wk1. At 48H, the concussion group had a significantly lower MW HR [p=0.03; 1.38 (1.11, 1.68) vs. 1.92 (1.64, 2.21) mmHg/hz] and CMW [p=0.01; -3.06 (3.35, -2.77) vs. -2.49 (-2.78, -2.20)] compared to the control group.

These group differences were gone by Wk1. CONCLUSIONS: These findings demonstrate that efferent autonomic discharge to the peripheral vasculature was reduced as evidenced by LF by the 2nd week following the 3D MOT versus with 3D MOT. Presented a dramatically greater discordance in autonomic discharge after concussion such that the majority of the concussion group distribution fell below the lower limit of the 95% CI of controls. Thus, the central autonomic mechanism(s) regulating MV discharge were discordant after concussion with apparent resolution by 1 week.

Board #238 May 30 3:30 PM - 5:00 PM
Effects of 3D Multiple Object Tracking on Head Impacts and Cognition in Ice Hockey
Lee Spahr, Erin Marchesseault, Daniel Nguyen, Jasmine Honey, Caroline Beals, John M. Rosene. University of New England, Biddeford, ME.

(no relevant relationships reported)

Ice hockey is a high intensity contact sport with elevated risk of injuries including concussion. Three dimensional multiple object tracking (3D MOT) has been proposed as an intervention to reduce the incidence of concussion, and potentially improve cognitive function. PURPOSE: The purpose of this study was to examine the effect of using 3D MOT on the frequency and force of head impacts and cognitive function (CTMT and Stroop) in men’s ice hockey. METHODS: Eight male collegiate ice hockey players (NCAA Division III) (mean age = 22.87 ± 1.46 yrs; mean ht = 177.48 ± 16.82 cm; mean wt = 90.31 ± 14.6 kg), had head impacts and cognitive function assessed throughout the regular season with 3D MOT versus without 3D MOT. Paired samples t-tests were performed to test for differences between first half (without 3D MOT) and second half (with 3D MOT) for all measures. RESULTS: Utilizing 3D MOT did not reduce the number of head impacts. With 3D MOT there was an increase in rotational force versus without 3D MOT (rotational acceleration (p = 0.001) 3.49 ± 2.31 vs. 3.88 ± 2.92 krads/sec2 respectively), (rotational velocity (p = 0.001) 16.21 ± 8.71 vs. 14.35 ± 8.38 krads/sec2 respectively) as well as force applied to the right side (p = 0.001) (13.10 ± 7.34 vs 16.67 ± 9.73 krads/sec2), and of the head (p = 0.019) (13.26 ± 8.40 vs 17.25 ± 9.43 krads/sec2). CTMT improved with 3D MOT (p = 0.004) (49.57 ± 35.97 vs 65.15 ± 36.36%), while Stroop had no significant differences. CONCLUSION: The use of 3D MOT during the second half of the competitive ice hockey season did not reduce the number of head impacts. The increase in rotational forces when using the 3D MOT may be attributed to the different time in the season that 3D MOT was utilized, where more aggressive play leading to higher forces was possible. CTMT improvement was not surprising as the CTMT measures all qualities the 3D MOT intervention improves, while the Stroop only measures working memory and opposition to distraction.

Board #239 May 30 3:30 PM - 5:00 PM
Baseline Visual Measures in High School Football Players With and Without Previous Concussion
Christina B. Vander Vegt, Johana K. Register-Mihalik, Vashoula T. Kostogiannis, Kody R. Campbell, Kevin M. Guskiewicz, FACSIM, Jason P. Mihalik. The University of North Carolina at Chapel Hill, Chapel Hill, NC. (Sponsor: Kevin Guskiewicz, FACSIM)

(no relevant relationships reported)

Visual impairments are common following sport-related concussion and may negatively affect athlete performance and safety if unresolved. PURPOSE: To examine differences in baseline visual assessment measures in high school football players with and without previous concussion. A secondary purpose was to examine the correlations between these assessments. METHODS: High school varsity football players (n=64, n=24 with concussion history) from a single high school (mean age=15.6±1.3 years) were enrolled in the study. Participants completed the following assessments prior to the start of the competitive football season: 1) three near-point of convergence (NPC) trials, 2) vision and sensory performance testing via the Senaptec Sensory Station, and 3) a demographic questionnaire. The independent variable was previous concussion history (with vs. without). Primary outcomes were average NPC across three trials (measured in centimeters) and the Senaptec Sensory Station scores for: visual clarity, contrast sensitivity, depth perception, near-far quickness, perception span, multiple object tracking, and hand-reaction time. Independent samples t-tests were used to examine differences in visual assessments between those with and without previous concussion. Pearson correlations examined the relationship between all Senaptec Sensory Station measures and average NPC at 3, 24, and 12 months following the previous concussion. RESULTS: Over half (62.5%) of those who reported a concussion history were discordant after concussion with apparent resolution by 1 week. To our knowledge, this is the first study to examine visual impairments following sport-related concussion. Over half (62.5%) of those who reported a concussion history were discordant after concussion with apparent resolution by 1 week. To our knowledge, this is the first study to examine visual impairments following sport-related concussion.
performance visual measures. Our data suggest that NPC and binocular visual clarity, while statistically correlated are clinically independent of one another and both warrant evaluation in assessing concussion.

### 5.7 days; HBO, therapy, all treatment and placebo groups returned to activity in a similar timeframe (HBO, ~ 13.7±5.1 days; HBA=13.0: 5.7 days; O2=19±16.5 days).

**Conclusion:** HBO, therapy may be an effective option to acutely treat post-concussion symptoms, particularly in young athletes presenting with high symptom burdens. Future research is needed to determine appropriate and standardized treatment protocols for HBO, therapy in this population following concussion.

**Supported by the National Operating Committee on Standards for Athletic Equipment**

**Meditation & Science in Sports & Exercise**

**Board #240 May 30 3:30 PM - 5:00 PM**

**The Affect of ADD on Baseline King-Devick and Clinical Reaction Time Performance In the Pediatric Population**

Paul J. Gubanich, FACSM1, Blake Simpson2, Eric W. Slattery2, Kelsey Logan1. 1Cincinnati Children’s Hospital Medical Center, Cincinnati, OH. 2Miami University, Oxford, OH. (No relevant relationships reported)

**PURPOSE:** It is estimated that 1.5-3.5 million concussions occur annually in the US related to sports participation. Recent studies of the King-Devick (KD) and Clinical Reaction Time Test (CRT) have shown promise in the diagnosis and management of concussive injuries in older teens and young adults. The purpose of this study is to evaluate if a history of ADD may affect the baseline performance and hence interpretation of these novel tests in the pediatric and adolescent population.

**METHODS:** Non-concussed, 6-18 year-olds were recruited from sports medicine clinics during evaluation of other conditions or during participation in their schools’ baseline concussion surveillance program. Participants who were felt to be limited in their ability to perform these tests due to comorbid conditions or injuries were excluded from the study. History of ADD or related medication use was assessed through review of the patient’s intake questionnaire or through examination of their past medical history and medication list as previously documented in the EMBR on the day of assessment. Subjects completed the KD and CRT tests as previously described in the literature.

**RESULTS:** 563 participants (333 M, 230 F) were included in the study. Participants (44) were categorized as having a diagnosis of ADD (20 M, 24 F). The average age in the normative group was 15.5 (±2.77) years in the ADD group. Baseline KD performance was 50.17 (±12.42) ms in the ADD group versus 48.54 (±11.89) ms in the normative group (p=0.43). CRT-RH was measured at 232.32 (±23.27) ms versus CRT-RH=223.89 (±22.71) ms (p=0.02) and CRT-LH=231.81 (±23.38) ms versus CRT-LH=224.75 (±22.75) ms (p=0.07) in the normative and ADD groups, respectively. Striatification by age group (6-13 vs. 14-18) did not reveal a difference in performance between groups on either test.

**CONCLUSIONS:** Baseline performance on the KD and CRT tests did not differ in this population of subjects with or without a history of ADD. Although limited by sample size, this study provides evidence that children with ADD perform similar to their peers on these baseline measures. Clinicians may therefore interpret these scores without adjustment. Additional factors which influence test performance need to be evaluated.

**Board #241 May 30 3:30 PM - 5:00 PM**

**Treating Pediatric Acute Sport-Related Traumatic Brain Injuries with Hyperbaric Oxygen Therapy: A Case Series**

Patricia R. Combs1, Robert C. Lynall1, Stephen W. Marshall1, Janna C. Fonseca1, James R. Stevens2, Jason P. Mihalki2. 1University of North Carolina at Chapel Hill, Chapel Hill, NC. 2University of Georgia, Athens, GA. (No relevant relationships reported)

Athletes often experience symptoms and neurologic deficits following sport-related concussion. Initial symptom burden is associated with longer recovery times. The current standard of care for concussed athletes includes cognitive rest and non-specific subthreshold physical activity until self-reported symptom resolve and objective concussion measures demonstrate clinical recovery. There is a paucity of treatment options beyond this wait-and-see approach. Hyperbaric oxygen (HBO2) therapy has benefited severe and moderate traumatic brain injury patients. It is unknown how HBO, therapy affects acute post-injury symptom burden and recovery time following concussion. **Purpose:** To explore the effect of HBO, therapy on reducing initial symptom burden in acutely concussed high school student-athletes compared to two different placebo treatments. **Methods:** Eight high school student-athletes suffering from sport-related concussion were randomly assigned into one of three blinded clinical intervention groups: 1) HBO, therapy (n=3); 2) hyperbaric therapy with compressed medical-grade air (HBA) (n=2); or 3) normobaric 100% O2 therapy (n=3). All groups completed five one-hour treatments within the first 10 days following their injury. Main outcome measures included change from initial post-concussion symptom burden and days until the physician (blinded to study group) permitted the student-athlete to return to activity. **Results:** The HBO2 treatment group experienced a considerably larger mean symptom reduction (A symptom score=15.7±5.4) than the HBA (A symptom score=−27.8) or O2 placebo treatment groups (A symptom score=−22) over the 5 treatment sessions. Despite the considerably higher symptom burden of those randomly assigned to the HBO2 therapy arm, all treatment and placebo groups returned to activity in a similar timeframe (HBO=13.7±5.1 days; HBA=13.0: 5.7 days; O2=19±16.5 days). **Conclusion:** HBO, therapy may be an effective option to acutely treat post-concussion symptoms, particularly in young athletes presenting with high symptom burdens. Future research is needed to determine appropriate and standardized treatment protocols for HBO, therapy in this population following concussion.

**Supported by the National Operating Committee on Standards for Athletic Equipment**

**B-71 May 30 1:00 PM - 6:00 PM**

**Free Communication/Poster - Exercise-Diabetes**

Wednesday, May 30, 2018, 1:00 PM - 6:00 PM

Room: CC-Hall B

**Board #243 May 30 2:00 PM - 3:30 PM**

**Maintenance of Health-Related Fitness Gains Following Underwater Treadmill Training in Adults with Type 2 Diabetes**

Ryan T. Conners1, John M. Coons1, Dana K. Fuller2, Youngdeok Kim1, Don W. Morgan, FACSM1. 1University of Alabama in Huntsville, Huntsville, AL. 2Middle Tennessee State University, Murfreesboro, TN. 3Texas Tech University, Lubbock, TX. (Sponsor: Dr. Don W. Morgan, FACSM) (No relevant relationships reported)

**PURPOSE:** To document short- and long-term effects of a 12-week aquatic exercise walking program on components of health-related fitness in middle-aged adults with type 2 diabetes.

**METHODS:** Thirteen adults with type 2 diabetes (age = 59.5 ± 4.5 y; 7 females, 6 males) completed 12 weeks of underwater treadmill training (UTT) (3d/wk’), followed by a 12-week follow-up period that involved no UTT. Exercise intensity and duration, which were initially set to 40-50% of heart rate reserve (HRR) and 30 minutes (three 10-min bouts) were systematically and progressively increased to 50-70% HRR and 60 minutes (three 20-min bouts) by week 12. During the follow-up period, study participants maintained their current diet and were given permission to perform any type or amount of physical activity except a formalized exercise program.
Primary outcome variables included cardiovascular function [resting heart rate (HR) and 6-min walk distance (6MWD)]; body composition [body mass (BM), body fat percentage (BF%), waist circumference (WC)]; and leg strength (peak hamstrings torque at 60°·sec⁻¹ and peak quadriceps torque at 30°·sec⁻¹). Baseline, post-UTT, and post-follow-up scores were analyzed using 1-way repeated measures analysis of variance.

**RESULTS:** Compared to baseline scores, significant (p < 0.05) improvements in cardiovascular variables (6MWD), body composition (decreased BM, BF%, and WC), and leg strength (greater peak hamstrings torque at 60°·sec⁻¹, and peak quadriceps torque at 30°·sec⁻¹) were observed after UTT. Three months following completion of UTT, positive changes in nearly all HRV variables (6MWD, BM, BF%, WC, peak hamstrings torque at 60°·sec⁻¹, and peak quadriceps torque at 30°·sec⁻¹) were maintained (p < 0.05) relative to baseline values.

**CONCLUSIONS:** Our findings indicate that improvements in HRV resulting from 12 weeks of UTT persist three months after cessation of UTT in middle-aged adults with type 2 diabetes.

---

**Board #244**
**A Bout of High-Intensity Interval Training Increases Serum Musclin in Adults with Metabolic Syndrome**

Jaime A. Gallo-Villegas¹, Leonardo A. Castro-Valencia¹, Miguel Alzate², Luis Valbuena³, Yeliana L. Sánchez¹, Juan C. Arístizábal⁴, Raúl Narváez-Sánchez⁴, Juan C. Calderón⁴

¹University of Antioquia, Medellin, Colombia; ²Politécnico Jaime Isaza Cadavid, Medellin, Colombia. ³Indeportes Antioquia, Medellin, Colombia.

(Nor relevant relationships reported)

Musclin is a myokine which induces insulin resistance (IR) in vitro, also proposed to favor aerobic capacity in marine models, which seems contradictory. Because of that, and since exercise contributes to improve IR in metabolic syndrome (MS) probably by regulating myokines, it is necessary to understand exercise’s role in regulating musclin in humans. **PURPOSE:** to study the effect of a bout of high-intensity interval training (HIIT) on serum musclin in adults with MS and IR. **METHODS:** 11 men and 4 women with MS and IR were evaluated in an experimental, pilot study. Musclin was measured by ELISA, and both glycemia and insulin by standard methods, at: (1) fasting conditions, (2) 60 minutes after a breakfast of 408 Kcal (55.1 g carbohydrates, 48.9 g fat, 13.4 g protein), and (50% of VO2max). Three minutes of warming up and cooling down at 3 MET intensity was always done. Data are presented as median (interquartile range). Comparisons were done with Friedman test. **RESULTS:** patients had an age of 52 years (45-59), a body mass index (BMI) of 26.8 kg·m⁻² (24.9-30.1), oxygen consumption (VO2max) of 34.6 ml·kg⁻¹·min⁻¹ (29.9-39.3) and HOMA-IR of 3.3 (2.2-4.3). Musclin values post-HIIT (709.6 pg·ml⁻¹ (585.2-833.9)) showed a trend to be higher than fasting (599.1 pg·ml⁻¹ (506.2-724.5), P=0.08) and reaching (593.0 pg·ml⁻¹ (466.4-918.2), P=0.061) conditions. Fasting musclin correlated with diastolic blood pressure during the HIIT bout (r=0.62, P=0.05). Insulin of 13.9 µU mL⁻¹ (10.4-16.6), 59.4 µU mL⁻¹ (23.1-159.8) and 30.8 µU mL⁻¹ (22.4-41.5) and glycemia of 102.4 mg·dl⁻¹ (89.9-108), 111 mg·dl⁻¹ (84.4-127.4) and 97.1 mg·dl⁻¹ (87.3-110.3), were measured at conditions 1 to 3, respectively. **CONCLUSIONS:** a bout of HIIT trend to increase circulating musclin in humans with MS and IR, which does not support the idea of a myokine that induces IR. Future experiments will test if the increase in musclin could be explained by an increase in insulin. Colciencias 11556238757, CODI 2605. Interinstitucional 2016-1341. Colciencias Doctoral scholarships 727-2015.

---

**Board #245**
**Time-efficient Sprint Interval Exercise Improves 24-h Glycemic Control In Men with Type 2 Diabetes**

Richard S. Metcalfe¹, Conor McClean², Sinead Fitzpatrick³, Gary McDermott⁴, Noel Brick⁴, Ben Fitzpatrick⁵, Gareth Davison⁶

¹Swansea University, Swansea, United Kingdom. ²Ulster University, Belfast, United Kingdom. ³Altnagelvin Area Hospital, Derry-Londonderry, United Kingdom.

(Nor relevant relationships reported)

**PURPOSE:** Reduced-exertion high-intensity interval training (REHIT) is a genuinely time-efficient exercise intervention that has been shown to improve aerobic capacity and blood glucose levels in individuals with T1DM. The acute effects of REHIT are not well established, particularly in individuals with T2DM. **METHODS:** 11 men with type 2 diabetes (mean ± SD: age, 52±6 years; BMI, 29.7±3.1 kg·m⁻²; HbA1c, 7.0±0.8 %) participated in a randomised four-trial crossover study, with continual interstitial glucose measurements captured during a 24 h period including: (1) no exercise (CON); (2) 20 min of continuous exercise (CE); (3) 10 x 1 min at ~90 HR₆₃ (HIIT, time commitment, ~25 min); and (4) 2 x 20 s ‘all-out’ sprints (REHIT; time commitment, 10 min). Nutritional intake and timings of consumption were standardised within participants. The 24 h monitoring period started prior to breakfast and the exercise was performed 30 min after breakfast. For comparisons 24 h glycemic variables were made using one-way repeated measures ANOVA and Holm-Sidak corrected t-tests for pre-planned contrasts (exercise conditions versus control). **RESULTS:** Compared with CON (HOMA-IR, 3.58±0.51 vs. 3.5±0.35; P=0.05 and d=0.55) and CE (7.7±1.1 mmolL⁻¹ vs. 7.0±0.6; d=0.35) lowered mean 24 h glucose, and this was largely driven by a markedly lowered glycaemic response (AUC) to dinner in both instances (11%, P=0.05 and d=0.8 for both). The prevalence of hyperglycaemia was reduced with all three exercise bouts compared with CON (REHIT: =112 min; CE: =115 min; HITT =125 min, all P=0.05, d=0.5), whilst measures of glycemic variability were not significantly altered. **CONCLUSIONS:** These data suggest that REHIT may offer a genuinely time-efficient alternative exercise option for improving 24 h glycemic control in men with type 2 diabetes.

---

**Board #246**
**The Acute Effects of Exercise Intensity on Blood Glucose Levels in Type 1 Diabetics**

Charles Fountaine, Christine Laughlin, Shane Blechering

University of Minnesota Duluth, Duluth, MN. (Sponsor: John R. Keener, FACSM)

(Nor relevant relationships reported)

For individuals with Type 1 diabetes mellitus (T1DM), regular physical activity is a fundamental strategy in the management of glycemic control. Previous studies have shown that continuous, moderate-intensity exercise in individuals with T1DM decreases blood glucose concentrations, often resulting in hypoglycemia, whereas vigorous-intensity exercise can increase blood glucose, impacting the risk of hyperglycemia. Sprint interval training (SIT), characterized by brief, all-out bursts of supramaximal exercise, has been shown to improve indices of cardiometabolic health, despite a minimal time commitment. However, the effects of low volume SIT on individuals with T1DM is largely unknown. **PURPOSE:** to contrast the acute effects of exercise intensity on blood glucose levels in Type 1 diabetics. **METHODS:** Four recreationally active college-age students with T1DM, completed a treadmill test to determine maximal aerobic speed (MAS), and performed each of the following 20-min treadmill-based protocols: 1) Moderate-intensity continuous training (MICT): 5min warm-up (WU), 10 minutes at 75% MAS, 5min cool-down (CD); 2) high-intensity interval training (HIIT): 5min WU, 1min at 90% MAS, 1min at 30% MAS repeated 5 times, 5min CD; 3) SIT: 5min WU, 30-sec at 120% MAS, 2min, 50-sec at 30% MAS repeated 3 times, 5min CD. Blood glucose was monitored via glucometer every 5 min during exercise and for 45 min after. **RESULTS:** A statistically significant decline in blood glucose was observed in both the MICT and HIIT conditions (p <0.001, respectively) but not in the SIT condition (p=0.696). From baseline to the 45 min mark, blood glucose decreased 37% in both the MICT (180±27 to 132±59) and HIIT (183±29 to 132±59) protocols, but only 11% in the SIT (193±41 to 165±70) protocol. **CONCLUSIONS:** The results of this study provide initial proof-of-concept that a low volume SIT protocol can maintain target blood glucose levels while exercising in individuals with T1DM.

---

**Board #247**
**Exercise Reduces Hba1c in Type 2 Diabetics, but Improved Strength Associates with Poorer Outcomes**

Cynthia Villalobos¹, Paul D. Vossl², J. Mark VanNess³, Courtney D. Jensen⁴

¹University of the Pacific, Stockton, CA. ²St. Joseph’s Hospital, Stockton, CA.

(Nor relevant relationships reported)

More than 25 million Americans have type 2 diabetes. Exercise is an effective method to prevent, delay, or manage the disease; however, fewer than 40% of patients report engagement in physical activity and more than 20% of this group underestimate their engagement. Structured exercise is warranted. Both aerobic and resistance training may be more effective than either mode in isolation, but studies reporting this are limited by their combined groups having greater volumes of exercise. **PURPOSE:** To evaluate different volumes of combined aerobic and resistance exercise on HbA1c levels in adults with diabetes. **METHODS:** 67 patients were randomly assigned to one of two groups: Group 1 performed supervised aerobic and resistance exercise twice per week. Group 2 performed the same exercise as Group 1 but also walked for 60 min on two additional days. At baseline, health history, seven tests of physical functioning, and measured cardiometabolic parameters, including HbA1c was performed. Following 10 weeks of exercise, follow-up data were collected. Independent-samples t tests compared baseline data of improvement between the two groups. Multiple linear regression tested predictors of improvement in HbA1c. **RESULTS:** Group differences at baseline were minimal. Patients in Group 2 were 4.7 years older (p=0.063), blood mass index was 3.3 points lower (p=0.058), and they walked an additional 72.7 minutes in the 6-minute walk (p=0.009). There were no differences in Abstracts were prepared by the authors and printed as submitted.
body fat percent (p=0.507), HbA1c (p=0.512), other cardiometabolic parameters, or the other six assessments of physical functioning. The patients who completed the exercise intervention improved in 13 of 15 assessments (p<0.05), including HbA1c (p=0.045). There were no differences in improvement between exercise groups. Regression analysis found elevated baseline body fat percent (p=0.001) and improvements in strength, assessed by arm curls (p=0.009) and grip strength (p=0.042) to correspond to poorer outcomes in HbA1c; the overall model was significant (R²=0.733; p=0.001).

**CONCLUSIONS:** Ten weeks of combined aerobic and resistance exercise improved cardiometabolic profiles of diabetic patients, including HbA1c. Additional volume of aerobic exercise did not enhance outcomes and improvements in strength associated with poorer outcomes.

987 Board #248 May 30 2:00 PM - 3:30 PM
The Effects Of Simulated Hypoxia Bouts On Resting Blood Glucose Levels And Hemodynamics Of A Type 1 Diabetic: A Case Study
Devin J. Rettke, Scott Drum, FACSM. Northern Michigan University, Marquette, MI. (Sponsor: Scott Drum, FACSM)

(No relevant relationships reported)

Individuals diagnosed with diabetes may choose adventure travel vacations at higher altitudes, thereby perturbing formerly controlled sea level (SL) blood sugar (BG) levels. **Purpose:** We sought to describe change in resting BG concentration, heart rate (HR), and mean arterial pressure (MAP) during repeat acute exposure to simulated altitude bouts in a type 1 diabetic (T1D) vs a non-diabetic (ND). We hypothesized T1D would encounter less stable readings on all variables. **Methods:** Two male participants (n=2), a T1D and ND, 22 and 23 years old, respectively, completed this case study. Participants, simultaneously, visited a lab on six different days [i.e., three days in a row one week (M, T, W) and the same three days the following week (M, T, W)]. They ingested the same meals the night before and day of (1.5-hrs before chamber use). At each visit, BG (Contour Next Link; Parsippany, NJ), HR (Polar, Lake Success, NY), and MAP (Briggs Healthcare, Waukegan, IL) were assessed at rest at SL and during 2-hr/bouts at 10-min intervals using a hypoxic chamber (Hypoxico Inc., New York, NY) set randomly to varying altitudes: SL; 915 m; 1,829 m; 2,743. m; 3,658 m; and 4,572 m. **Results:** For each variable, magnitude of change (Δ) was averaged over the 6 lab visits and compared across all variables. SL ABG (mg/dL), ABG (mg/dL), MAP (mmHg), and MAP (mmHg) for T1D and ND, respectively, were: 19, 16, 18, and 34, 18, 12. T1D maintained a more stable BG at SL over 6 days. When averaging the five altitude levels over 6 days, ABG (mg/dL), HR (bpm), and MAP (mmHg) for T1D and ND, respectively, were: 58, 9, 10, and 47, 9, 10. Notably, T1D had a less stable BG during hypoxic exposure. **Conclusion:** Simulated hypoxia perturbed BG to a greater extent in T1D. This could have practical application for when a T1D travels to higher, natural elevations, at which point they should more closely monitor their BG levels with normal food and fluid intake.

988 Board #249 May 30 2:00 PM - 3:30 PM
Effects of Aerobic Exercise on Plasma Metabolites in Prediabetes Subjects
Bowen Li,1 Mian Jia,1 Ningning Zhang,1 Chaojun Li,1 Yan Wang,1 XiaoBo Zhang,2 Juan Wang,1 Zhenghen Wang, FACSM.1 Beijing Sport University, Beijing, China. 2Beijing Hospital, Beijing, China. (Sponsor: Zhenghen Wang, FACSM)

(No relevant relationships reported)

**Objective:** Regular exercise can improve the insulin sensitivity in Prediabetes(PDM). However, the mechanisms remain unclear. This study aimed to examine the effect of aerobic exercise on PDM subjects plasma metabolites. **METHODS:** 24 PDM subjects were selected [mean age of (54.4±1.03) yr, body mass index of (25.7±3.8)kg/m², 8 males]. Each 10 age and sex-matched normal subjects and new-onset T2DM subjects were enrolled. PDM subjects received exercise (n=13) or health education (n=12) for 12 weeks. Exercise training: 3 times/week, 50 min per session at 40%–60% of of VO2 reserve. The body composition (dual-energy x-ray absorptiometry) and cardiorespiratory fitness (VO2 peak) were detected before and after exercise. Plasma metabolites were analyzed by using liquid chromatography/mass spectrometry (LC/MS). **RESULTS:** After training, the body fat percentage, 2-hour OGTT plasma glucose, and low density lipoprotein cholesterol of PDM patients were significantly reduced (by 4.6%, 16.22% and 9.27%, on average). The metabolic characteristics were significantly different before and after exercise; there were 31 enhanced metabolites (VIP > 1 and P < 0.05), of which 25 were increased and 6 were decreased. Main metabolites that changes with training included phosphatidicholine, lysocephatidylcholine, sphingomyelin, betaine, linoelic acid,oleic acid and docosahexaenoic acid. **CONCLUSION:** Aerobic exercise intervention has a marked effect on the plasma metabolites in PDM patients, which can improves the glucose and lipid metabolism by regulating the metabolic pathway of linoelic acid and phospholipid. These findings may lead to a better understanding of the mechanism of aerobic exercise in preventing T2DM. Supported by Key Projects of State General Sports Administration of China (2014B007),Specialized Research Fund for the Doctoral Program of Higher Education of China (20131112110002).

989 Board #250 May 30 2:00 PM - 3:30 PM
A Curious Relationship Between Obesity, Diabetes, and Dementia
Megan L. Darling1, J. Mark VanNess, Jonathan M. Saxe2, Michelle M. Amaram,1 Lewis E. Jacobson,2 Courtney D. Jensen1.1University of the Pacific, Stockton, CA. 2St. Vincent Hospital, Indianapolis, IN.

(No relevant relationships reported)

Among American adults (age ≥ 18), 36.3% have obesity, 9.3% have diabetes, and more than 4 million have dementia. These pathologies do not develop and progress independently. Compared to adults with a body mass index (BMI) less than 23, overweight adults (BMI>25) have a 10-fold increase in the odds of developing diabetes. In turn, body weight and diabetes appear to exert independent effects on the risk of dementia. More work is necessary to elucidate these relationships. **PURPOSE:** To assess the effects of obesity and diabetes on incidence of dementia. **METHODS:** We analyzed a hospital population that included 2,306 consecutively admitted patients. We conducted a health history, diagnosed cerebral, metabolic, and cardiovascular diseases, and measured anthropometric and cardiometabolic parameters. Chi-square tests analyzed rates of dementia among patients with and without obesity and diabetes. Logistic regression tested the effects of obesity and diabetes on odds of a dementia diagnosis, holding constant potential confounders. **RESULTS:** Across the total sample, 16.3% of patients were obese, 14.3% had diabetes, and 4.6% had dementia. Among obese patients, 26.0% had diabetes; 12.0% of non-obese subjects had diabetes (p<0.001). Among obese patients, 1.6% had dementia; 5.1% of non-obese patients had dementia (p=0.003). Among patients with diabetes, 8.8% had dementia; 3.8% of patients without diabetes had dementia (p<0.001). Logistic regression, holding age and history of stroke constant, found trends for obesity to reduce odds of dementia by 56% (p=0.079) and diabetes to increase odds by 63% (p=0.060). Sex (p=0.418), depression (p=0.608), mean arterial pressure (p=0.837), smoking status (p=0.920), and histories of heart attack (p=0.250), congestive heart failure (p=0.627), and peripheral vascular disease (p=0.943) were not significant. Among patients age ≥ 65 (n=724), 13.8% were obese, 27.2% had diabetes, and 14.0% had a diagnosis of dementia. The same logistic regression preserved its trends for obesity (OR=0.376; p=0.054) and diabetes (OR=1.600; p=0.079). **CONCLUSIONS:** Obesity appears to carry a protective role, lowering risk of dementia. Given the absence of a relationship with vascular disease, this is more likely a consequence of glucose, insulin, and amyloid metabolism.  

990 Board #251 May 30 2:00 PM - 3:30 PM
The Dose Effect of Whey Protein on Insulin Responses in Pre-Diabetic and Type 2 Diabetics
Todd J. Castleberry, Christopher Irvine, Michael Oldham, Matthew Brisebois, Sarah E. Deemer, Ryan Gordon, Aubrien Henderson, Vic Ben-Ezra. Texas Woman’s University, Denton, TX. (Sponsor: David Nichols, FACSM)

(No relevant relationships reported)

**BACKGROUND:** People with pre-diabetes and type 2 diabetes have shown an increase in insulin secretion after ingesting 55 g of whey protein coupled with a glycemnic challenge. However, the effect of lower amounts of whey protein on insulin responses remains unclear. Our hypothesis was that both 20 g and 30 g of whey consumption prior to an oral glucose tolerance test (OGTT) would produce an increase in insulin secretion, with 30 g producing the greatest increase compared to a control.

ACSM May 29 – June 2, 2018
Minneapolis, Minnesota
PURPOSE: The purpose of this study was to examine the effect of two different doses of whey protein ingested 30 min prior to a 50 g OGTT on glucose, insulin, C-peptide, and glucagon responses.

METHODS: Diabetic or pre-diabetic participants (n=9, mean ± SD; age: 64.3 ± 8.1 yrs; BMI: 29.4 ± 6.0 kg/m²; body fat percentage: 42.5 ± 7.8 %; fasting plasma glucose: 6.9 ± 1.2 mmol/l; HbA1c: 6.4 ± 0.6 %) completed three trials. The randomly assigned trials consisted of 250 ml of water (CON), 250 ml of water + 20 g whey (20g), and 250 ml of water + 30 g whey (30g), followed by an OGTT. Blood was collected at -30, 0, 15, 30, 60, 90, 120, and 150 min for the measurement of glucose, insulin, C-peptide, and glucagon. The whey protein mixture was administered immediately following the -30 min blood draw, and the 50 g OGTT began immediately following the 0 min blood draw. Glucose was analyzed using a YSI 2900D glucometer analyzer and insulin, C-peptide, and glucagon were measured via multiplex fluorescent detection (MagPhx). A one-way repeated measures ANOVA (<p>0.05) with a Bonferroni post hoc was used for statistical analysis for each dependent variable.

RESULTS: Integrated area under the curve (AUC) for glucose presented no difference between the 3 trials. Insulin AUC was significantly increased from CON to 20g (p=0.004, 36.3%), CON to 30g (p=0.002, 61.7%), and 20g to 30g (p=0.030, 18.6%). C-peptide and glucagon AUC significantly increased from CON to 20g (p=0.018, 20.6%); p=0.046, 33.1%) and CON to 30g (p=0.001, 30.1%; p=0.017, 33.7%)

CONCLUSION: Whey protein elicited a dose response on plasma insulin, increasing concentrations from CON to 20g, and 20g to 30g, however plasma glucose was unaffected. 20g and 30g displayed similar responses for glucagon. Neither 20 g nor 30 g of whey protein may be adequate to provide glycemic improvement in the disease management of type 2 or pre-diabetes.

B-72 Free Communication/Poster - Hypertension, Exercise Response, and Aging
Wednesday, May 30, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

991 Board #252
May 30 2:00 PM - 3:30 PM
A Bout Of Intense Exercise Cannot Substitute Antihypertensive Medication But When Combined, Enhances Medicine Actions.
MIGUEL RAMIREZ-JIMENEZ, FELIX MORALES-PALOMO, JUAN FERNANDO ORTEGA, RICARDO MORA-RODRIGUEZ. UNIVERSIDAD DE CASTILLA-LA MANCHA, TOLEDO, Spain
(No relevant relationships reported)

Purpose: We studied the blood pressure lowering effects of a bout of exercise and/or antihypertensive medication with the goal of studying if exercise could substitute or enhance pharmacologic hypertension treatment. Methods: Twenty-three hypertensive metabolic syndrome patients chronically medicated with angiotensin receptor blockade antihypertensive medicine underwent 24-hr monitoring in four separated days in a randomized order; a) after taking their habitual dose of antihypertensive medicine (AHM trial), b) substituting their medicine by placebo medicine (PLAC trial), c) placebo medicine with a morning bout of intense aerobic exercise (PLAC+EXER trial) and d) combining the exercise and antihypertensive medicine (AHM+EXER trial).

Results: In trials with AHM subjects had lower plasma aldosterone/renin activity ratio evidencing treatment compliance. Before exercise, the trials with AHM displayed lower systolic (130±16 vs 133±15 mmHg; P=0.018) and mean blood pressures (94±11 vs 96±10 mmHg; P=0.036) than trials with placebo medication. Acutely (i.e., 30 min after treatments) combining AHM+EXER lowered systolic blood pressure below the effects of PLAC+EXER (-8.1±1.6 vs -4.9±1.5 mmHg; P=0.015). Twenty-one hours monitoring revealed no differences among trials in body motion. However, PLAC+EXER and AHM lowered systolic blood pressures below PLAC during the first 10 hours, time at which PLAC+EXER effects faded out (i.e., at 19 PM). Adding exercise to medication (i.e., AHM+EXER) resulted in larger reductions in SBP that lasted most of the night (Figure 1).

Conclusion: One bout of intense aerobic exercise in the morning cannot substitute the long-lasting effects of antihypertensive medicine and glucagon. The whey protein mixture was administered immediately following the -30 min blood draw, and the 50 g OGTT began immediately following the 0 min blood draw. Glucose was analyzed using a YSI 2900D glucometer analyzer and insulin, C-peptide, and glucagon were measured via multiplex fluorescent detection (MagPhx). A one-way repeated measures ANOVA (<p>0.05) with a Bonferroni post hoc was used for statistical analysis for each dependent variable.

RESULTS: Integrated area under the curve (AUC) for glucose presented no difference between the 3 trials. Insulin AUC was significantly increased from CON to 20g (p=0.004, 36.3%), CON to 30g (p=0.002, 61.7%), and 20g to 30g (p=0.030, 18.6%). C-peptide and glucagon AUC significantly increased from CON to 20g (p=0.018, 20.6%); p=0.046, 33.1%) and CON to 30g (p=0.001, 30.1%; p=0.017, 33.7%)

CONCLUSION: Whey protein elicited a dose response on plasma insulin, increasing concentrations from CON to 20g, and 20g to 30g, however plasma glucose was unaffected. 20g and 30g displayed similar responses for glucagon. Neither 20 g nor 30 g of whey protein may be adequate to provide glycemic improvement in the disease management of type 2 or pre-diabetes.
observed for many of the body composition and diastolic BP variables. The differences observed for BMD and fat% may have been related to the number of years the OAAW had been running. These data suggest that greater physical activity participation by AAW can aid in managing many aspects of body composition. Since BP and fat% are cardio-metabolic risks for cardiovascular disease, an active lifestyle may aid in increasing the quality and perhaps the quantity of their lives.

When HIIT was compared to CAE, SBP was significantly decreased in HIIT (*p* < 0.05), but not in CAE, during exercise. DBP was significantly decreased in HIIT (*p* < 0.001), but not in CAE. DBP was significantly increased in HIIT (*p* = 0.001) and CAE, but only in HIIT, (*p* = 0.006). Finally, HIIT had no effect on systolic BP during the final minute of exercise. When HIIT and CAE were compared to PLA, there was a significant decrease in SBP and DBP in HIIT (*p* < 0.05), but not in CAE or PLA. No difference in the mean pre-exercise systolic ABP was 129.2 (120.3-138.1) vs 124.8 (116.7-132.9) and post-exercise systolic ABP was 126.3 (118.8-133.9) vs 122.8 (116-129.6) in normotensive and hypertensive subjects respectively (*p* = 0.07). Nighttime diastolic BP difference did not differ between AOX groups, whereby it increased in participants with low VO2max, while it decreased in those with average VO2max and high VO2max (*p* = 0.037). As well, post-exercise systolic BP variability was decreased in men but increased in women (*p* = 0.07). CONCLUSIONS: Healthy older normotensive and hypertensive subjects had similar post 24-hour systolic BP dipping. However, nighttime diastolic blood pressure as significantly different according to fitness level and systolic BP variability was reduced in men suggesting low fitness and male gender may alter BP response to maximal exercise in older adults.

Abnormal blood pressure (BP) response to maximal exercise may lead to compromised cardiovascular health. PURPOSE: To examine the 24-hour ambulatory blood pressure response in older adults following a maximal exercise treadmill test. METHODS: Ambulatory BP was recorded every 30 minutes (daytime) and 60 minutes (nighttime) on the day preceding and then 24 hours following a symptom limited maximal exercise treadmill test. Participants were a convenience sample of healthy older adults free of cardiovascular and musculoskeletal limitations who were participants in a community-based exercise program in London, Ontario, Canada. Symptom limited exercise was performed in the AM in a fasted state, during which VO2max was estimated. The study outcomes included mean systolic and diastolic BP (daytime, nighttime and 24-hour), as well as mean change in BP from daytime to nighttime (BP dipping), and BP variability (APV). Mixed between-within ANOVA was used in the statistical analysis, exploring main effects for time (pretest vs posttest), grouping factors (presence of hypertension [normotensive vs hypertensive], gender [men vs women], and fitness level [low, average and high VO2max]), and interaction effects for time *×* grouping factors.

RESULTS: 11 men and 9 women, mean age 71.5 (SD=5.4) years were included in the analysis. Mean VO2max was 34.8 (SD=7); 10 subjects had documented hypertension. No difference in the mean pre-exercise systolic ABP was 129.2 (120.3-138.1) vs 124.8 (116.7-132.9) and post-exercise systolic ABP was 126.3 (118.8-133.9) vs 122.8 (116-129.6) in normotensive and hypertensive subjects respectively (*p* = 0.07). Nighttime diastolic BP dipping differed according to VO2max groups, whereby it increased in participants with low VO2max, while it decreased in those with average VO2max and high VO2max (*p* = 0.037). As well, post-exercise systolic BP variability was decreased in men but increased in women (*p* = 0.07).

CONCLUSIONS: Healthy older normotensive and hypertensive subjects had similar post 24-hour systolic BP dipping. However, nighttime diastolic blood pressure as significantly different according to fitness level and systolic BP variability was reduced in men suggesting low fitness and male gender may alter BP response to maximal exercise in older adults.

**Post-isometric Exercise Hypotension After Moderate Intensity Handgrip Exercise In Hypertensive Elderly**

**MILTON R. MORAES1, VIVIAN E. MORAES1, JOYCE B. VICENTE1, GEIZIANE R. MELO2, RAFAEL R. OLHER1, IORRANY C. SOUSA1,2, LUIZ H. PERUCHI1, RODRIGO V. NEVES1, THIAGO S. ROSA1, APARECIDO P. FERREIRA1, LUIZ R. SOUZA1,1 CATHOLIC UNIVERSITY OF BRASILIA BRASILIA, Brazil. 2University of Mogi das Cruzes, Mogi das Cruzes, Brazil. (No relevant relationships reported)

Hypertension is common in people aged 65 or more. The isometric handgrip (IHG) is a model of effective exercise in reducing blood pressure (BP). However, the mechanisms involved in post-isometric exercise hypotension (PIEH) are not well understood. Hydroxyethylriamine (NO) is a potent vasodilator and may be involved in PIEH. PURPOSE: To determine the response hypotensive and mechanism involving in older with arterial hypertension. METHODS: Ten sedentary hypertensive elderly (73.2±2.2 years), underwent two experimental sessions using a portable isometric handgrip dynamometer Jamar: (i) sham session with 3 percent of maximal voluntary isometric contraction (MVIC), and (ii) experimental isometric session with 30 percent of MVIC, total of 8 sets of 1 min contraction and 1 min rest period. The BP and heart rate (HR) were evaluated at rest and post-exercise (1, 5, 10, 15, 30, 45 and 60 min). Saliva samples were collected at rest, 0, 30 and 60 min post-exercise. RESULTS: Systolic BP (SBP) presented a reduction from the 10th min post-exercise to 30 percent MVIC (p = 0.05). At 60 min post-exercise the SBP was lower 30 percent vs. 3 percent MVIC (p = 0.006). There were no differences for diastolic BP, mean arterial pressure, HR and NO metabolites. The results demonstrated that IHG exercise at 30 percent MVIC was tolerated by elderly individuals and induced an PIEH for up to 60 min, but there was no association significant NO with PIEH. Yet, portable equipment of cost-effective, easy performance and short duration can be an excellent adjuvant strategy in the control and prevention of arterial hypertension in elderly. Supported by FAPDF Grant 032015 193.000.963

**Post-isometric Exercise Hypotension After Moderate Intensity Handgrip Exercise In Hypertensive Elderly**

**MILTON R. MORAES1, VIVIAN E. MORAES1, JOYCE B. VICENTE1, GEIZIANE R. MELO2, RAFAEL R. OLHER1, IORRANY C. SOUSA1,2, LUIZ H. PERUCHI1, RODRIGO V. NEVES1, THIAGO S. ROSA1, APARECIDO P. FERREIRA1, LUIZ R. SOUZA1,1 CATHOLIC UNIVERSITY OF BRASILIA BRASILIA, Brazil. 2University of Mogi das Cruzes, Mogi das Cruzes, Brazil. (No relevant relationships reported)
PURPOSE: The aim of this study was to compare the antihypertensive effects of isometric handgrip exercise (IHE) versus aerobic exercise (AE) on office, central and 24-h ambulatory blood pressures in elderly hypertensive patients. METHODS: We conducted a randomized controlled trial with a three-arm design. Thirty-seven elderly hypertensive patients (mean age 69±6 years) were randomized to IHG (n=12), AE (n=9), or no-exercise control group (n=12) for 12 weeks. Bilateral IHG training was performed at 30% of maximal voluntary contraction using a digital handgrip device. AE training was performed brisk walking for 30-min at moderate intensity with 3 times per week. Resting office, central, and 24-h ambulatory blood pressures were obtained at baseline and after intervention. RESULTS: No group differences were found at baseline for any variable. Following 12 weeks, resting office blood pressures decreased in both IHG and AE groups (IHG: SBP 135±14.1 to 125.8±9.9 mmHg (p=0.004), DBP 84.8±8.5 to 79.6±5.8 mmHg (p=0.005); AE: SBP 130.3±13.3 to 123.1±8.1 mmHg (p=0.022), DBP 80.5±7.0 to 76.8±5.0 mmHg (p=0.037)), without any improvement in the control group. Furthermore, central SBP (122.0±13.5 to 117.9±8.9 mmHg (p=0.05)) and mean 24 h ambulatory DBP (80.3±8.8 to 75.6±7.2 mmHg (p=0.021)) decreased only in the IHG group, but not in the AE or control groups. CONCLUSIONS: These findings suggest that both IHG and AE training reduces resting office blood pressure, but only IHG training is effective in improving central and ambulatory blood pressures. Thus, IHG training may be an alternative antihypertensive therapy for the elderly hypertensive patients.

PURPOSE: To compare the effects of 12 wks of whole-body vibration training (WBVT) on strength, body composition, and functional performance in 20 (16 female) pre-frail and frail skilled nursing home residents (82±5 yrs).

METHODS: Participants were screened for frailty syndrome using the FRAIL scale. Isometric knee extension strength (KE) was measured using a mechanical push-pull dynamometer. Bioelectrical impedance analysis was used to measure lean mass (LM) and fat mass (FM). The short physical performance battery (SPPB) was used to assess function. Participants were assigned to 12 wks of WBVT (2x/wk) or CON. WBVT was well tolerated and occurred without adverse health complications. WBVT can be used to counteract losses in leg strength. Interventions of greater frequency and duration may help improve functional performance in pre-frail and frail older adults. WBVT was well tolerated and occurred without adverse health complications. WBVT can be used to counteract losses in leg strength. Interventions of greater frequency and duration may help improve functional performance in pre-frail and frail older adults. This study was supported by grants from the College of Human Sciences and FSU.
Post-exertional malaise (PEM) is an exacerbation of symptoms that leads to a reduction in functional ability. Recognizing the triggers, onset, symptoms and duration of PEM is important for the diagnosis of Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS). PEM following serial exercise tests has not been examined.

**Purpose:** To compare descriptions of symptoms by ME/CFS and control subjects following serial exercise tests, after two maximal exercise tests, each separated by 24 hours.

**Methods:** Open-ended questionnaires were provided to 11 control subjects and 49 ME/CFS patients who underwent two maximal exercise tests, 24 hours apart. Each subject evaluated how they felt immediately after the first exercise test, before and immediately after the second exercise test, and in the week following the tests. Responses were analyzed and categorized by two reviewers, blinded to subject diagnosis. Repeated measures ANOVA was used to examine differences between groups. Results: Over the two days of testing, ME/CFS subjects reported an average of 15.4±7.7 symptoms compared to 5.5±1.8 in the control group. Following the tests, ME/CFS subjects reported an average of 5.0±2.8 symptoms compared to 0.1±0.3 in the control group. Among the ME/CFS subjects, fatigue, cognitive dysfunction, and sleep problems were reported with the greatest frequency. Out of the eighteen symptom categories, ME/CFS subjects reported seventeen at a higher frequency than control subjects. The largest differences were observed in cognitive dysfunction, headache, light-headedness, muscle/joint pain and weakness. Other symptoms included decreased function, pain, flu-like and gastrointestinal symptoms. Forty-nine percent of ME/CFS subjects recovered within an average of 4.5 days while fifty-one percent had not recovered by day seven. In contrast, all but one control subject recovered within 1 day. Conclusion: A standardized exertional stimulus produces prolonged and more diverse symptoms in ME/CFS subjects compared with those seen in control subjects. Understanding PEM more comprehensively may provide clues to the underlying pathophysiology of ME/CFS and lead to improved diagnosis and treatment.

**Purpose:** The metabolic cost of walking increases with age, but the effect of functional status that accompanies aging remains unknown. The purpose of the study was to compare the metabolic cost of walking between low functioning (LF) and high functioning (HF) older adults.

**Methods:** Ten HF and ten LF older adults (70+ years), pair matched by age (± 3 Yrs) and gender, were categorized using the Short Physical Performance Battery (SPPB) that ranks participants from 0 (worst performance) to 12 (best performance) based on balance, walk speed, and chair stand tests. High functioning participants scored ≥10 (11.5 ± 0.7) and low functioning participants scored <8 (6.06 ± 1.4). Participants walked over ground at self-selected usual and rapid paces. Participants also walked at a standard pace on the treadmill at 0.76 m/s. Respiratory gases were measured using a portable indirect caloriometer. Gross metabolic rate was defined as W/L-kg/min. Metabolic cost was calculated as gross metabolic rate by walking speed (W.L- kg/min/m). Peak energy expenditure was measured during a graded exercise treadmill test to normalize walking metabolic rate (e.g. walking metabolic rate as a percent of peak metabolic rate).

**Results:** Peak VO2 values were 34.7 ± 7.4 ml/kg/min for LF and 48.7 ± 12.1 ml/kg/min for HF (p = 0.015). There was a statistically significant difference in VO2 between HF and LF at 70% of peak VO2. HF had a reduction in VO2 by 8.03 ± 1.45 ml/kg/min at 70% VO2, compared to LF at 11.23 ± 1.45 ml/kg/min. The effect of RPM on energy cost revealed VO2 at 70% of peak VO2 was significantly lower than the constant of 7 ml/kg/min used in ACSM's metabolic cycling equation. This may have negative health implications when prescribing a constant level of exercise intensity, particularly for low-level exercise in a clinical population.
B-73
Exercise is Medicine®/Poster - EIM: Exercise and the Older Adult

Wednesday, May 30, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

1006
Board #267
May 30 3:30 PM - 5:00 PM
Comparative Th1 Th2 of Elderly Women Engaged in a Program of Resistance or Aerobic Exercise
Otavio Machado1, Maria Elizabeth Pereira Passos1, Heloisa Helena de Oliveira1, Vinicius Leonel Diniz2, Laiane Cristina dos Santos1, Mariana Mendes de Almeida1, Eliane Borges da Silva1, Cesar Miguel Momeso1, José Paulo de Moraes Junior2, Evandro Diniz Corvino2, Luiz Francisco Kiliann2, Renata Gorjao3, UNICEL, SAO PAULO, Brazil. 2FEPSO, SOROCABA, Brazil.

(No relevant relationships reported)

It is well-known the alterations that occur in the immune response with aging that can generate an imbalance of the immune response leading to a low-grade chronic inflammation. Some studies have described the decrease in proliferative capacity of Th1 cells in elderly. The imbalance between Th1 and Th2 cells seems to play a role in the development of autoimmune and inflammatory diseases. PURPOSE: Therefore, the aim of this study was to evaluate Th1 and Th2 responses and verify Th1/Th2 ratio in elderly women engaged in different exercise programs. METHODS: Initially, 27 elderly women (65±3.2 years old) were selected and distributed into four groups accordingly to exercise program that they practiced: 1. sedentary (SED), 2. resistance training practitioners (RE), 3. aerobic exercise practitioners (AE) and 4. resistance and aerobic exercise practitioners (RAE). Th1 and Th2 cell populations were assessed by flow cytometry. RESULTS: Th1 response was higher in RE groups (RE, 16.7±5.8% ; RAE 15.7±4.7%) when compared with AE (12.5±2.9%) and SED (12.9±4.4%). Inversely, Th2 had a trend to decrease in exercise programs (SED, 10.4±5.3; RAE, 9.2±4.9; AE, 11.9±5.3; RE, 4.9±2.4 %) Finally, the Th1/Th2 ratio was higher in RE (3.2±1.4) versus RAE (2.2±1.4), AE (1.9±1.0) and SED (1.3±0.3). CONCLUSIONS: Increased Th1/Th2 ratio was due to a higher response of Th1 cells and lower response of Th2 cells. These findings suggest an improvement in Th1 response in elderly women engaged in exercise program, mainly in resistance exercise groups.

1007
Board #268
May 30 3:30 PM - 5:00 PM
The Effects Of Core Muscle Training Combined With Lower Limbs Strengthening On Physical Fitness Of community Elderly
YU-TSAI TU, Hsiang-Ying Hsueh, Feng-Chiao Lo, Mu-Jung Kao. TAIPEI CITY HOSPITAL, TAIPEI, Taiwan.

(No relevant relationships reported)

According to the long-term care service planning proposed by the Ministry of Health and Welfare in Taiwan, 90% of the aging population requiring long-term care service would also require community-based or home-based care. The strength of lower limbs and core muscle plays important role in prevention against fall behavior, especially for the community elderly. PURPOSE: To evaluate the physical fitness of the elderly in local community care-concern center in Taiwan, a four-month course of regular core muscle training and lower limbs strengthening was conducted.METHODS: Four elderly (Age: 66-16.1 years of age; Body height: 156.7±6.6 cm; Body weight: 62.5±13.7 kg) without any serious illness were included in this study. The training of core muscle training and lower limbs strengthening last for four months with 3 sessions per week, 60 min per session, and an intensity of 5-6 on the Ratings of Perceived Exertion scale. Physical fitness was evaluated one week before and after the intervention. Data of multiple variables were collected by using questionnaire and examination on functional fitness including grip, two-min step test, back scratch test, and 8-foot up-and-go test. The ranges of motion and isometric strength of lumbar spine and knee were measured by the microFE3T. Descriptive statistics, independent sample t-test, and paired-samples t test were used to evaluate the effects of the intervention. RESULTS: The results showed significant improvement after the 4-month course in back scratch test, 2-min step test, chair sit-and-reach test, and isometric strength of lumbar spine and knee (p < 0.05). Among the other tests, no significant differences were observed. CONCLUSION: Core muscle training combined with lower limbs strengthening for community elderly can improve physical fitness and isometric strength of low back and knee.

1008
Board #269
May 30 3:30 PM - 5:00 PM
Multicomponent Exercise Program Effects On Functional Capacity And Cognition In Frail Hospitalized Patients
Mikel Lopez Saez de Asteasu1, Nicolas Martinez-Velilla2, Alvaro Casas-Herrero3, Fabricio Zambom-Ferrareis2, Francisco Antonio Amu-Ruiz4, Javier Alonso-Renedo2, Mikel Izquierdo1. 1Public University of Navarre, Pamplona, Spain. 2Complejo Hospitalario de Navarra, Pamplona, Spain.

(No relevant relationships reported)

Frail older adults have reduced functional and physiological resources, rendering them more vulnerable to the effects of hospitalization, which frequently results in failure to recover from functional decline related to the hospitalization and new disability. PURPOSE: To analyze the effects of a multicomponent exercise program on functional capacity and cognition in frail hospitalized patients. METHODS: Randomized clinical trial conducted in 326 patients admitted in an Acute Care Unit were randomly assigned to the intervention (IG) or control group (CG). The intervention consisted of a multicomponent exercise training program, composed of supervised progressive resistance exercise training at low-moderate intensities 30-60%RM (Repetition Maximum), balance training, and walking for 5-7 consecutive days. Evaluations of functional capacity (Short Physical Performance Battery (SPPB), Gait velocity Test (GVT), GVT under dual task conditions, Barthel index), strength assessments; maximal isometric force of handgrip (HG), knee extension and hip flexion, IRM test and knee extension exercises, and cognitive tasks; Mini Mental State Examination (MMSE), Trail Making Test Part A (TMT-A) and verbal fluency test were conducted at admission and previous to discharge in both groups. RESULTS: 326 completed pre/post evaluations (IG n= 126, CG n=141). Drop-out rate was 18%. In the IG, significant improvements were observed at discharge in all the functional capacity outcomes (SPPB 4.4 vs. 7.0 points, GVT 14.1 vs. 19.0s., Verbal GVT 17.6 vs. 13.2s., Arithmetic GVT 17.6 vs. 12.9s., p<0.001 and Barthel score 83.8 vs. 85.9 points p<0.05) strength measurements (HG 17.2 vs. 18.8kg., knee extension 97.8 vs. 112.7N., hip flexion 90.8 vs. 104.4N., IRM knee press 57.7 vs. 76.3kg., IRM chest press 24.2 vs. 28.45s., IRM knee extension 38.5 vs. 47.0s, p<0.001) and cognitive tasks (MMSE 22.1 vs. 24.3 points, TMT-A 154.6 vs. 121.3s., verbal fluency 6.0 vs. 8.0 words, p<0.001). In contrast, in the CG, no significant improvements were found in those outcomes. CONCLUSIONS: A multicomponent exercise program, with special emphasis in progressive resistance training, is an effective therapy to improve functional capacity and cognitive function in frail patients during hospitalization.

1009
Board #270
May 30 3:30 PM - 5:00 PM
Correlation Between One-leg Standing Time and Trail Making Test in Japanese Older Adults
Yasuo KIMURA1, Kazuko OHKI3, Mamoru HISATOMI1, Mieko SHIMADA1, Nobuko K. HONGU4, 1Inst. Fitness & Health Sciences, Toshioka, Tokyo, Japan. 2Sagamihara Jogakuen University, Nagoya, Japan. 3Chiba Pref. University of Health Sciences, Chiba, Japan. 4The University of Arizona, Tucson, AZ.

(No relevant relationships reported)

PURPOSE: For older adults maintaining the ability to control balance is closely associated with the risk of falling, an independent mobility, including walking, and engagement with active life. The aim of this study was to examine the one-leg standing time with eyes open and its association with physical, cognitive, and psychological functions in community-dwelling older adults residing in Japan. METHODS: Sixty-five women aged 65 years and over (mean age 73±7 yrs.) participated in the study. They were being involved in habitual physical activity at least once a week for three months prior to the study. At the first assessment session, participants completed a demographic questionnaire and one-leg standing balance test. The participants were then divided into two groups according to time of one-leg standing time with eyes open: 1) longer than 15 seconds (n=46, high group - HG: 75.4±61.7 sec.) and 2) shorter than 15 seconds (n=19, lower group - LG: 7.8±13.0 sec.). All participants performed hand-grip strength (HGS), chair-stand (CS), timed up-and-go (TUG), 10-m maximal gate speed (MGS), mini-mental state examination (MMSE), and trail making test (TMT). Data were analysed using unpaired t-test and ANCOVA. RESULTS: For all participants the mean length of one-leg standing time was 60.2±45.2 sec. (2 - 120 sec.). Significant difference (p<0.05) were observed between two groups: age (HG: 70.3±3.4, LG: 72.3±3.6 yrs.), HGS (HG:24.9±3.8, LG:22.2±5.8 kg), CS (HG:8.0±2.1, LG:9.0±2.2 sec.), TUG (HG:5.2±1.0, LG:5.7±0.8 sec.), MGS (HG:1.82±0.24, LG:1.69±0.28 sec./m), MMSE (HG:28.4±1.8, LG:26.9±2.2 score). After adjusting for age, the only significant difference (p<0.05) observed between the two groups was for TMT (HG:99.5±23.0, LG:119.8±49.3 sec.).
Exercise treatment is recommended for older patients with lumbar spine diseases that result in degeneration of muscles and the skeletal system and a resultant decline in function. However, it is often difficult for patients to exercise by themselves and assistance from an exercise professional can be valuable to maintain health status and improve quality of life. PURPOSE: This study was designed to evaluate the effect of personalized exercise instruction on changes in body composition, physical fitness and pain management in older adults with degenerative lumbar spinal disorders (DLSD).

METHODS: Three individuals (Range, 66-78 yrs), who no prior experience with a personal trainer and who reported chronic low back pains for more than 12 weeks, participated in the study. This study was conducted by a researcher and a professional personal trainer who had more than 10 years’ experience in the personal training area. The data was collected by employing a single-subject, ABA repeated measure design. In addition, schematic analysis was utilized to visualize the changes of participants’ body composition, physical strength and rating of perceived pain. A paired t-test using SPSS 20.0 was employed to examine before-and-after differences for key outcome measures. RESULTS: The results showed that muscle mass was increased and body fat mass and central obesity were decreased at the end of phase II, which coincided with the period of supervision by the personal trainer. Additionally, there were statistically significant changes in strength of upper and lower extremity, cardiovascular endurance, upper and lower body flexibility and the rating of perceived pain. CONCLUSIONS: This study resulted in better understanding of the role for individualized instruction by exercise professionals for older adults with degenerative lumbar spinal disorders. Furthermore, the results may have some applicability to the design and implementation of future personal training programs for seniors with similar conditions.

The benefits of regular physical activity on health, fall prevention, and quality of life are widely recognized. However, only a small percentage of older adults meet the current recommendations for aerobic exercise and strength. Primary care providers are in a unique position to counsel patients about exercise and provide them with exercise locations and prescription. PURPOSE: The aim of this study was to assess the perceptions of health care providers regarding knowledge and confidence to assess and counsel older adult patients about physical activity and fall prevention. METHODS: One hundred and twenty health care providers in Pierce County, Washington received a link to an online survey. The survey consisted of 35 questions including demographic and general practice questions, and questions that assessed knowledge and counseling practices of primary care providers about physical activity and fall prevention. Chi-square was used to determine if categorical variables differ from one another. Significance was set at p < 0.05. RESULTS: Thirty-four (28.3% response rate) individuals responded to the questionnaire. Most of the respondents were female (66.6%), and 89.1% indicated that they routinely counsel their patients to participate in exercise programs, only a small percentage of respondents described their knowledge of fall prevention assessment and management as “not very knowledgeable” to “somewhat knowledgeable.” Most of the health care providers (68.8%, χ2 = 2.25, p = 0.13) indicated that they routinely administer fall risk screening. CONCLUSION: These results show that while half of these primary care providers counsel their patients to participate in exercise programs, only a small percentage of them refer their clients to an exercise specialist. Furthermore, the lack of knowledge of the Exercise is Medicine® initiative and website by health care providers indicates the importance of further education of health care providers.

Due to the increased burden of chronic disease, prescription medication use in older adults is high. This rise in the use of multiple medications (polypharmacy) is concerning due to its relationship with adverse drug related events (ADEs), drug-drug interactions, and increasing healthcare costs. Level of physical activity (PA) and habitual dietary nutrient intake are lifestyle factors that correlate with medication use and associated complications. The PURPOSE of this study was to identify correlates among PA level measured subjectively and objectively, habitual dietary nutrient intake, and prescription medication use in older adults.

METHODS: In 96 older adults (58F, 38M, 77±7 years) prescription medication use (Rx), subjective PA level (Community Healthy Activities Model Program for Seniors, CHAMPS), and objective PA level (Accelerometer, Actical, Philips Respiroscins) were measured. In a subset of 73 subjects, habitual dietary intake of nutrients was assessed (3-Day Diet Log). Partial correlations were run between variables while controlling for age, sex, and body mass index (BMI). Significance was set to p < 0.05. RESULTS: Mean ±SE for the variables include: moderate-to-vigorous subjective PA (MVPA-S): 1353±120 kcal·wk⁻¹, moderate-to-vigorous objective PA (MVPA-O): 51.2±5.1 min·day⁻¹; Rx number: 3.4±0.3; total caloric intake: 2107±64 kcal·d⁻¹; and percent polyunsaturated fatty acid (PUFA) intake: 10.4±1.7 g·kcal⁻¹ of diet. Rx was inversely correlated with MVPA-S (r = -0.24, p < 0.05) and with MVPA-O (r = -0.31, p < 0.05). MVPA-S and MVPA-O were modestly correlated (r = 0.64, p < 0.01). Rx number was inversely correlated with percent dietary intake of PUFA (r = -0.31, p < 0.01). There were no significant correlates between Rx and other nutrients. CONCLUSION: Preliminary data show that Rx use in older adults is inversely associated with subjectively and objectively measured PA level. These data also show a strong correlation between the subjective and objective measures of PA, which could be important when looking at measurement possibilities in clinical settings and for future studies. Additionally, these data show an inverse correlation with Rx number and PUFA. These preliminary data suggest that lifestyle factors may significantly influence Rx use and associated complications.
Lower limb proprioception, muscle strength and standing balance are all proposed as important factors in relation to mobility of the elderly. However, it is not clear what the relative contributions are for hip, knee and ankle proprioception, and strength and postural sway.

**PURPOSE:** To determine the relative contributions of proprioception at each lower limb joint, muscle strength and standing balance, to mobility in community-dwelling older adults.

**METHODS:** A group of 102 community-dwelling adults, with mean age of 68.4 years, volunteered. Hip, ankle and knee joint proprioception were measured in standing using joint-specific versions of the active movement extent discrimination apparatus (AMEDA). Muscle strength was determined by grip strength with a hand dynamometer as a proxy variable, and bipedal postural sway was assessed via the Biodex Balance System, tested in anterior-posterior and medio-lateral directions, with eyes open and with eyes closed. Mobility was measured using the timed-up-and-go test (TUG).

**RESULTS:** TUG scores for the group were significantly worse with low ankle proprioception (r = -0.29, p < 0.01) and low hand grip strength (r = -0.25, p = 0.01), and across age in years, TUG scores showed an inverted-U shaped function (p < 0.001) with the greatest decline after 75 years of age. From multiple regression, ankle proprioception was shown to be the most important factor in predicting TUG performance (Adj R² = .13, p < 0.001).

**CONCLUSIONS:** Results here add a specific proprioceptive component, ankle proprioception in standing, to the known association of strength with mobility in the elderly. Further, these results suggest that to effectively improve mobility in the elderly, and reduce falls risk, intervention methods should focus on improving ankle proprioception ability as well as increasing strength.
More than 5 million Americans live with dementia; it affects 10% of the population over age 65. There is no cure, but recognition of risk factors could be helpful for prevention. Identifying demographic, genetic, and behavioral risk factors can improve the prescription of lifestyle choices, such as exercise training, to minimize risk.

**Purpose:** To evaluate predictors of dementia in a patient population. **Methods:** We obtained the patient registry of a hospital in the Midwestern United States. Demographic data, vital signs, health history, and current diagnoses were recorded. There were 2,244 consecutive patients admitted over a 3-year period who met inclusionary criteria; 105 of these patients had a diagnosis of dementia. Logistic regression tested the effects of age, sex, vital signs, and diagnostic history on incidence of dementia in this sample. **Results:** Significant predictors of dementia were age (p<0.001), diastolic blood pressure (p=0.048), core temperature (p=0.040), presence of a bleeding disorder (p=0.028), and diagnosis of a previous stroke (p=0.001). For each degree F that core temperature increased, the odds of dementia were elevated by 44% (95% CI: 1.02 to 2.05). A history of stroke was the most pronounced predictor of dementia (95% CI: 1.89 to 7.57). When history of stroke was analyzed as the dependent variable, core temperature continued to be a significant predictor (p=0.025); holding all other variables constant, each additional degree F associated with a 48% elevation in the odds of a stroke (95% CI: 1.05 to 2.10). **Conclusion:** Age and cardiovascular function are known risk factors for strokes, and strokes are a known risk factor for dementia. In this sample, core temperature emerged as the significant predictor of both stroke and dementia. While poor thermoregulation may be a consequence, rather than a cause, of dementia, a possible consideration is the relationship between heat in the brain, cerebral oxygen demand, and blood brain barrier permeability. The brain’s energy demand is several orders of magnitude greater than other body cells, and thus temperature dissipation for the brain is vitally important. Because exercise training improves thermoregulatory capacity, it is possible that this capacity could benefit the brain in previously unidentified ways.

**B-74**  
**Exercise is Medicine®/Poster - EIM: Exercise Programs**

**Wednesday, May 30, 2018, 1:00 PM - 6:00 PM**  
**Room: CC-Hall B**

**1020 Board #281 May 30 3:30 PM - 5:00 PM**  
**The Effect of Two Training Protocols on Post Exercise Lactate Clearance in Heart Failure Patients**

Yair Blumberg1, Eyal Amnon2, Basem Hijazi2, Offir Erreich1, Ilan Goldenberg2, Robert Klemptner1, Shaul Atar1. 1 Bar Ilan, Zefat, Israel. 2 Sheba Medical Center, Ramat Gan, Israel.  

**Purpose:** Heart failure (HF) patients suffer from functional aerobic impairment due to reduced cardiac output and O2 delivery. This condition leads to metabolic and physiological changes, such as longer recovery time from physical activity. It was shown that aerobic exercise confers a beneficial effect on quality of life (QOL) and physiological parameters in HF. High intensity interval training (HIT) has been argued by some studies to have a superior rehabilitative effect compared to moderate aerobic training (MAT). We hypothesized that HIT has a superior effect on lactate clearance and, by extension, on recovery from exercise. **Methods:** Twenty-nine HF patients were randomized into two exercise groups: MAT or HIT, and trained twice a week for 12 weeks. Before and after completion of the exercise program patients were assessed for QOL, six-minute walk test (6MWT) and a cardiometabolic exercise test (CPET). Blood lactate concentration was measured after the CPET and lactate clearance kinetics were fit to each patient by a bi-exponential time function. **Results:** HIT group showed a significant improvement compared to baseline in QOL and aerobic capacity (VO2 max 21.4±7 vs. 17.5±3 ml/min/kg. 6MWT 461±71 vs. 355±58 m). Both exercise groups improved lactate clearance, as represented by the y2 constant. While the MAT group showed a trend towards significance (0.061±0.020 units) (p=0.07), the HIT group improved lactate clearance significantly (0.074±0.020 units) (p<0.01). **Conclusions:** HIT improves lactate clearance kinetics; thereby can partly explain the improved QOL attributed to exercise training.

**1021 Board #282 May 30 3:30 PM - 5:00 PM**  
**Effects Of 12 Weeks Of Yoga Program in Middle Aged Women With Frozen Shoulder**

Iau Kwon, Jae-keun Oh, Taeyeon Kim. Korea National Sport University, Seoul, Korea, Republic of.  

**Purpose:** The aim of this study is to identify the effects of yoga exercise program on muscle function and pain of shoulder in middle aged women with frozen shoulder. **Methods:** Subjects were divided into 2 groups; yoga group (n=8) and control group (n=8). They participated in yoga exercise program 3days per week, 50minutes every day during 12 weeks and were measured Visual Analogue Scale, Shoulder Pain and Disability Index, Range of Motion, Strength, Pressure threshold to develop rehabilitation program for frozen shoulder. Data of the results was analyzed by using the SPSS/PC Window version 21.0 statistics program. To verify interaction between the groups, Two-Way ANOVA was conducted. All the statistical significance level was set at p<0.05. **Results:** In VAS, there was a significant interaction between the groups and time(p<0.002). In SPADI(Shoulder Pain and Disability Index), Yoga group showed significantly decreased score after exercise with interaction in times and groups(p<.020). In Shoulder Pressure threshold, Yoga group showed a significant increase at subacapula (p=0.024) and teres minor of affected shoulder with interaction in times and groups(p<0.012). **Conclusion:** As a result, yoga exercise program is considered as helpful for middle aged women with frozen shoulder to relieve pain. However, correlation of shoulder muscle strength and range of motion were not clearly identified in this study. In future study, experiments for change of range of motion and muscle strength during yoga exercise and various groups of subjects might be required to establish theoretical basis.
High Intensity Interval Training (HIIT) Protocols are well established in the literature as a beneficial health inducing strategy to improve health, fitness levels and metabolic biomarkers. Risks management of participation of HIIT programs is challenging despite benefits. Cardiovascular, Musculoskeletal and Metabolic issues, such as dehydration status may play an important role on pre-participation screening of participants. 

Purpose: The purpose of this study was to evaluate energy cost and metabolic stress biomarkers due a HIIT protocol. Methods: 8 males (23±6 years) were evaluated during a HIIT protocol (30 minutes of CrossFit based multiskit pattern) using a Portable Metabolic Analyzer (K4b2® - Cosmed®) for VO2, energy expenditure and substrate oxidation. Blood samples were taken before and after protocol for Creatine-Kinase (CK), Creatine-Kinase Myocardial Band (CK-MB), Lactate Dehydrogenase (DHL), and Cortisol levels analysis. Results: VO2 peak during HIIT protocol were 53.1±1.0 mL/kg/min; 16.2±1.0 kg/min; with peak energy cost of 17.3±4.1 kcal/min; being the fat oxidation less than 10% during the role protocol. Pre vs Post levels for CK, CK-MB, DHL and Cortisol were 1129.6±213.6U/L vs 1300.8±341.2U/L; 57.1±3.2 U/L vs 68.0±3.7 U/L; 646.1±27.1 mg/dL vs 720.8±32.7mg/dL and 12.1±1.1 pg/dL vs 17.2±1.9 pg/dL respectively. Conclusions: Energy cost of the HIIT protocol evidences some of the benefits, thus leading to weight-loss strategy. Stress biomarkers CK, CK-MB, DHL and Cortisol responses to HIIT protocol suggests metabolic overload on systemic and local: skeletal muscle and myocardial tissue, despite clinical outcomes (pain or claims). Risk versus Benefit analysis of HIIT protocols should be focused on general populations and specific patients, which may lead to detrimental health outcomes.

1023 Board #284 May 30 3:30 PM - 5:00 PM
Patterns of Physical Activity and Muscle Strengthening Exercise in U.S. Undergraduates
Adrienne Wald. The College of New Rochelle, New Rochelle, NY. (Sponsor: Carol Ewing Garber, FACSM)
(No relevant relationships reported)

BACKGROUND: Universities and colleges are target settings for the Exercise is Medicine® (EIM) on Campus initiative, aiming to make physical activity a part of campus culture and to foster collaboration between campus organizations for physical activity assessment and promotion. PURPOSE: To describe the prevalence of meeting targets for aerobic (PA) or muscle strengthening (MS) exercise of U.S. undergraduates, by gender, and across various university and college types, sizes, and settings. METHODS: Data from undergraduate respondents to the 2011 American College Health Association-National College Health Assessment II (ACHA-NCHA-II) were classified by meeting or not meeting target PA and MS recommendations. Data were analyzed by cross tabulation analysis (X2) by PA and MS status by gender, and across university designation (public vs. private), region of the country (Northeast, South, West, or Midwest), campus size (by student enrollment) and by 4-year or 2-year community college type. RESULTS: The sample of undergraduates, aged 18-24 years (n=75,511), included 33.5% men 46.3% women and 0.2% transgender (TG) students. Among these, there were significant differences (p<0.001) across genders and meeting PA and meeting MS: 55.2% men, 48.4% women, and 35.9% TG students met PA, and 47.7% men, 32.6% women, and 25% TG met MS. Meeting PA was significantly different by campus size (p<0.001) and type (p<0.05), but not by region (p=0.018) or designation (p=0.775). Significant differences for meeting MS were found across regions (p<0.001), campus size (p<0.001), type (p=0.49), and university designation (p<0.001).

CONCLUSIONS: PA and MS exercise participation in college students is modest at best, and it varies across geographic locations and differing campus characteristics. This results suggest that targeting college students with EIM on Campus is indicated, particularly sub-populations where PA and MS participation is low.

1024 Board #285 May 30 3:30 PM - 5:00 PM
Multiple Strength Assessments to Evaluate Adaptations to High-Load and Low-Load Blood Flow Restricted Exercise
Summer B. Cook, FACSM,1 Dain P. LaRoche, FACSM,1 Todd M. Manini, FACSM,1 University of New Hampshire, Durham, NH.1University of Florida, Gainesville, FL.
(No relevant relationships reported)

Differences in muscle strength adaptations between high-load (HL) and low-load blood flow restricted (BFR) resistance training protocols may be due to the type of strength test performed (e.g. isotonic, isokinetic and isometric). PURPOSE: To assess differences in isotonic, isokinetic and isometric strength adaptations in older adults following HL and BFR resistance training. METHODS: Thirty-six males and females (mean: 75.6±7.6 years, 1.67±0.9m, 74.3±13.2kg) classified as being at risk of mobility limitations were randomly assigned to HL (70% 1-RM) or low-load BFR (30% 1-RM coupled with a vascular restriction) exercise for the knee extensors twice per week for 6 weeks. A control group performed light upper body resistance and flexibility training. Knee extension 10-RM to predict 1-RM strength, isometric maximum voluntary contraction (MVC) and isokinetic strength at 60°, 130°, 180°/s were measured before and after 6-weeks of training. RESULTS: HL and BFR training increased predicted 1-RM strength 34% (P<0.001) and 24% (P<0.001) respectively, from baseline to 6-weeks of training. HL training produced a 16% increase in MVC (P<0.002) while BFR training did not change (P=.91). No interventions, included the control, resulted in changes in isokinetic strength at the various speeds (P=.20). CONCLUSION: Strength improvements from HL resistance training carried over to other strength tests. This favorable adaptation did not occur following BFR exercise which may limit the effectiveness of this training program. Isotonic training does not carry over to isokinetic strength adaptations and therefore may be a drawback when implementing resistance training programs for older adults. Supported by NIH grant 1R15AR047070-01A1.

1025 Board #286 May 30 3:30 PM - 5:00 PM
Oral Creatine Hydrochloride Supplementation: Acute Effects on Intermittent, Submaximal Bouts of Resistance Exercise
Daniel McDonough, Shawn Simonson, Yong Gao, Scott Conger, Boise State University, Boise, ID. (Sponsor: Dr. Zan Gao, FACSM)
(No relevant relationships reported)

PURPOSE: Creatine hydrochloride (CrHCl) supplementation and its effects on musculoskeletal performance and body composition remains largely unexplored. The purpose of this study was to examine the acute effects of oral CrHCl supplementation on three intermittent, submaximal bouts of bench press and repeated vertical jump exercises (maximal repetitions) and body composition measures (body weight [BW], fat-free mass, and fat mass).

METHODS: Fifteen resistance trained males (X±SD = 22.8 ± 2.0 years; X±SD = 81.6 ± 9.9 kg) completed 3 sets of the barbell bench press (70% 1RM) and 3 sets of the repeated counter-movement vertical jump (CMI; 85% maximal CMI height), with 2 min rest between sets, before and after a 7 d CrHCl intervention (4 g·d-1). Participants continued their normal resistance training and nutrition routines. A two-factor repeated measures ANOVA was used to determine significant main effects (time and set) and interaction effects (time x set) for bench press and CMJ performances from pre- to post-intervention. A one-factor repeated measures ANOVA was used to assess pre- to post-intervention differences in body composition.

RESULTS: Significant main and interaction effects for time and set were found in the bench press from pre- to post-intervention, F(2, 28) = 4.2-268.3; p<0.005; n² = 0.2-0.9, with post-hoc analysis indicating increased performance on later sets (eg, Set 3 > Set 2 > Set 1). Significant main effects for time and set were found in the CMJ test from pre- to post-intervention, F(2, 28) = 27.5-55.6; p<0.005; n²= 0.7-0.8, but no interaction effect was found (p>0.05). Post-hoc analysis indicated increased performance on later sets (eg, Set 3 > Set 2 > Set 1). BW was the only body composition measure to reach significance (p<0.005).

DISCUSSION: Findings suggest 7 d of CrHCl supplementation (4 g·d-1) to increase repetitions completed on three sets of the intermittent, submaximal bench press and CMJ exercises and BW. The non-significance in the time x set interaction for CMJ performance may due to small sample size, and thus future research with larger samples is warranted.
1027 Board #288
May 30 3:30 PM - 5:00 PM
ICT Use and Physical Activity & Implication for Musculoskeletal Pains among Tertiary Institution Students in Kwara State Nigeria
Seidina Yakubu Ilia1, Olufunmilola Leah Dominic1, Faithia Adeyemi Niyi-Odomus3, Talabi Eun Abdetayo1. 1University of Ilorin, Ilorin, Nigeria. 2Loughborough University, Loughborough, United Kingdom. (No relevant relationships reported)

PURPOSE: Recent studies show that prolonged ICT use is associated with increased sedentariness and postural imbalances. This has implication for the prevalence of musculoskeletal pains among ICT users. To investigate the implications of ICT use for physical activity level and musculoskeletal pains among tertiary institution students in Kwara state. METHODS: The research design was ex-post facto. Multistage sampling comprising students in Kwara State Nigeria (No relevant relationships reported)

1028 Board #289
May 30 3:30 PM - 5:00 PM
Bedside Exercise Device for Heart or Liver Transplantation Recipients in Early Postoperative Period
Suyu-Yuan Chen1, Shohei-Sheng Wang1, Ray-Heng Hu1, Yih-Sharrng Chen1, Chih Lan2, Andrew K. Dorsch3, Bruce H. Dobkin4, Fu Jen Catholic University Hospital and Fu Jen Catholic University, New Taipei City, Taiwan. 4National Taiwan University Hospital and National Taiwan University, Taipei, Taiwan. (No relevant relationships reported)

PURPOSE: The aims of this study were to investigate the effect of exercise 25 min or more per day on the bedside exercise device in heart or liver transplantation recipients who are at-risk for functional deterioration during a long inpatient stay after transplantations. METHODS: Adult patients who received a heart or liver transplantation were randomized to either UCFit exercise group or usual care group. UCFit exercise group will exercise on the bedside exercise device which uses foot pedals that record exerted forces against adjustable resistances, measure repetitions of upper and lower extremity cycling movements, and give feedback about performance via a wireless internet connection. Usual care group was only encouraged to increase the amount of physical activities. The outcome measure was level of independence for walking, walking speed, 6-minute walking distance, Short-Form 36 health-related quality of life, heart rate variability, knee strength, and cardiopulmonary fitness. RESULTS: Thirty-five patients who received a heart (n=15) or liver (n=20) transplantation participated at a median of 8 days after surgery. No adverse events were reported during the median study period of 15 days. The UCFit exercise group (n=15) showed increased standard deviation of all NN intervals (SDNN) from 16.5±13.0 ms to 26.3±18.7 ms, compared to the usual care group (n=20) from 18.4±18.9 ms to 16.6±17.9 ms (p=0.01; indicating analysis); and increase in systolic BP (24.4±21.3 mmHg) of 18.4±22.3 mmHg compared to control group (19.8±20.7 mmHg) (p=0.001). The UCFit exercise group achieved a trend toward greater 6-minute walking distance and higher knee strength at discharge compared to the usual care group. No significant between-group differences were detected in the other outcomes of interest. CONCLUSIONS: In this ongoing trial of bedside exercise with remote monitoring for inpatient organ transplantation rehabilitation, exercise 25 min or more per day showed increased heart rate variability of the study subjects in the early postoperative period. Supported by Grant MO1-2314-B-002 -MTY3 from Foundation Science and Technology, Taiwan.
CONCLUSIONS: While there is a tendency of weight gain and fitness decline among university students, PA classes addressing health-related physical fitness are effective in maintaining body weight and improving other health-related physical fitness components for college students.

1030 Board #291 May 30 3:30 PM - 5:00 PM
Retrospective Analysis Of A Supervised Exercise Program Offered To Post-hematopoietic Stem Cell Transplant Patients
Kate M. Edwards, Adelle Bottrell, Steven R. Larsen, Michael Martinick. 1University of Sydney, Sydney, Australia. 2Royal Prince Alfred Hospital, Sydney, Australia. 3Chris O’Brien Lifehouse, Sydney, Australia. (Sponsor: Ollie Jay, FACSM)
(No relevant relationships reported)

A growing number of cancer patients receive hematopoietic stem cell transplants (HSCT), a potentially curative treatment, but engenders adverse symptoms of fatigue, reduced physical function and decreased quality of life. Maintaining physical fitness for functional independence and the ability to perform activities of daily living is a high priority for patients. Exercise programs have been found to be effective in improving physical fitness and quality of life and reducing fatigue level in haematological cancer patients, and recently supervised programs have been offered to patients as part of Wellness treatment. PURPOSE: To evaluate adherence, safety and physiological effects of an eight-week supervised exercise program in post HSCT patients. METHODS: A retrospective study including 55 patients (N=22 female) referred to the optional exercise program after undergoing HSCT for a haematological malignancy. Safety and adherence information was collected throughout the program. Physiological outcomes were measured at baseline and post program (fatigue, quality of life, strength, 6 minute walk test (6MWT), balance and body composition). RESULTS: No adverse events were reported during the program and patients demonstrated a high (86.1%) adherence to supervised sessions. Fatigue decreased (4.6±1.9 to 3.4±2.1, p<.003) and Quality of Life increased (105.9±17.8 to 113±17.8, p<.040) from baseline to post intervention. Physical function increased in all measures (6MWT, 413.8±97.2m to 497.4±82.5m, p<.001; 1RM leg press 56.3±34.7kg to 68.0±36.6kg, p<.011; 1RM seated row, 32.7±15.8kg to 40.0±17.5kg, p<.001; Chair stand, 12.0±3.7 to 15.0±3.0, p<.001). Reported weekly physical activity also increased (114.2±132.7min to 205.7±137.8min, p<.001). Body mass, fat free mass and body fat percentage did not change. CONCLUSIONS: In line with prior findings, this supervised exercise program was an effective treatment for comorbidities associated with HSCT. Importantly, these results include participants who self-enrolled in the program, and paid a contribution to the cost. The high adherence and significant improvements confirm the efficacy of an exercise program and support the continued offerings of such Wellness treatment as part of usual care.

1031 Board #292 May 30 3:30 PM - 5:00 PM
Shriners Hospitals For Children® At Galveston Exercise Prescription Guidelines For Children With Severe Burn Injury
Eric Rivas, David N. Herndon, Janos Cambiaso-Daniel, Victoria G. Rontoyannii, Shauna Glover, Craig Porter, Oscar E. Suman, FACSM1, Shriners Hospitals for Children and the University of Texas Medical Branch, Galveston TX, and Texas Tech University, Lubbock, TX. 2Shriners Hospitals for Children and the University of Texas Medical Branch, Galveston, TX. 3Medical University of Graz, Austria, Shriners Hospitals for Children and the University of Texas Medical Branch, Galveston, TX. (Sponsor: Oscar E. Suman, FACSM)
(No relevant relationships reported)

PURPOSE: Burn trauma is associated with metabolic abnormalities coupled with prolonged immobilization and deconditioning, where burned patients have markedly reduced strength and aerobic exercise capacity. Over the last 20 years, Shriners Hospitals for Children®—Galveston has endeavored to improve the rehabilitation of burned children. A key contribution from this work has been identifying the benefits of rehabilitation exercise training (RET) in restoring function in burned children. Currently, there are no clear guidelines for the implementation of RET in burned individuals. Therefore, we quantified the training logs for exercise intensity, frequency, and duration of 6 weeks of this program in order to develop a basic framework for outpatient RET in patients recovering from severe burns.

METHODS: Thirty-three children (mean±SD, 11 female, 12±3 yrs, 145±18 cm, 40±11 kg) with severe burns (49±15% body surface area burned, with 35±22% third-degree burn) completed a 6-week resistance and aerobic exercise training program. Cardiorespiratory function (peak VO2), strength and power, and lean body mass (LBM) were measured pre- and post-RET. Outcome measures were analyzed as a relative percentage of the age-sex matched non-burned counterpart (n=33, 11 females, 12±3 yrs, 154±20 cm, 49±22 kg).

RESULTS: At discharge, LBM was attenuated by 77% [of non-burned values], peak torque by 53%, power by 62%, and cardiorespiratory fitness by 56%. After 6 weeks of training, LBM increased from pre-training values by 5% (82% of non-burned values), peak torque by 18% (71%), power by 20% (81%), and cardiorespiratory fitness by 18% (74%); P<0.0001 for all). The quantification of exercise logs found that physical capacity can be improved by aerobic exercise training at 5 metabolic equivalents (74% of peakVO2) performed at least 3 days per week and 150 min per week and by resistance training performed at volume loads [reps × sets × weight] of 280 (19% of total body mass, TBM) for the upper body and 590 (42% TBM) for the lower body at least 2 days per week.

CONCLUSIONS: For the first time, we quantify our RET program and provide exercise prescription guidelines specific to burn populations. Future research should build upon this work and individualize exercise prescription to optimize rehabilitation benefits in severely burned children.

1032 Board #293 May 30 3:30 PM - 5:00 PM
Post-menarcheal Trabecular Bone Score as a Function of Organized Physical Activity
Jodi N. Dowthwaite1, Renaud Winzenrieth2, Tamara A. Scerpella1. 1SUNY Upstate Medical University; Binghamton University, Syracuse, NY. 2Medimaps Group, Merignac, France. 3University of Wisconsin, Madison, Madison, WI. (Sponsor: Jill Kanaley, FACSM)
(No relevant relationships reported)

PURPOSE: Trabecular bone score (TBS) grades lumbar spine trabecular texture based on DXA scan gray level variation. In adults, TBS correlates with trabecular density indices and predicts fracture risk, independent of areal bone mineral density (BMD). However, few pediatric studies have evaluated TBS, with none demonstrating significant exercise loading associations. Bone accrual accelerates circum-menarche; thus, we hypothesized that circum-menarcheal organized physical activity (OPA, h/wk) would correlate with post-menarcheal TBS, suggesting potential for improvement of baseline adult trabecular texture via circum-menarche exercise.

METHODS: Annual DXA scans and semi-annual OPA records were collected via a prospective, longitudinal study of exercise and bone accrual. Analysis inclusion criteria were: 1) a postero-anterior lumbar spine DXA scan (Hologic, Waltham MA) from 0-1 year post-menarche; 2) prior year OPA records. Raw TBS data were generated using proprietary TBS In-sight software (v2.2, Medimaps, France), adjusted for pediatric-specific soft-tissue effects. Multiple regression evaluated linear and quadratic associations between prior year OPA and TBS, accounting for gynecological age; β and significance are reported for each predictor. To reduce variance inflation, the quadratic function was mean-centered.

RESULTS: Data were included for 111 girls, with means as follows: age 13.4 yrs (10.0 to 15.6, sd 1.1), age at menarche 12.9 yrs (sd 1.1), gynecological age 0.5 yrs (sd 0.3), OPA 8.0 h/wk (sd 5.8) and TBS 1.38 (1.15 to 1.58, sd 0.08). In a regression model entering OPA, OPA2 and gynecological age, a significant non-linear association was observed with OPA (respectively β = 0.003, -0.001, 0.043, p=0.08, 0.003, 0.12). Importantly, these results include participants who self-enrolled in the program, and paid an additional contribution to the cost. The high adherence and significant improvements confirm the efficacy of an exercise program and support the continued offerings of such Wellness treatment as part of usual care.

CONCLUSIONS: Our data suggest a target circum-menarcheal OPA range of 5 to 15 h/wk. Further research is needed to confirm that TBS is modifiable via pediatric exercise to optimize baseline adult trabecular texture.
**MEDICINE & SCIENCE IN SPORTS & EXERCISE®**

**RER declined during exercise [p<0.001] but there was no difference between sexes for women. Body mass declined by 1% and did not differ between sexes [p=0.98].**

**RESULTS**

Water was provided at a rate of 1% body mass/h. Ventilatory gas exchange was their ventilatory threshold (~65% VO\(_{2\text{max}}\)) on a subsequent day, they drank a standardized breakfast of a liquid meal replacement.

**METHODS**

Well-trained cyclists [18 women, 16 men] were recruited. Subjects performed either low intensity exercise (LE) on a treadmill at a self-selected pace and consumed a high-fat milkshake made from premium chocolate cream and heavy whipping cream, delivering 1.3 g/kg bodyweight of fat. Participants performed either low intensity exercise (LE) on a treadmill at a self-selected pace to elicit a heart rate (HR) of 40-60% of heart rate reserve (HRR) for 30 minutes or perform high-intensity interval exercise (HE) of 8 repetitions of 30 second sprints on a treadmill with 90 second active rest. Participants returned on a non-consecutive test day to perform the opposite test. Blood was sampled via fingerstick for TG at baseline (T0), 1 hour (1H), 3 hours (3H), and 5 hours (5H) postprandially. Area under the curve (AUC) determined the postprandial TG response via the trapezoid method. Comparisons among TG at each time point and AUC were determined via paired samples t-tests. Significance was set at \( p<0.05 \).

**RESULTS**

No differences were found among baseline, 1H, or 3H TG values between the exercise conditions (\( p>0.05 \)). 5H TG and AUC were lower in LE compared to HE (5H: 149.54 ± 113.85 mg/dL; vs. 508.12 ± 256.97 mg/dL, respectively, \( t(13)= -3.384, p=0.005, d=0.402; \) AUC: 430.39 ± 269.64 mg/dL vs. 508.12 ± 256.97 mg/dL, respectively, \( t(13)= -3.384, p=0.005, d=0.402; \) normalized peak TG values were not significantly different across time, but did not differ between men and women [\( \text{time x sex } p\geq0.26, \text{effect of sex, } p=0.62 \)].

**CONCLUSIONS:** It is generally accepted that, compared to men, women rely more upon lipolysis or running performance. METHODS: Ten trained male runners completed three experimental trials consisting of 30 min at 60% VO\(_{2\text{max}}\), 30 min at 75% VO\(_{2\text{max}}\), and a 5-km time trial (TT). Thirty min prior to exercise, participants consumed one of three beverages: 1) 75 g low glycemic index modified starch supplement (UCAN), 2) 75 g high glycemic index glucose-based supplement (GI), or 3) a no-calorie placebo (PL). SCAAT lipolysis was assessed via microdialysis. RESULTS: Prior to exercise, blood glucose and insulin were elevated with G vs. PL (+53.0 ± 21.3 mg∙dL\(^{-1}\); \( p=0.000; +33.9 ± 11.0 \text{ µU/mL}; p=0.000; +25.2 ± 11.0 \text{ µU/mL}; p=0.000), respectively. Fat oxidation was attenuated, and carbohydrate oxidation increased prior to exercise with G vs. PL (+0.18 ± 0.07 g∙min\(^{-1}\); \( p<0.05; +0.18 ± 0.14 g∙min^{-1}; p<0.001 \)). There were no differences in SCAAT lipolysis or running performance. CONCLUSIONS: Pre-exercise carbohydrate results in metabolic effects favoring carbohydrate utilization, and these effects are attenuated with low glycemic index carbohydrate. However, these effects are not the result of alterations in SCAAT lipolysis, nor do they affect exercise performance.

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

**Carbohydrate Regardless of its Glycemic Index**

**INTRODUCTION:** It is well-documented that ingesting carbohydrate prior to exercise reduces fat oxidation, and that this effect is attenuated with low glycemic index carbohydrates. However, it is yet to be established whether these metabolic effects are primarily the result of alterations in the mobilization of free fatty acids (FFA) from adipose tissue (i.e. lipolysis) or whether these effects impact exercise performance.

**PURPOSE:** To determine the impact of pre-exercise carbohydrate of different glycemic indices on subcutaneous abdominal adipose tissue (SCAAT) metabolism and running performance.

**METHODS:** Ten trained male runners completed three experimental trials consisting of 30 min at 60% VO\(_{2\text{max}}\), 30 min at 75% VO\(_{2\text{max}}\), and a 5-km time trial (TT). Thirty min prior to exercise, participants consumed one of three beverages: 1) 75 g low glycemic index modified starch supplement (UCAN), 2) 75 g high glycemic index glucose-based supplement (GI), or 3) a no-calorie placebo (PL). SCAAT lipolysis was assessed via microdialysis. RESULTS: Prior to exercise, blood glucose and insulin were elevated with G vs. PL (+53.0 ± 21.3 mg∙dL\(^{-1}\); \( p=0.000; +33.9 ± 11.0 \text{ µU/mL}; p=0.000; +25.2 ± 11.0 \text{ µU/mL}; p=0.000), respectively. Fat oxidation was attenuated, and carbohydrate oxidation increased prior to exercise with G vs. PL (+0.18 ± 0.07 g∙min\(^{-1}\); \( p<0.05; +0.18 ± 0.14 g∙min^{-1}; p<0.001 \)). There were no differences in SCAAT lipolysis or running performance. CONCLUSIONS: Pre-exercise carbohydrate results in metabolic effects favoring carbohydrate utilization, and these effects are attenuated with low glycemic index carbohydrate. However, these effects are not the result of alterations in SCAAT lipolysis, nor do they affect exercise performance.

**No Lipolytic Suppression With Pre Exercise Carbohydrate Regardless of Its Glycemic Index**

**INTRODUCTION:** It is generally accepted that ingesting carbohydrate prior to exercise reduces fat oxidation, and that this effect is attenuated with low glycemic index carbohydrates. However, it is yet to be established whether these metabolic effects are primarily the result of alterations in the mobilization of free fatty acids (FFA) from adipose tissue (i.e. lipolysis) or whether these effects impact exercise performance. **PURPOSE:** To determine the impact of pre-exercise carbohydrate of different glycemic indices on subcutaneous abdominal adipose tissue (SCAAT) metabolism and running performance. **METHODS:** Ten trained male runners completed three experimental trials consisting of 30 min at 60% VO\(_{2\text{max}}\), 30 min at 75% VO\(_{2\text{max}}\), and a 5-km time trial (TT). Thirty min prior to exercise, participants consumed one of three beverages: 1) 75 g low glycemic index modified starch supplement (UCAN), 2) 75 g high glycemic index glucose-based supplement (GI), or 3) a no-calorie placebo (PL). SCAAT lipolysis was assessed via microdialysis. RESULTS: Prior to exercise, blood glucose and insulin were elevated with G vs. PL (+53.0 ± 21.3 mg∙dL\(^{-1}\); \( p=0.000; +33.9 ± 11.0 \text{ µU/mL}; p=0.000; +25.2 ± 11.0 \text{ µU/mL}; p=0.000), respectively. Fat oxidation was attenuated, and carbohydrate oxidation increased prior to exercise with G vs. PL (+0.18 ± 0.07 g∙min\(^{-1}\); \( p<0.05; +0.18 ± 0.14 g∙min^{-1}; p<0.001 \)). There were no differences in SCAAT lipolysis or running performance. CONCLUSIONS: Pre-exercise carbohydrate results in metabolic effects favoring carbohydrate utilization, and these effects are attenuated with low glycemic index carbohydrate. However, these effects are not the result of alterations in SCAAT lipolysis, nor do they affect exercise performance.
a low fat diet (LFD) or a 60 kcal high fat diet (HFD) for 12 wks to induce insulin resistance. Plantaris muscle overload was elicited by unilateral ablation of the distal 2/3 of the gastrocnemius and soleus. The contralateral leg was sham-operated. Muscles were weighed 5 days later. Overload increased muscle mass ~40% in both LFD and HFD mice. To assess glucose uptake, muscles were incubated in [1-14C]-2-deoxyglucose. Overload increased muscle glucose uptake ~80% in both LFD (Sham: 0.52 ± 0.02, Overload: 0.91 ± 0.04 (µmol.g muscle/h)) and HFD mice (Sham: 0.49 ± 0.04, Overload: 0.86 ± 0.09 (µmol.g muscle/h)), showing that overload stimulates glucose uptake independent of insulin resistance. To determine if this effect is due to increased glucose transporter (GLUT) or hexokinase levels, immunoblots were performed. Overload did not alter GLUT4 or hexokinase. In contrast, overload increased GLUT1 ~70%, but only in insulin resistant muscles. Decreased glycogen enhances glucose uptake. To determine if overload lowered glycogen levels, glycogen content was measured using a hexokinase-based reagent. Overload increased glycogen ~26% in LFD (Sham: 29.0 ± 1.6; Overload: 36.1 ± 1.5 nmol/mg muscle), and ~40% in HFD mice (Sham: 31.2 ± 2.1; Overload: 42.3 ± 1.7 nmol/mg muscle). To determine if overload-induced glucose uptake is dependent on glucose utilization, muscles were incubated in [3-3H]-glucose to assess glycolytic flux, and immunoblots performed to assess the rate limiting enzyme of the pentose phosphate pathway, glucose-6-phosphate dehydrogenase (G6PD). Overload did not alter muscle glycolytic flux. In contrast overload increased muscle G6PD ~140% in LFD, and ~82% in HFD mice. CONCLUSION: Insulin resistance does not impair overload-induced muscle hypertrophy or glucose uptake, but does alter glucose utilization. SUPPORT: NIH R01 DK103562

1073 Board #5 May 31 8:00 AM - 10:00 AM
Post-Exercise Fructose-Maltodextrin Ingestion Enhances Subsequent Endurance Capacity
Gareth A. Wallis, Tim Podlogar, Ed Maudner. University of Birmingham, Birmingham, United Kingdom. (Sponsor: Professor Janice Thompson, FACSM)

(No relevant relationships reported)

PURPOSE: Restoring muscle and liver glycogen content during short-term (<6 h) recovery from prolonged exercise is pertinent for athletes seeking to maximize performance in repeated exercise bouts. Previous research suggests co-ingestion of fructose-glucose carbohydrate sources augments liver and has equivalent effects on muscle glycogen storage during short-term recovery from prolonged exercise compared to isosenergetic glucose ingestion. The aim of the present investigation was to determine if this has a discernible effect on subsequent exercise capacity.

METHODS: Eight trained endurance runners and triathletes performed two experimental trials in a single-blind, randomised, and counterbalanced cross-over design. Trials involved treadmill running to exhaustion at 70 %VO2max, a four-hour recovery with 90 g.h of glucose-maltodextrin (GLU) or fructose-maltodextrin (FRU) ingestion (1:1.5 ratio), and a second bout of treadmill running to exhaustion at 70 %VO2max. Indirect calorimetry and stable isotope methods were employed to estimate substrate oxidation and ingested carbohydrate oxidation.

RESULTS: Endurance capacity in the second exercise bout was significantly greater with FRU (81.4 ± 22.3 vs. 61.4 ± 9.6 min, P = 0.02), a large magnitude effect (ES = 1.15 ± 1.2; 95% CI: -0.07, 2.34). Total carbohydrate oxidation rates were not significantly different between-trials at given time-points, although the total amount of carbohydrate oxidised in the second exercise bout was significantly greater with FRU (223 ± 66 vs. 157 ± 26 g, P = 0.02). Ingested carbohydrate oxidation rates, representing carbohydrate stored during recovery and/or that derived from ongoing absorption, were greater during both trials with FRU (P = 0.001). Plasma glucose and non-esterified fatty acid concentrations were not significantly different between-trials. Plasma lactate concentrations were significantly greater during recovery with FRU (P = 0.001). Self-reported nausea and stomach fullness during both trials were marginally greater in favour of FRU.

CONCLUSION: Short-term recovery of endurance capacity was significantly enhanced with fructose-maltodextrin vs. glucose-maltodextrin ingestion during recovery.

1074 Board #6 May 31 8:00 AM - 10:00 AM
Prolonged Low-moderate Intensity Exercise On Physiological Markers Of Metabolic And Oxidative Stress
Dominique Gagnon1, Sandra Dorman1, Stephen Ritchie1, Shivaparakash Jagiul Mutt1, Ville Stenbäck1, Jarek Walkowiak1, Karl-Heinz Herzig2, Sandra Dorman1, Stephen Ritchie1, Jarek Walkowiak1, Karl-Heinz Herzig2, Laurentian University, Sudbury, ON, Canada. 1University of Oulu, Oulu, Finland. 2Poznan University, Poznan, Poland.

(No relevant relationships reported)

Oxidative stress results in lipid, protein and DNA oxidation as well as metabolic dysfunctions. This may result in chromosomal damage, and accelerated cellular ageing. Long-term physical activity promotes healthy metabolic and oxidative profiles. The effects of prolonged physical activity however, are unknown.

Purpose: This study investigated the effects of prolonged physical activity on oxidative and metabolic stress in healthy adults participating in a 260-km wilderness canoeing expedition.

Methods: Twenty-seven participants took part in the study. Sixteen went on a 14-day wilderness canoeing expedition (EXP) (24 ± 7 yrs, 72 ± 6 kg, 178 ± 80 cm, 18.4 ± 8.4 %BF, 47.5 ± 9.3 g/kg, 0.1 ± 0.4 L·kg⁻¹·h⁻¹), covering a distance of 260 km, requiring 6-9 hrs of low to moderate exercise daily, and eleven were used as controls (CON) (31 ± 11 yrs, 72 ± 15 kg, 174 ± 15 cm, 22.8 ± 0.1 %BF, 47.1 ± 9.0 g/kg, 0.1 ± 0.4 L·kg⁻¹·h⁻¹). Blood sample collection was completed before and after the expedition. ANCOVA analyses were performed on metabolic and oxidative variables as well as telomere length from isolated blood mononuclear cells.

Results: For metabolic results, no statistical differences were observed in total cholesterol, high- and low-density lipoprotein, testosterone and insulin concentration. Triglycerides were lower following the expedition (EXP 69 ± 18 vs. CON 106 ± 45 mg·dl⁻¹; p = 0.002). Malondialdehyde was unaffected (EXP 4.2 ± 1.3 vs. CON 4.1 ± 0.7 µM; p > 0.05) but superoxide dismutase activity, representative of antioxidant activity, was greater in the expedition group (EXP 3.1 ± 0.4 vs. CON 0.8 ± 0.5 U·ml⁻¹; p < 0.001). Further, telomere length was unchanged (EXP 1.00± 0.48 vs. CON 0.89 ± 0.28 TS ratio; p > 0.05).

Conclusion: The present results suggest that there is a stronger cellular protective response from antioxidants to counteract the exercise-associated production of pro-oxidant free radical and reactive oxygen species during prolonged low-moderate physical loading. This shift in cellular oxidative balance, however, did not seem to be sufficient to induce a notable change in telomere length.

1075 Board #7 May 31 8:00 AM - 10:00 AM
In Vivo Knockdown of Hepatocellular eNOS Reduces Cellular Anti-Oxidant Defense and Mitochondria Biogenesis/Function
Grace Meers, Rory Cunningham, Matthew Panasevich, R. Scott Rector, FACSM. Harry S Truman Memorial VA Hospital and University of Missouri, Columbia, MO.

(No relevant relationships reported)

PURPOSE: The purpose of this study was to examine the effects of long-term knockdown of endothelial nitric oxide synthase (eNOS) in hepatocytes in vivo to establish a potential regulatory role in liver mitochondrial health. METHODS: C57Bl6 mice (6 months of age) were tail vein injected with either an adeno-associated virus with a hepatocyte specific promoter for the shRNA induced silencing of eNOS (AAV8-Scr-shRNA-eNOS). The mice were maintained on a high fat diet (HFD) or a low fat diet (LFD) for 12 weeks to induce insulin resistance. RESULTS: Body mass and percent body fat did not differ between treatment groups. Hepatocellular knockdown of eNOS signficantly reduced hepatic mitochondrial biogenesis and function. Long-term physical activity promotes healthy metabolic and oxidative variables as well as telomere length from isolated blood mononuclear cells.

Conclusion: These findings represent the first observations that in vivo long-term knockdown of eNOS specifically in hepatocytes with AAV-shRNA-eNOS results in suppression of hepatic anti-oxidant defense, impaired hepatic mitochondrial biogenesis and mitochondria, and reduced hepatic mitochondrial function. Funded: This work was supported by VA-Merit Grant I01BX003271-01 (R.S.R.).

Abstracts were prepared by the authors and printed as submitted.
TUESDAY, MAY 30, 2017

ACSM May 29 – June 2, 2018

Minneapolis, Minnesota

1076 Board #8 May 31 8:00 AM - 10:00 AM
Acute Exercise by Insulin Resistant Rats Induces Muscle Fiber Type-selective Improvement in Insulin-stimulated Glucose Uptake
Mark W. Pataky, Carmen S. Yu, Yulin Nie, Edward Arias, Manak Singh, Robert Ploutz-Snyder, Christopher Mendigas, Gregory Cartee, FACSM. University of Michigan, Ann Arbor, MI. (Sponsor: Gregory Cartee, FACSM)

(No relevant relationships reported)

PURPOSE: To determine if acute exercise induces muscle fiber type-selective changes in glucose uptake (GU), glycogen content or GLUT4 protein abundance in insulin resistant rats.

METHODS: Rats were fed a high-fat diet (HFD; 40% fat) or a low-fat diet (LFD; 15% fat) ad libitum for two weeks. On the experimental day, HFD rats were sedentary (SED) or exercised (2h swim exercise). All LFD rats remained SED, serving as controls. Exercised rats were studied immediately-post exercise (IPEX) or 3.5h post-exercise (3.5hPEX). Isolated epitrochlearis muscles were incubated with [14C]-deoxyglucose (2DG). Muscles from IPEX and SED controls were incubated without insulin. Muscles from 3.5hPEX and SED controls were incubated ±100µU/ml insulin. Muscles were incubated with collagenase to isolate single fibers. Fiber type (myosin heavy chain expression: type I, IIA, IIB, IIX, IIAX, or IIBX) was determined by SDS-PAGE. In the same single fibers, GU was measured by [14C]-2DG accumulation. Fiber type-specific glycogen was measured by histochemical periodic-acid Schiff staining. GLUT4 abundance was determined by immunoblotting. Data were analyzed by one-way ANOVA.

RESULTS: In HFD vs LFD rats, GU of insulin-stimulated single fibers was decreased in all fiber types (P<0.05) except type I. Insulin-independent GU in single fibers of each fiber type was increased IPEX (P<0.05). Glycogen content decreased in all fiber types IPEX (P<0.01). In HFD rats insulin-stimulated GU 3.5hPEX was increased in all fiber types (P<0.05) except type I. GLUT4 content was unchanged by diet or exercise in each fiber type. CONCLUSIONS: Greater insulin-independent GU and decreased glycogen IPEX provides compelling evidence that each fiber type, including type I fibers, was recruited. Neither diet nor exercise effects on GU were attributable to altered GLUT4 abundance regardless of fiber type. Earlier research using whole muscles from normal rats demonstrated that exercise causes greater GLUT4 translocation concomitant with greater phosphorylation of AS160 protein, a key regulator of GLUT4 translocation. Our working hypothesis is that fiber type-selective improvement in insulin-stimulated GU at 3hPEX in insulin resistant rats is attributable to fiber type-selective increases of AS160 phosphorylation that facilitates greater GLUT4 translocation.

1077 Board #1 May 31 8:00 AM - 10:00 AM
Thematic Poster - Mental Health and Exercise
Thursday, May 31, 2018, 8:00 AM - 10:00 AM
Room: CC-Lower level L100E

C-08 Chair: Matthew P. Herrig, University of Limerick, Limerick, Ireland.

(No relevant relationships reported)

1078 Board #1 May 31 8:00 AM - 10:00 AM
Acute Exercise Effects Among Young Adults with Subclinical Generalized Anxiety Disorder: Replication and Expansion
Matthew P. Herrig1, Derek C. Monroe2, Brett R. Gordon3, Mark J. Campbell.1 1University of Limerick, Limerick, Ireland. 2University of California Irvine, Irvine, CA.

(No relevant relationships reported)

Little is known about the effects of acute exercise among individuals with subclinical Generalized Anxiety Disorder (GAD), a disorder marked by persistent worry, elevated anxiety, and low energy and fatigue. Recent findings supported the positive effects of acute exercise on worry, state anxiety, and feelings of energy and fatigue among young women with subclinical GAD. However, exercise effects among young men with subclinical GAD and to explore potential sex-related differences. METHODS: Thirty-five young adults (21.4±2.3y; 19M; 16F) with Penn State Worry Questionnaire scores ≥45 (60±8) completed 30-min treadmill running at –71±0.04 percent heart rate reserve and 33%-10% of maximum predicted VO2. Post-exercise questionnaire included worry, worry engagement, absence of worry, state anxiety, and feelings of energy and fatigue. RM-ANOVA examined differences across condition and time. Sex-related differences were explored with RM-ANOVA and paired samples t-tests stratified by sex. Hedges’ d effect sizes were calculated to quantify and compare magnitude of change in the full sample, men, and women. RESULTS: There were significant baseline differences between sexes. Compared to quiet rest, exercise significantly improved state anxiety (P<0.04; d=0.27) and feelings of energy (P<0.001; d=1.09). Small improvements were found for worry (d=0.22), worry engagement (d=0.18), and feelings of fatigue (d=0.21). Although RM-ANOVA did not support significant differences between sexes, exercise effects on worry, worry engagement, absence of worry, and feelings of energy were stronger among females. Moderate-to-large improvements in worry (d=0.53), absence of worry (d=0.38), and feelings of energy (d=1.35) were found among women. Among men, moderate-to-large improvements in state anxiety (d=0.37) and feelings of energy (d=0.92) and fatigue (d=0.40) were found. CONCLUSION: Findings support initial reports of positive effects of acute aerobic exercise on worry, state anxiety, and feelings of energy and fatigue among young women with subclinical GAD. Findings also provide initial support for these positive effects among young men with subclinical GAD.

1079 Board #2 May 31 8:00 AM - 10:00 AM
Working It Out: Acute Exercise to Combat Anxiety and Depression in Individuals Living with PTSD
Daniel R. Greene1, Steven J. Petruzzello, FACSM.1 1Augustana University, Augustana, GA. 2University of Illinois at Urbana-Champaign, Urbana, IL. (Sponsor: Steven J. Petruzzello, FACSM)

(No relevant relationships reported)

Mental health problems are increasingly prevalent in today’s society. Exercise interventions have been shown to significantly reduce symptoms of many mental health problems, but often overlooked is the potential for exercise to reduce symptoms of Post-Traumatic Stress Disorder (PTSD) and comorbid psychological conditions (e.g., anxiety & depression). PURPOSE: To examine the acute effects of a bout of moderate intensity continuous aerobic exercise (MICE) and a bout of high-intensity interval exercise (HIIE), relative to a no-exercise inactive control (SED), in participants with subsyndromal PTSD. METHODS: Participants [N=24, 9 males; age (M ± SD): 25.9 ± 9.2 yrs; Estimated VO2max (M ± SD): 34.6 ± 10.2 ml·kg⁻¹·min⁻¹] completed three randomly ordered 35-min conditions (HIIE, MICE, SED) following a within subjects design. All participants met the criteria for subsyndromal PTSD (i.e., having at least one symptom in each of the major DSM-5 clusters), with an average PCL-S score of 47.64 which exceeded the cut point for probable PTSD of 33. State Anxiety, and Depression were assessed before (Pre), immediately after (Post0), 20-minutes after (Post20), and 40-minutes after (Post40) each condition. RESULTS: Anxiety and Depression were significantly reduced following all conditions. Anxiety Post40 was significantly less than Pre for HIIE [Cohen’s d = 1.05], MICE [Cohen’s d = 0.78], and SED [Cohen’s d = 0.53]. Depression Post40 was significantly less than Pre for HIIE [Cohen’s d = 0.76], MICE [Cohen’s d = 0.84], and SED [Cohen’s d = 0.32]. CONCLUSION: Exercise significantly reduced Anxiety and Depression to a greater extent than SED. This study provides evidence for exercise-induced short-term improvements in comorbid psychological conditions associated with PTSD. Future studies need to apply these benefits to a longitudinal program.

1080 Board #3 May 31 8:00 AM - 10:00 AM
The Interrelationship Between Depression and Hemoglobin: Men Are Affected More Than Women
Tina Bhatia1, Jonathan M. Saxe2, Lewis E. Jacobson3, Courtney D. Jensen1. 1University of the Pacific, Stockton, CA. 2St. Vincent Hospital, Indianapolis, IN.

(No relevant relationships reported)

There are 16.1 million Americans with major depressive disorder (MDD) and 3.4 million Americans with anemia. Low hemoglobin (Hb) is known to predict depressive symptoms, but seldom is the inverse examined: how does MDD affect Hb? There may be a cyclic relationship in which depression reduces engagement in physical activity and reduced activity lowers Hb. This presents possible implications for young athletes owing to higher depression scores on average than age-matched controls.

PURPOSE: To investigate MDD as a predictor of serum Hb levels. METHODS: We analyzed 2,206 patients who were treated at a major hospital. All patients had Glasgow Coma Scale scores ≥24, received a complete blood count with differential, and were screened for MDD. Differences in Hb between depressed and non-depressed patients were assessed with independent samples t-tests; multiple linear regression measured the effect of MDD on Hb, controlling for confounding variables. RESULTS: Among depressed patients, Hb was 12.16 ± 1.86 g/dL, among non-depressed patients, Hb was 13.52 ± 1.93 g/dL (p<0.001). This difference was more pronounced among men (14.24 ± 13.62; p<0.001) than women (12.62 ± 12.02; p=0.165). Across the total sample, holding constant age, sex, oximetry, blood pressure, use of dialysis, and diagnoses of diabetes, bleeding disorder, cirrhosis, cancer, and respiratory disease, depression associated with a 5.7% reduction in Hb (p=0.035; 95% CI: -1.38 to -0.50 g/dL). The overall model was significant (r²=0.299; p<0.001). Among men,
the model retained significance (r=0.226; p<0.001) and a diagnosis of depression associated with a reduction in HB of 1.56 g/dL (p=0.022; 95% CI: -2.56 to -0.56 g/dL). **CONCLUSION:** The relationship between HB and depression may be cyclic. In our population, depression had a greater effect on HB than diabetes and respiratory diseases, and it had the same effect as bleeding disorders. Depression, via endothelial changes and reductions in physical activity, may lower oxygen-carrying capacity of the blood, and in turn affect endurance performance. Exercise-induced oxidative stress promotes HB synthesis. For the anemic patient, exercise may enhance mood, for the moody, exercise may enhance oxygen-carrying capacity. For the athlete and the sport psychologist, there may be further implications.

1081 Board #4 May 31 8:00 AM - 10:00 AM Prevalence of Depression and Low Self-Esteem among Collegiate Female Track and Field Athletes Samantha Weber, Toni M. Torres-McGehee, Eva Monsmas, Allison Smith. University of South Carolina, Columbia, SC. 

No relevant relationships reported

Track and field athletes are under extreme amounts of pressure to be successful as student-athletes. Their academics and demands for their events may predispose them to having low self-esteem (LSE) and mental health disorders like depression (DEP). **PURPOSE:** To examine the prevalence of LSE and DEP in collegiate, NCAA Division 1 track and field athletes; and to investigate differences between academic status (i.e., freshman, senior, etc.) and event type (e.g., sprinter, distance, lean events etc.) **METHODS:** Collegiate female track and field athletes (n=387) were recruited from 25 NCAA Division I Institutions to participate in an online study. Demographic information, Center for Epidemiologic Studies Depression Scale (CESD) to estimate the risk for DEP and the Rosenberg Self-Esteem Scale for LSE were completed. **RESULTS:** The prevalence of DEP risk was estimated to be 65.1% (n=252). No significant differences were found between academic status; however the highest DEP risk was freshman (19.4%) then sophomores (17.3%). Significant differences were found between event type and DEP within sprinters, middle distance runners, and distance runners (11.4% - 19.6%, p<0.01). Overall, LSE was 10.9% (n=42), with LSE found highest among sophomores (4.1%) then freshman (3.9%). No significant differences were found for event type and LSE; however, distance runners were at the highest risk for LSE with 4.4%. **CONCLUSIONS:** Female track and field athletes demonstrated a high risk of DEP and a lower risk for LSE. Freshman and sophomores demonstrated the highest risk for DEP and LSE, potentially due to the new academic and collegiate sport demands placed upon them. Overall, it is perceived the more acclimated (upper classman) a student-athlete is, the lower risk they have for DEP and LSE. Additionally, distance runners were found to have a higher risk of DEP and LSE; therefore, further examination is needed to draw conclusions to what additional pressures they have may. With a risk of DEP and LSE being most prevalent among younger collegiate athletes, universities need to focus on establishing a support system or mentoring program for incoming student-athletes.

1082 Board #5 May 31 8:00 AM - 10:00 AM Associations Between Physical Activity and Depression: Results from The Irish Longitudinal Study on Ageing Cillian P. McDowell1, Rodney K. Dishman, FACSM2, Mats Hallgren1, Ciaran MacDonncha1, Matthew Herring1. 1University of Limerick, Limerick, Ireland. 2University of Georgia, Athens, GA. 3Karolinska Institutet, Stockholm, Sweden. 

No relevant relationships reported

Physical activity (PA) can protect against depression. However, few studies have assessed the influence of PA, including whether meeting PA guidelines is sufficient or if greater benefits can be derived from greater volumes of PA. **PURPOSE:** To examine associations between different volumes of MVPA and walking prevalence and incidence of depressive symptoms and depression status using data from The Irish Longitudinal Study on Ageing. **METHODS:** Participants (N=4,456; 56.7% female) aged 50 years completed the International PA Questionnaire (IPAQ) at baseline, and the Center for Epidemiological Studies Depression Scale at baseline and two years later. Participants were classified as meeting World Health Organisation PA guidelines or not, divided into IPAQ categories, and divided into tertiles based on weekly minutes of walking. Prospective analyses included 4,146 non-depressed respondents. **RESULTS:** After adjustment for age, sex, waist circumference, social class and smoking, odds of prevalent depression were 45.2% (OR=0.55, 95%CI: 0.44-0.69; p<0.001) lower among those meeting PA guidelines, 40.3% (OR=0.60, 0.47-0.76; p<0.001) and 53.2% (OR=0.47, 0.65-0.66; p<0.001) lower among those in minimally-active and very-active IPAQ categories, respectively, and 24.9% (OR=0.75, 0.59-0.96; p=0.02) and 44.1% (OR=0.56, 0.43-0.73; p<0.001) in moderate and high walking tertiles, respectively. Odds of incident depression were 24.4% (OR=0.76, 0.56-1.01; p=0.06) lower among those meeting PA guidelines, 34.7% (OR=0.65, 0.46-0.93; p=0.02) and 24.5% (OR=0.75, 0.77-1.07; p=0.10) lower among those in minimally-active and very-active IPAQ categories, respectively, and 22.7% (OR=0.77, 0.54-1.09; p=0.13) and 25.6% (OR=0.74, 0.52-1.06; p=0.10) lower among those in moderate and high walking tertiles, respectively. **CONCLUSION:** Among a large, nationally-representative sample of older adults, moderate and high volumes of MVPA were significantly associated with lower odds of concurrent depression and significantly and non-significantly associated with lower odds of incident depression, respectively. Meeting PA recommendations and walking were associated with significantly lower odds of concurrent depression and non-significantly lower odds of incident depression.

1083 Board #6 May 31 8:00 AM - 10:00 AM Influence Of Omega-3 Status On Depression And Anxiety In Young Women With Obesity Helen T. O’Connor1, Rebecca L. Cook1, Helen M. Parker1, Cheyne Donges2, Janet Franklin1, Kate S. Steinbeck1, Hoi Lun Cheng1, Manohar Garg1, Nicholas J. O’Dwyer1. 1The University of Sydney, Sydney, Australia. 2Charles Sturt University, Bathurst, Australia. 3Royal Prince Alfred Hospital, Sydney, Australia. 4The Children’s Hospital Westmead, Sydney, Australia. 5The University of Newcastle, Newcastle, Australia. 

Sponsor: Melinda Manore, FACSM

No relevant relationships reported

**PURPOSE:** Obesity is associated with an increased risk of depression and anxiety. Higher omega-3 polyunsaturated fatty acid (n-3PUFA) status may help to reduce negative consequences of obesity on mental health outcomes. This cross-sectional study aimed to investigate the relationship of obesity and n-3PUFA with depression and anxiety in young women. **METHODS:** A national representative sample of older adults, moderate and high volumes of (BMI). **METHODS:** Healthy, young (18-35y) women (N: 18.5-24.9kg/m2; O: >30kg/m2) with no history of treatment (counselling or medication) for depression or anxiety completed the Depression, Anxiety and Stress Scale (DASS). Status of n-3PUFA was assessed using the blood total Omega-3 Index (0-4%, safe; 4-8%, moderate; >8%, high). Data were analysed via repeated measures ANOVA, ANCOVA (controlling for n-3PUFA). DASS components are reported as mean ± SD scores (normal <0.5, mild 0.5-1, moderate >1-2, severe >2-3, extremely severe >3). Cohen’s d effect size (ES) between BMI, depression and anxiety was also determined. **RESULTS:** 299 women (N: n=157, 24.9±6.6y; O: n=142, 26.9±3.4y) completed the study. Although mean DASS scores were in the normal range, the O group had higher risk of DEP and anxiety compared to the N group. Significant differences were found between event type and DEP within sprinters, middle distance runners, and distance runners were at the highest risk for DEP and LSE; therefore, further examination is needed to draw conclusions to what additional pressures they may have. With a risk of DEP and LSE being most prevalent among younger collegiate athletes, universities need to focus on establishing a support system or mentoring program for incoming student-athletes.

1084 Board #7 May 31 8:00 AM - 10:00 AM An Examination of Affective Change in the Absence of Physical Sensation Kathryn M. Rougeau1, Stephen R. Kozie1, Steven J. Petruzzello, FACSM2. 1Oakland University, Rochester, MI. 2University of Illinois, Urbana, IL. 

Sponsor: Steven J. Petruzzello, FACSM

No relevant relationships reported

Examination of affective responses to acute exercise has been plagued by the inability to find an appropriate control condition, as a true placebo has been elusive. This has resulted in various “control” conditions (e.g., quiet rest, reading, sitting in a chair on a treadmill, stretching). A potential option involves passive cycling. This would also provide a unique methodology for studying affective responses to activity in spinal cord injured (SCI) individuals. **PURPOSE:** To examine the psychological and physiological effects of Passive (PaC) versus Placebo cycling (PLC), both compared to Rest, in SCI individuals. **METHODS:** Heart rate (HR), Rating of Perceived Exertion (RPE), and affect (Calmness, Tension, Energy, Tiredness, State Anxiety) were recorded in 21 (11 male; 27 ± 6.52 yrs; M ± SD) participants before, during and after each Rest, PaC, and PLC 25-min bout. Each cycling session consisted of identically paced warm-ups (5-min @ 35 r·min⁻¹), movement bout (15-min @ 60 r·min⁻¹), and cool-down (5-min @ 35 r·min⁻¹). **RESULTS:** PaC elicited psychological changes that varied significantly with respect to perceptions of Energy and Calmness, but not valenced (i.e., positive, negative) affect. Energy increased from Pre to Post-0 exercise (P=0.02), then decreased Post-0 to Post-10 (P=0.002). Enjoyment was greater following PaC relative to PLC (M=3.89, P=0.06) and Rest (M=3.93, P=0.001). RPE was significantly higher during PaC compared to PLC (M=7.05, P=0.001); however, among those whose scores were in the normal range, the O group had higher depression (N: -0.33±0.71, 0.11±0.09, p=0.001) and anxiety (N: -0.29±1.23, 0.29±0.80, p=0.004) scores but they still remained significantly higher for the O group. **CONCLUSIONS:** Young women with obesity had significantly higher scores for depression and anxiety. The status of n-3PUFA had a minimal impact on these scores. This study reinforces the pervasive, negative impact of obesity on mental health in young women.
way of examining potential placebo effects of activity on affective outcomes. This also provides insights into how activity may influence affective responses in individuals with a SCI.

1085 Board #8 May 31 8:00 AM - 10:00 AM
Acute Effects of Resistance Exercise in Depressed Black/African American People Living with HIV
Sanaz Nosrat, James W. Whitworth, Nicholas J. SantaBarbara, Mark E. Louie, Joseph T. Ciccolo, Teachers College, Columbia University, New York, NY.
(No relevant relationships reported)

In the US, Blacks/African Americans (AA) comprise the largest proportion of People Living with HIV (PLWH). Depressive symptoms and fatigue are highly prevalent among PLWH. Depressive symptoms are linked to progression of HIV disease, and fatigue is linked to severity of depressive symptoms. Resistance exercise (RE) is shown to have psychological benefits in non-HIV depressed populations, and these benefits are hypothesized to be intensity-dependent. To date, no study has examined the use of a single bout of RE for management of affect and fatigue with depressed PLWH.

METHODS: Twenty-five men and 17 women ages 24-66 (47.5±11.2) with a Center for Epidemiologic Studies Depression Scale score of ≥10 completed a battery of questionnaires and 10 repetition maximum (10RM) muscular strength tests. Participants were randomized into: moderate intensity RE (MRE) (i.e., 70% of 10RM), n=21, or vigorous intensity RE (VRE) (i.e., 100% of 10RM), n=21. They had to complete 3 sets of 10 repetitions for 5 exercises. Affect, arousal, and distress were measured with the Feeling Scale, Felt Arousal Scale, and Subjective Units of Distress Scale, respectively. Measures were administered at PRE, MID, POST, at 15-minute DELAY, and at 30-minute DELAY. Changes were analyzed using ANOVAs, with Bonferroni adjustments.

RESULTS: There were significant group x time interactions for affect (p<.05), and distress (p<.01), and main effect of time for arousal (p<.01). With MRE, affect improved PRE to POST (p<.01), PRE to DELAY15 (p<.01), and PRE to DELAY30 (p<.01), and arousal increased PRE to MID, and PRE to POST (p<.01). In addition, distress reduced PRE to all time points (p<.01). With VRE, affect decreased PRE to MID (p<.01), while arousal increased PRE to MID, and PRE to POST (p<.01). In addition, distress reduced PRE to DELAY15 (p<.01), and PRE to DELAY30 (p<.01).

CONCLUSIONS: Results suggest that an acute bout of MRE is more effective than VRE in improving affect, increasing energy, and reducing distress in depressed AA PLWH. However, VRE also appears to have distress-reducing benefits. These findings should be considered when prescribing exercise for symptom management in this population.

C-09 Thematic Poster - Performance after ACL Reconstruction
Thursday, May 31, 2018, 8:00 AM - 10:00 AM
Room: CC-Lower level L100F

1086 Chair: Brian Noehren, FACSM. University of Kentucky, Lexington, KY.
(No relevant relationships reported)

1087 Board #1 May 31 8:00 AM - 10:00 AM
Peak and Rapid Force Deficits during Countermovement Jump Persist Longer than Reduced Jump Height post-ACLR Reconstruction
(No relevant relationships reported)

Following anterior cruciate ligament reconstruction (ACLR) athletes often demonstrate persistent lower extremity biomechanical abnormalities which may inhibit return to sports and/or contribute to increased risk of re-injury. Countermovement jump (CMJ) height is an indicator of lower extremity explosiveness and athletic ability. Phase-specific CMJ ground reaction force-time curve variables provide detailed information on jump performance, and have not yet been examined in collegiate athletes post-ACLR.

PURPOSE: To assess eccentric (ECC) and concentric (CONC) phase CMJ maximal and rapid ground reaction force (GRF) variables in collegiate athletes post-ACLR and non-injured healthy controls.

METHODS: 18 Division I athletes (12 males) post-ACLR and 18 controls matched by sport, gender, year, and position performed maximal CMJs on force plates (800 Hz) 5.7 ± 1.8 (EARLY) and 9.8 ± 1.8 months post-surgery (LATE), ECC and CONC phase peak force, rate of force development (RFD), and rate of force unloading (RFU) were computed. Variables were analyzed by 3-way mixed ANOVAs (group x limb x interval).

RESULTS: Jump height was significantly lower in the ACLR group EARLY (ACLR: 29.7 ± 7.5 cm, CONTROL: 35.7 ± 11.3 cm), but not LATE (33.8 ± 7.6 cm). ACLR group involved (INV) limb peak and rapid force variables were significantly reduced compared to the uninjured limb at both time intervals (LIMB symmetry indices; peak ECC force - EARLY: 84.1%, LATE: 96.9%; peak CONC force - EARLY: 83.8%, LATE: 90.1%; ECC RFD - EARLY: 83.3%, LATE: 82.4%, CONC RFU - EARLY: 80.3%, LATE: 90.0%). LATE post-surgery, ACLR group INV peak ECC force (deficit: 10.8%), peak CONC force (7.6%), ECC RFD (41.8%), and CONC RFU (22.5%) were significantly lower compared to CONTROL athletes.

CONCLUSIONS: Although CMJ height was not significantly reduced compared to healthy controls 10 months post-surgery, collegiate athletes post-ACLR present with CMJ maximal and rapid force deficits between limbs and when compared to healthy controls. These findings indicate that kinetic abnormalities persist despite minimal limitation in jump height, the most common CMJ performance metric. Deficits in rapid GRF capacity are greater than deficits in maximal GRF capacity and have practical relevance, as sports activities have limited time available for force development.

1088 Board #2 May 31 8:00 AM - 10:00 AM
Neuromuscular Training Improves Sagittal Plane Hip and Knee Landing Kinematics and Kinetics In ACL-reconstructed athletes
Christopher Nagelli, Samuel Wordeman, Stephanie Di Stasi, Joshua Hoffman, Tiffany Marulli, Timothy E. Hewett, FACSM. Mayo Clinic, Rochester, MN. The Ohio State University, Columbus, OH.
(No relevant relationships reported)

Deficits in hip and knee biomechanical and neuromuscular control are commonly observed in anterior cruciate ligament (ACL) reconstructed (ACLR) athletes and are associated with an elevated risk of future ACL injury. The efficacy of neuromuscular training (NMT) programs to improve hip and knee biomechanical deficits in ACLR athletes is currently unknown.

PURPOSE: To quantify the effect of a NMT program in ACL-reconstructed athletes to improve sagittal plane landing biomechanics. The primary hypothesis tested was that sagittal plane hip and knee biomechanics associated with greater risk of ACL injury would be significantly reduced in ACLR athletes after participation in an NMT program. It was further hypothesized that following training hip and knee sagittal plane biomechanics in the ACLR cohort would not differ from a control cohort who also completed the training program.

METHODS: Eighteen ACLR and ten control athletes were recruited and completed a 12 session NMT program. Both groups of athletes participated in three-dimensional motion analysis prior to and after completion of the NMT program to evaluate hip and knee kinetics and kinematics during a drop vertical jump. Reported measures were computed. Variables were analyzed by 3-way mixed ANOVAs (group x limb x interval).

RESULTS: There were significant group x time interactions for affect (p<.05), and distress (p<.01), and main effect of time for arousal (p<.01). With MRE, affect improved PRE to POST (p<.01), PRE to DELAY15 (p<.01), and PRE to DELAY30 (p<.01), and arousal increased PRE to MID, and PRE to POST (p<.01). In addition, distress reduced PRE to all time points (p<.01). With VRE, affect decreased PRE to MID (p<.01), while arousal increased PRE to MID, and PRE to POST (p<.01). In addition, distress reduced PRE to DELAY15 (p<.01), and PRE to DELAY30 (p<.01).

CONCLUSIONS: Results suggest that an acute bout of MRE is more effective than VRE in improving affect, increasing energy, and reducing distress in depressed AA PLWH. However, VRE also appears to have distress-reducing benefits. These findings should be considered when prescribing exercise for symptom management in this population.

1089 Board #3 May 31 8:00 AM - 10:00 AM
Biomechanical Adaptations After Exercise in Healthy and ACL Reconstructed Individuals
Lindsay V. Slater, Silvia Blemker, Jay Hertel, FACSM; Sue Saliba, Art Weltman, FACSM; Joe Hart, FACSM.
Northwestern University, Chicago, IL. University of Virginia, Charlottesville, VA. (Sponsor: Joe Hart, FACSM)
(No relevant relationships reported)

Athletes with history of anterior cruciate ligament (ACLR) reconstruction (ACLR) who return to high level of sport are at increased risk of another ACL injury during a game. Neuromuscular fatigue during sport may result in adaptive movement patterns which increase risk of injury. PURPOSE: To compare changes in an ACLR limb and a healthy limb based on fitness level after exercise.

METHODS: Thirty-three individuals with history of ACLR (22F/11M, 22.7±23.3 months post-surgery) and 29 healthy

ACSM May 29 – June 2, 2018
Minneapolis, Minnesota
Fear of reinjury and optimization of movement control in the ACLR limb during rehabilitation, rather than limb symmetry, may help to improve ACLR outcomes at return to play.

Previous work has revealed significant between limb asymmetry following anterior cruciate ligament reconstruction (ACLR). Current clinical return to sport testing utilizes single-limb hop distance symmetry (limb symmetry index (LSI) > 90%) and time since surgery to determine readiness to return to sport (RTS). Loading metrics could provide new insights on readiness to RTS. Functional knee braces are recommended by clinicians following ACLR. The impact of bracing on hop symmetry is not well understood. Purpose: To evaluate the effect of knee bracing and time since surgery on loading symmetry during hop testing (single hop (SH), triple hop (TH) and crossover hop (CH)). Methods: 25 ACLR (6 male/19 female, age: 18.7 ± 9.3 years) completed hop testing after being RTS (29.8 weeks post-op) by the orthopedic surgeon and again 3 months later (RTS +3), while wearing the loadcell (100Hz) (Novel Electronics, St. Paul, MN). Hopping tasks (SH, TH and CH) were collected twice per task. Testing (testing order was randomized) was completed with and without a custom extension constraint knee brace (DonJoy Orthopaedics). Peak vertical ground reaction force (vGRF), loading rate (LR), and impulse (Imp) were calculated using a custom Matlab program. The LSI was calculated as the ratio of the Sx/Nsx*100%. The effect of time (RTS, RTS +3) and condition (Braced, Non-Braced) was assessed using a repeated measures ANOVA for all tasks. Results: No significant interactions or main effects for time were found. Bracing resulted in improved LSI’s for vGRF during TH (p=0.039) and CH (p=0.013) and for Imp during the TH (p=0.039) (Table 1). Conclusion: These results reveal that loading symmetry is improved while wearing a functional knee brace and loading symmetry (LSI>90%) was achieved during most hopping tasks. Future work needs to examine additional functional measures (eg. bilateral landings, running) to determine the impact of functional knee bracing and time on loading LSI.

<table>
<thead>
<tr>
<th>Table 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single Hop</strong></td>
</tr>
<tr>
<td><strong>vGRF</strong></td>
</tr>
<tr>
<td>RTS</td>
</tr>
<tr>
<td>(4.177)</td>
</tr>
<tr>
<td>RTS +3</td>
</tr>
<tr>
<td>(1.984)</td>
</tr>
<tr>
<td>Braced</td>
</tr>
<tr>
<td>(0.939)</td>
</tr>
<tr>
<td>Non-</td>
</tr>
<tr>
<td>braced</td>
</tr>
</tbody>
</table>

Note: values are presented as mean (SE)
Anterior cruciate ligament (ACL) injury can disrupt one’s proprioception such as joint position sense (JPS) and ultimately motor function. The application of localized vibration has been used to investigate the integrity of the sensorimotor system and the mechanisms of quadriceps weakness after ACL injury and ACLR-reconstruction (ACLR). However, effects of localized vibration on knee JPS in ACLR subjects are largely unknown.

**PURPOSE:** To evaluate JPS with and without vibration and compare among ACLR, contralateral, and control limbs. **METHODS:** Fourteen subjects with ACLR (8 males and 6 females) and fourteen control subjects (7 males and 7 females) participated. Subjects sat on an isokinetic dynamometer chair with vibration strapped on the quadriiceps tendon while visual and auditory cues were removed. Subjects were asked to remember target position and replicate that position. The absolute difference between the target and replicated trial was used as JPS. There were three trials at each of three target positions (15, 45, and 75 degrees of knee flexion) with and without vibration. The JPS differences between vibration and no-vibration conditions were calculated by subtraction. The average JPS was used for analyses. The order of testing conditions was randomized. One-way analysis of variance (ANOVA) was used to compare variables (Kruskal-Wallis) was used to compare among limbs. Significance was set at p=0.05 a priori. **RESULTS:** There were no significant JPS differences among ACLR, contralateral, and control limbs (p=0.207-0.914) in vibration and no-vibration conditions. Similarly, the JPS differences between vibration and no-vibration conditions were used to compare the limbs, there were no significant JPS differences among ACLR, contralateral, and control limbs (p=0.288-0.755). **CONCLUSION:** The current investigation found minimal effects of localized vibration on JPS on the ACLR, contralateral, and control limbs. There are several potential reasons such as vibration-induced post effect, locations of vibration, types of vibration, and rehabilitation status. Despite the current results and limitations, continued effort to develop and refine a means to examine one’s sensorimotor system is warranted.

Supported by NIH R01AR056259, R01AR055563, L30AR070273, K12HD065987, the Mayo Clinic Kelly Orthopedic Fellowship.
for pilot data collection were randomized to one of three groups: no additional PA (CON), 300 min/wk of lighter-intensity PA (LIPA; 40-60% HRmax) and 150 min/wk of higher-intensity PA (HIIP; 60-80% HRmax). VO2peak (maximal Balke protocol), anthropometric measures (height, weight, waist and hip circumferences) and body composition (DXA) were assessed at baseline and end of study. Participants in both PA groups received written resources on PA, an activity tracker (Polar A360®) to record heart rate and PA time, and a diary to record PA goals, facilitators and barriers throughout the intervention. In-person/telephone meetings occurred every three weeks to review activity tracker data, reinforce adherence and discuss barriers to achieving the prescribed PA goals.

RESULTS: Statistical differences in VO2peak between groups were noted. Specifically, increases in VO2peak were noted in HIPA vs. CON (5.9±0.6 vs. 0.5±3.0 ml/min/kg; P = 0.01) and LIPA vs. CON (4.2±4.9 vs. 0.5±3.0 ml/min/kg; P = 0.03). No significant changes in BMI (0.3±0.9, -0.1±1.08, -0.01±1.4 kg/m2; P = 0.6), waist (1.2±2.4, -1.1±3.3, -1.1±3.8 cm; P = 0.2) and hip (0.8±1.7, -0.2±2.7, -0.2±2.1 cm; P = 0.4) circumferences, body fat (0.1±1.1, 0.4±1.9, -1.1±2.3 kg; P = 0.3) and lean (0.4±0.8, -0.1±1.4, 0.7±1.5 kg; P = 0.3) mass were observed between CON, LIPA and HIPA, respectively.

CONCLUSIONS: Pilot results indicate that improvements in cardiorespiratory fitness can be achieved with both higher- and lower-intensity PA in breast cancer survivors.

Background: Increased physical activity among cancer patients is associated with decreased cancer-related deaths and improved quality of life. The underlying mechanisms of this association are under investigation. We examined the association between biomarkers of angiogenesis and inflammatory pathways and physical activity in colorectal cancer patients.

Materials/Methods: Pre-surgery (baseline) serum samples were collected from 222 colorectal cancer patients in the ColoCare cohort. Levels of CRP, SAA, IL-6, IL-8, MCP-1, sICAM-1, sVCAM-1, TNFα, VEGFA, and VEGFD were measured with the Meso Scale Discovery platform. Self-reported physical activity levels were assessed at baseline by using the VITAL questionnaire from the VITamins And Lifestyle cohort study and converted into metabolic equivalent (MET) hours/week (h/wk). Patients were classified into ≤10 METs versus >10 METs hours/week based on the American Cancer Society (ACS) cancer prevention recommendations. Partial correlations, t-test, and multinomial linear regression adjusted for age, gender, and body mass index were used to quantify the associations between biomarker and physical activity levels.

Results: A total of 132 patients (59%) reported weekly physical activity levels below cancer prevention recommendations. Lower METs h/wk were significantly correlated with increased IL-8, sICAM-1, and VEGFD serum levels (r=-0.14, p=0.046, r=-0.15, p=0.047; r=-0.20, p=0.006, respectively). sVCAM-1 and VEGFD also significantly differed by METs h/wk groups, where increased physical activity was associated with decreased biomarker levels (≤10 METs h/wk vs. >10 METs h/wk, sVCAM-1: 0.6±0.2 vs. 0.6±1.2, p=0.03, VEGFD: 926 ± 308 vs. 791 ± 240, p=0.002).

Discussion: For the first time, we report an association between not only inflammation-related, but also angiogenesis-related biomarkers among patients diagnosed with colorectal cancer. This research contributes to our understanding regarding potential mechanisms of physical activity in relation to cancer development, and prognosis.

ABSTRACT

Purpose: Patterns of activity and rest in a typical day may provide insight into functional capacity and reserve in older cancer survivors that may not be apparent in examining total physical activity alone. Using objectively collected PA data from the Baltimore Longitudinal Study of Aging, we assessed differences in the accumulation of daily PA among older adults by cancer history.

Methods: 663 participants (mean age 71 ±10 years, 51% women) wore a chest- fitted accelerometer for 7 consecutive days. Participants self-reported cancer history via questionnaire. Accelerometer data were summarized into two continuous metrics: 1) log-transformed total daily PA volume defined as mean counts/day and 2) a fragmentation index defined as the total number of PA bouts (consecutive minutes registering at 100 counts/min)/total PA minutes. Volume and fragmentation were also each dichotomized into low and high categories using their medians. Participants were categorized into four groups: high PA/low fragmentation, low PA/low fragmentation, high PA/high fragmentation, and low PA/high fragmentation to assess patterns of daily PA accumulation. Multivariable regression models were used to estimate PA patterns differences by cancer history, adjusting for demographics, behavioral factors and number of morbid conditions.

Results: Participants reporting cancer history averaged 0.12 (SE=0.05, p=0.002) fewer log-transformed activity counts per day compared to those reporting no cancer history. Although no significant fragmentation differences were detected between cancer groups (p=0.15) in the continuous model, cancer history was associated with a 78% (odds ratio: OR; 1.78, 95% confidence interval: CI; 1.12-2.8) higher odds of being in a high (versus low) fragmentation group and a 93% (OR: 1.98, 95% CI: 1.13-3.3) higher odds of being in a low PA/high fragmentation group (versus high PA/low fragmentation group) when compared to no cancer history.

Discussion: These results suggest that cancer survivors engage in lower total daily PA and that this activity is performed in a more fragmented manner, compared to those with no cancer history. Collectively, these results may be attributable to lower reserve capacity and greater fatigue burden among older cancer survivors that warrant further investigation.

Pilot results indicate that improvements in cardiorespiratory fitness can be achieved with both higher- and lower-intensity PA in breast cancer survivors.

Background: Increased physical activity among cancer patients is associated with decreased cancer-related deaths and improved quality of life. The underlying mechanisms of this association are under investigation. We examined the association between biomarkers of angiogenesis and inflammatory pathways and physical activity in colorectal cancer patients.

Materials/Methods: Pre-surgery (baseline) serum samples were collected from 222 colorectal cancer patients in the ColoCare cohort. Levels of CRP, SAA, IL-6, IL-8, MCP-1, sICAM-1, sVCAM-1, TNFα, VEGFA, and VEGFD were measured with the Meso Scale Discovery platform. Self-reported physical activity levels were assessed at baseline by using the VITAL questionnaire from the VITamins And Lifestyle cohort study and converted into metabolic equivalent (MET) hours/week (h/wk). Patients were classified into ≤10 METs versus >10 METs hours/week based on the American Cancer Society (ACS) cancer prevention recommendations. Partial correlations, t-test, and multinomial linear regression adjusted for age, gender, and body mass index were used to quantify the associations between biomarker and physical activity levels.

Results: A total of 132 patients (59%) reported weekly physical activity levels below cancer prevention recommendations. Lower METs h/wk were significantly correlated with increased IL-8, sICAM-1, and VEGFD serum levels (r=-0.14, p=0.046, r=-0.15, p=0.047; r=-0.20, p=0.006, respectively). sVCAM-1 and VEGFD also significantly differed by METs h/wk groups, where increased physical activity was associated with decreased biomarker levels (≤10 METs h/wk vs. >10 METs h/wk, sVCAM-1: 0.6±0.2 vs. 0.6±1.2, p=0.03, VEGFD: 926 ± 308 vs. 791 ± 240, p=0.002).

Discussion: For the first time, we report an association between not only inflammation-related, but also angiogenesis-related biomarkers among patients diagnosed with colorectal cancer. This research contributes to our understanding regarding potential mechanisms of physical activity in relation to cancer development, and prognosis.

Pilot results indicate that improvements in cardiorespiratory fitness can be achieved with both higher- and lower-intensity PA in breast cancer survivors.

Background: Increased physical activity among cancer patients is associated with decreased cancer-related deaths and improved quality of life. The underlying mechanisms of this association are under investigation. We examined the association between biomarkers of angiogenesis and inflammatory pathways and physical activity in colorectal cancer patients.

Materials/Methods: Pre-surgery (baseline) serum samples were collected from 222 colorectal cancer patients in the ColoCare cohort. Levels of CRP, SAA, IL-6, IL-8, MCP-1, sICAM-1, sVCAM-1, TNFα, VEGFA, and VEGFD were measured with the Meso Scale Discovery platform. Self-reported physical activity levels were assessed at baseline by using the VITAL questionnaire from the VITamins And Lifestyle cohort study and converted into metabolic equivalent (MET) hours/week (h/wk). Patients were classified into ≤10 METs versus >10 METs hours/week based on the American Cancer Society (ACS) cancer prevention recommendations. Partial correlations, t-test, and multinomial linear regression adjusted for age, gender, and body mass index were used to quantify the associations between biomarker and physical activity levels.

Results: A total of 132 patients (59%) reported weekly physical activity levels below cancer prevention recommendations. Lower METs h/wk were significantly correlated with increased IL-8, sICAM-1, and VEGFD serum levels (r=-0.14, p=0.046, r=-0.15, p=0.047; r=-0.20, p=0.006, respectively). sVCAM-1 and VEGFD also significantly differed by METs h/wk groups, where increased physical activity was associated with decreased biomarker levels (≤10 METs h/wk vs. >10 METs h/wk, sVCAM-1: 0.6±0.2 vs. 0.6±1.2, p=0.03, VEGFD: 926 ± 308 vs. 791 ± 240, p=0.002).

Discussion: For the first time, we report an association between not only inflammation-related, but also angiogenesis-related biomarkers among patients diagnosed with colorectal cancer. This research contributes to our understanding regarding potential mechanisms of physical activity in relation to cancer development, and prognosis.

Pilot results indicate that improvements in cardiorespiratory fitness can be achieved with both higher- and lower-intensity PA in breast cancer survivors.
Cancer-related fatigue is the most debilitating side effect reported by cancer survivors, often lasting years following treatment. **PURPOSE:** To determine the effects of a 10 wk exercise intervention compared to a health education intervention on fatigue, psychological health outcomes and physical fitness in cancer survivors with documented fatigue. **METHODS:** This quasi experimental study allocated 37 post-treatment cancer survivors (33 female, 30 breast cancer, aged 55±2 yr, body mass index 28.5±1.3, time since treatment 2.3±0.3 yr, mean±SEM) to an exercise group (EXG, n=19) or health education comparison group (HEG, n=18). The intervention, with 2 min increments weekly, was tailored to fatigued individuals and emphasized brisk walking, stretching, exercise education and self-efficacy enhancement. Participants were evaluated at 0, 4, 8, and 10 weeks with the EXG evaluated again at 26 weeks. **RESULTS:** The intervention effect on fatigue (FACIT-F) in EXG was greater (p<0.05) than in HEG, the difference between groups at 10 weeks being 4 times the recognised clinical important difference. The intervention also increased (p<0.05) cognitive function, global quality of life, 6 min walk test and 30 sec sit to stand scores. It reduced (p<0.05) insomnia and fear of physical activity. There was no intervention effect on C-reactive protein, total leukocytes, monocytes, mononocytes or granulocytes, or on pulse wave velocity. The intervention effect on fatigue in EXG was largely achieved by wk 4 and maintained to 26 weeks. There was 100% retention rate at 10 weeks in both experimental groups and no adverse events reported. **CONCLUSIONS:** In survivors with documented fatigue, progressive exercise training has beneficial and sustained effects of considerable magnitude on fatigue, physical fitness and other quality of life outcomes beyond those attributable to peer support and investigator attention. These effects do not appear to be mediated by inflammatory factors.

### Fatigue and fitness changes following an exercise intervention in fatigued cancer survivors

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Exercise</th>
<th>Health Education</th>
</tr>
</thead>
<tbody>
<tr>
<td># Fatigue (FACT-F)</td>
<td>19.3±2.2</td>
<td>21.9±2.2</td>
</tr>
<tr>
<td># Quality of Life (EORTC QL-C30)</td>
<td>50.0±4.6</td>
<td>50.5±4.9</td>
</tr>
<tr>
<td># Cognitive Functioning (EORTC QL-C30)</td>
<td>41.2±7.7</td>
<td>50.9±7.9</td>
</tr>
<tr>
<td># Insomnia Severity (ISI)</td>
<td>15.2±1.8</td>
<td>15.5±2.0</td>
</tr>
<tr>
<td># Fear of physical activity  (FAPX-B)</td>
<td>28.9±6.3</td>
<td>27.1±3.7</td>
</tr>
<tr>
<td># 6 min walk test (m)</td>
<td>438±16</td>
<td>462±19</td>
</tr>
<tr>
<td># 30 sec Sit to Stand (reps)</td>
<td>13.4±0.8</td>
<td>12.6±1.2</td>
</tr>
<tr>
<td>Pulse Wave Velocity (m/s)</td>
<td>5.8±0.8</td>
<td>7.7±3.3</td>
</tr>
<tr>
<td>C reactive protein (mg/L)</td>
<td>1.9±0.6</td>
<td>2.9±0.9</td>
</tr>
</tbody>
</table>

**Values are mean ± SEM. * p<0.05 compared to pre-value in same group. † significant group x timepoint interaction.**

**Effects of a Lifestyle Intervention on Change in Body Composition in Postbreast Cancer Patients Undergoing Androgen Deprivation Therapy**

Zachary L. Chaplow\(^1\), Brian C. Focht, FACSM\(^2\), Alexander R. Lucas\(^2\), Elizabeth Grainger\(^3\), Christina Simpson\(^1\), Ciaran M. Fairman\(^1\), Jennifer M. Thomas-Ahner\(^4\), Victoria R. DeScenza\(^5\), Jessica Bowman\(^6\), Jacki Buell\(^7\), Steven K. Clinton\(^1\), The Ohio State University, Columbus, OH. \(^1\)Wake Forest University, Winston Salem, NC. (Sponsor: Brian C. Focht, FACSM)

Androgen deprivation therapy (ADT) is a foundation of treatment for a many prostate cancer (PCa) patients. However, the adverse effect of ADT on body composition place PCa patients at increased risk for sarcopenic obesity, cardiovascular disease, and metabolic syndrome. The synergistic benefits of promoting concurrent change in both exercise and dietary behavior (EX-D) could represent an optimal lifestyle intervention approach for offsetting the adverse effects of ADT on body composition. Nonetheless, knowledge of the effects of lifestyle EX-D interventions on change in body composition remains relatively limited. **PURPOSE:** The purpose of the single-blind, randomized controlled Individualized Diet and Exercise Adherence

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

Pilot (IDEA-P) trial is to evaluate the preliminary efficacy of an EX-D intervention, implementing a group-mediated cognitive behavioral (GMCB) approach, relative to standard-of-care (SC) treatment among PCa patients undergoing ADT. In the current study, we evaluated the effects of the EX-D intervention on select body composition outcomes. **METHODS:** A total of 32 PCa patients (M age = 65 years) on ADT were randomly assigned to the EX-D (n = 16) or SC (n = 16) interventions. Measures of body composition were obtained via Dual x-ray absorptiometry (DEXA) at baseline and 3-month follow-up assessments.

**RESULTS:** Results of intention to treat 2 (Intervention) x 2 (Time) ANOVA analysis yielded significant Intervention x Time interactions for android, gynoid, and total body fat (p<0.05). Post hoc analysis revealed that the EX-D intervention resulted in significant reduction in android, gynoid, and total body fat while no change in any body composition outcomes were observed with the SC intervention across 3 months. **CONCLUSIONS:** Findings from this IDEA-P trial suggest that an EX-D intervention, implementing a GMCB approach designed to promote adoption and adherence to lifestyle behavior change, resulted in superior improvements in key body composition outcomes relative to SC approach. Given the meaningful impact favorable body composition changes may have on chronic disease risk, these results underscore the utility of including EX-D intervention in the adjuvant treatment of PCa patients undergoing ADT.

Supported by NIH/NCI R03 CA162969/01

**Board #6**

May 31 8:00 AM - 10:00 AM

**Exercise Is More Effective Than Health Education In Reducing Fatigue In Fatigued Cancer Survivors\(^1\)\(^,2\)**

Patricia Sheehan, Suzanne Denieffe, Michael Harrison, FACSM. Waterford Institute of Technology, Waterford, Ireland.

(No relevant relationships reported)

BREAST CANCER SURVIVORS MAINTAIN EXERCISE AFTER BREAST CANCER SURVIVORS MAINTAIN EXERCISE AFTER TEAM TRIATHLON TRAINING**

Linda B. Picciotto\(^1\), Judy A. Tjoe\(^2\), Leslie J. Walke\(^2\), Aidan M. Flanagan\(^1\), Elizabeth M. DePauw\(^1\), Julia A. Hilbert\(^1\), Lauren Opelniski\(^2\), Alexander V. Ng, FACSM. \(^1\)Marquette University, Milwaukee, WI. \(^2\)Aurora Health Care, Milwaukee, WI.

(No relevant relationships reported)

**Board #8**

May 31 8:00 AM - 10:00 AM

**Breast Cancer Survivors Maintain Exercise after Team Triathlon Training**

Linda B. Picciotto\(^1\), Judy A. Tjoe\(^2\), Leslie J. Walke\(^2\), Aidan M. Flanagan\(^1\), Elizabeth M. DePauw\(^1\), Julia A. Hilbert\(^1\), Lauren Opelniski\(^2\), Alexander V. Ng, FACSM. \(^1\)Marquette University, Milwaukee, WI. \(^2\)Aurora Health Care, Milwaukee, WI.

(No relevant relationships reported)

Breast Cancer Survivors (BCS) often do not exercise at recommended levels. Estimates are that only 21% exercise at recommended levels 10 years after treatment. Interventional exercise programs examining exercise maintenance have found 49% to 58% maintain exercise at 6 months, and less then 50% of BCS can be expected to maintain exercise levels at 1 year or longer. Our previous studies have shown improvement in physical and psychosocial function with a 14-week training program. The 14-week triathlon training was comprised of two supervised group sessions and three home-based sessions per week. The training program culminated with participation in a sprint distance triathlon (0.25-0.5 mi swim, 12-15 mi bike, 3.1 mi run). **PURPOSE:** To determine if BCS who participate in a triathlon training program maintain high exercise levels after training. **METHODS:** Female BCS (n=156) were asked to complete a mailed survey about their leisure time activity 1-6 years after completing a triathlon training program. A Leisure Score Index (LSI) was derived from the Godin Leisure-Time Activity Questionnaire in the survey. Those completing the survey who reported the highest and lowest LSI scores were invited to participate in testing which included weight, BMI, body fat and circumference measurements as well as a 6-minute walk test and the FACIT-fatigue scale. **RESULTS:** Eighty (75%) reported LSI of 24 or greater. A subset of BCS with high (H) scores (n=6) and low (L) scores (n=5) were tested. No significant group differences (p>0.05) were noted in age (H=62.3±5.1, L=56.6±5.7 yrs), time since training (H=7±2.1, L=3.2±1.3 yrs), and 6MWHT (H=593±260.6, L=553±429.6 cm min p<0.01). Group differences were found in hip circumferences (H=96.2±6.9 L=116±11.5 cm, p<.01), waist circumferences (H=97±8.11 L=97.5±9.1 cm, p<.05), weight (H=61±9.9 kg, L=48±12.9 kg, p<.01), BMI (H=23±3.2, L=39±13.7 p<.05), body fat % (H=36±7.4 L=46±8.5, p<.01) and fatigue (H=49±3, L=34±18 p<.05). Data are mean (sd).

**CONCLUSIONS:** Structured training for BCS can lead to higher levels of activity maintenance at 1-6 years after training. Thus, triathlon training could lead to continued exercise, less fatigue, and better health in breast cancer survivors.
Prior research has evaluated the influence of sleep deprivation on endurance performance, but the influence of real-world variation in acute and chronic sleep in youth athletes is unknown.

**Purpose:** To determine the relationship between acute, chronic, and acute:chronic sleep on aerobic performance in female youth soccer athletes.

**Method:** Nineteen female soccer players (13-18 years) underwent cycle ergometer testing to determine maximal aerobic capacity (VO_{2\text{max}}), time to exhaustion (T_{\text{EE}}), and ventilatory threshold (VT). Subjects were asked to report prior night sleep duration and average sleep duration during the previous calendar month. Acute:chronic sleep was calculated as the ratio of prior night and prior month sleep variables. Variables were grouped by prior night and prior month sleep duration (<8 hours, ≥8 hours) as well as acute:chronic sleep (ac:ch ≥1). VO_{2\text{max}}, T_{\text{EE}}, and VT were compared between groups using least square means from age-adjusted linear models. Effect size was calculated as Cohen’s d.

**Results:** No statistically significant differences were identified between those subjects who slept ≥8 the prior night and those who slept <8 hours, with respect to VO_{2\text{max}} (50.3 ± 2.4 vs 47.6 ± 2.0 mL/kg/min, p=0.10, d=0.45), T_{\text{EE}} (15.7 ± 0.7 vs 14.9 ± 0.9 min, p=0.17, d=0.37), or VT (43.2 ± 1.9 vs 40.7 ± 2.2 mL/kg/min, p=0.09, d=0.46). Subjects who averaged ≥8 hours of sleep in the prior month demonstrated significantly greater VO_{2\text{max}} (50.4 ± 3.2 vs 45.2 ± 1.7 mL/kg/min, p=0.011, d=0.83) and VT (43.0 ± 1.5 vs 39.0 ± 2.9 mL/kg/min, p=0.016, d=0.78), but not T_{\text{EE}} (15.6 ± 0.6 vs 14.8 ± 1.2 min, p=0.24, d=0.37). On the other hand, subjects who slept more the previous night than over the previous month (acute: chronic ≥1) demonstrated greater T_{\text{EE}} (16.4 ± 1.0 vs 14.9 ± 0.7 min, p=0.012, d=0.73), but not VO_{2\text{max}} (50.1 ± 2.8 vs 48.7 ± 1.3 mL/kg/min, p=0.38, d=0.25) or VT (42.7 ± 2.5 vs 41.9 ± 1.7 mL/kg/min, p=0.60, d=0.015).

**Conclusion:** Among female adolescent athletes, greater sleep duration over the prior month is associated with increased VO_{2\text{max}} and VT, while increased prior night sleep relative to the preceding month was associated with increased T_{\text{EE}}. This suggests that chronic sleep may facilitate physiologic adaptation to increased aerobic capacity, while acute:chronic sleep may exert a greater influence on perceived exertion that impacts overall performance.

**Abstracts were prepared by the authors and printed as submitted.**
CONCLUSIONS: While being a competitive scholarship athlete is stressful and time consuming, it is not all that defines the participants. Further examination of other factors, such as academic demands, along with social and family commitments should be studied to better understand their effects on the hormone and psychometric scores. The total sleep time of the population is decreasing every year and, in addition, the number of people complaining of poor sleep or sleep disorders is increasing. On the other hand, regular exercise is known as one of the tools that help to promote sleep hygiene. However, it is not known which type of exercise is best. PURPOSE: To evaluate the effects of continuous running and interval running on the sleep profile of healthy young males. METHODS: 12 healthy males were recruited, all physically active, aged 23.6 ± 1.9 years and BMI of 24.9 ± 2.7 kg/m². The volunteers were all submitted to 3 different conditions: Baseline (BL), Continuous Running (CR) and Interval Running (IR). In the BL condition, no physical exercise was performed for 24h. In the CR condition, they were submitted to continuous running (5 minutes of warm-up, 30 minutes run at intensity 12±1.11 on the Borg Scale, and 5 minutes of cool down). In the IR condition, they were submitted to interval running (5 minutes of warm-up, 6 bouts of 2.5 minutes at intensity 15±1.7 on the Borg Scale separated by 2.5 minutes recovery intervals, followed by 5 minutes of cool down). In the morning soon after waking up, volunteers completed 4 records: Sleep Diary, Visual Analog Pain Scale, Scale of Overall Quality of Recovery and STAI-state. The data analysis performed was one-way ANOVA with Duncan test and a significance level at P < 0.05. The study was approved by UNIFESP Ethics Committee (#16686/08).

Results: In the sleep diary, a decrease was observed in the scores in CR condition when compared to the BL (CR= 23.6 ± 4.59, p < 0.01). In the waking sensation, a decrease was observed in CR condition when compared to the BL (CR= 6.68 ± 1.82, p < 0.02). In the Visual Pain Scale, the CR condition presented higher scores when compared to the BL condition (CR= 14.64 ± 2.94, IR= 14.58 ± 2.11, p < 0.02). No significant differences were found regarding STAI-state. Conclusions: After more intense exercise volunteers had a more restful sleep when compared to continuous running. Thus, we concluded that interval exercise can be used in training to also improve sleep quality. Financial support: CAPES.

PURPOSE: To examine the relationship between sleep coaching intervention (SC) and improvements in the psychological health of athletes. Methods: Thirty-eight healthy fitness club patrons (22 men) were randomized to receive SC (n = 19), consisting of twelve, 10-min education sessions between the trainer and participant to decrease barriers and increase self-reflection through weekly sleep data feedback and tailored advice. Results: No significant differences were found between the SC and control groups in the total sleep time of the population. Specific improvements in subjective sleep quality, including a decrease in early morning awakening and increase in sleep efficiency, were observed after the program. The participants also reported an increase in the perceived control and self-efficacy related to sleep. There was a significant decrease in self-reported daytime sleepiness (Epworth Sleepiness Scale: pre= 17.08 ± 2.50, post= 14.64 ± 2.94, p < 0.01). Conclusion: Sleep Coaching (SC) improves subjective sleep quality and reduces daytime sleepiness in trained athletes. No significant improvements or differences were found in objective sleep data.

PURPOSE: To examine the relationship between sleep coaching intervention (SC) and improvements in the psychological health of athletes. Methods: Thirty-eight healthy fitness club patrons (22 men) were randomized to receive SC (n = 19), consisting of twelve, 10-min education sessions between the trainer and participant to decrease barriers and increase self-reflection through weekly sleep data feedback and tailored advice. Results: No significant differences were found between the SC and control groups in the total sleep time of the population. Specific improvements in subjective sleep quality, including a decrease in early morning awakening and increase in sleep efficiency, were observed after the program. The participants also reported an increase in the perceived control and self-efficacy related to sleep. There was a significant decrease in self-reported daytime sleepiness (Epworth Sleepiness Scale: pre= 17.08 ± 2.50, post= 14.64 ± 2.94, p < 0.01). Conclusion: Sleep Coaching (SC) improves subjective sleep quality and reduces daytime sleepiness in trained athletes. No significant improvements or differences were found in objective sleep data.

PURPOSE: To examine the relationship between sleep coaching intervention (SC) and improvements in the psychological health of athletes. Methods: Thirty-eight healthy fitness club patrons (22 men) were randomized to receive SC (n = 19), consisting of twelve, 10-min education sessions between the trainer and participant to decrease barriers and increase self-reflection through weekly sleep data feedback and tailored advice. Results: No significant differences were found between the SC and control groups in the total sleep time of the population. Specific improvements in subjective sleep quality, including a decrease in early morning awakening and increase in sleep efficiency, were observed after the program. The participants also reported an increase in the perceived control and self-efficacy related to sleep. There was a significant decrease in self-reported daytime sleepiness (Epworth Sleepiness Scale: pre= 17.08 ± 2.50, post= 14.64 ± 2.94, p < 0.01). Conclusion: Sleep Coaching (SC) improves subjective sleep quality and reduces daytime sleepiness in trained athletes. No significant improvements or differences were found in objective sleep data.
time (R²=0.33, p=0.015). No additional relationships were seen. A cutoff value was found at 401.6 min of average total race-night sleep time, indicating the top 25% of race finishers slept for ≥401.6 min. CONCLUSIONS: During a multistage ultra-endurance triathlon, performance time can be predicted by sleep time the night before. In addition, faster performance times during each stage predicts more sleep time. Based on our results, average total race-night sleep time of roughly 402 min (6.7h) night leads to faster finishing time in the Ultraman Florida. This study was supported by FSU and FatigueScience.

C-12 Free Communication/Slide - New Insights in Measurement of Physical Activity and Sedentary Behavior

PURPOSE: The present study compared sedentary time estimates from a thigh-worn monitor (AP) to a wrist and hip-worn AG monitor across five different activity domains in a free-living environment.

METHODS: Participants (n=16, mean age=26.9yrs, 69% female) were two AG monitors (right hip, non-dominant wrist), and one AP accelerometer (thigh) for two, 2-hour sessions. Each participant completed 2 out of 5 activity domains that represent daily life: household (H, N=5), active leisure (AL, N=8), sedentary leisure (SL, N=6), work (W, N=7), and transportation/errands (TE, N=4). Sedentary time was estimated from the AG hip data using: Sjoujorn 3x (S3x), 100 vertical count cut-point (V100), 200 vector magnitude cut-point (VM200), and the Crouer two-registry (C2) method. A random forest machine learning method (RF) was used to classify AG wrist data. Relationship between AG and AP methods were examined with Pearson correlations. A paired t-test was used to examine mean differences in overall sedentary time estimates, and a linear mixed effects model was used to test for any significant interaction between accuracy of AG methods by activity domain. P-values < 0.05 are considered statistically significant.

RESULTS: Compared to AG correlations for AG methods were: S3x (r=0.82), VM200 (R=0.81), C2 (R=0.71), V100 (r=0.61) and RF (R=0.68), (all p<0.05). Compared to AP, estimates were significantly higher for the S3x (mean diff [95%CI] 9.0 (4.5, 13.4, 18, 5, 32, 0.02)min, p=0.003). The RF [-4.6, -1.7, 8.2]min, 200VM [-1.2, -10.8, 8.4] min, and C2 (2.2 [-9.8, 14.2]min), were not statistically different than AP. The accuracy of S3x did not differ by domain (p=0.05), while the accuracy of the 200VM, C2, 100V and RF estimates significantly differed by domain (p<0.05). VM200, C2 and RF underestimated sedentary time in the TE and H domains and underestimated in AL and SL.

CONCLUSIONS: The S3x method overestimated sedentary time compared to AP, but was the most precise and consistent across domains. These data highlight the importance of ensuring a range of activity domains in free-living validation studies. Future research should expand the sample and include direct observation measures of sedentary time compared to AP and AG supported by Bill and Linda Frost Fund.

May 31 8:45 AM - 9:00 AM

Video-Recorded Validation of Wearable Step Counters Under Free-living Conditions

Lindsay Toth. University of Tennessee, Knoxville, TN. (Sponsor: David R. Bassett, Jr., PhD, FACSM)

(NO relevant relationships reported)

Research-grade accelerometers (RGA) are valuable tools to monitor sedentary behavior. Despite the broad appeal of RGA for researchers and clinicians, there is limited evidence of how well they estimate sedentary time (ST) in free-living settings.

PURPOSE: To examine the accuracy and precision of ST estimates from an RGA worn on the hip and wrist in free-living settings. METHODS: Thirty-two participants were directly observed while completing three, 2-hour sessions on different days and wearing commonly used hip- and wrist-worn RGAs. A validated video-taped direct observation (DO) system was used to determine ST. For the RGA, ST was estimated using (1) the 100 counts/min cutpoint (hip RGA) and (2) random forest model using 15-sec raw acceleration data (Staudemayer et al., 2015) (wrist RGA). Linear mixed models were used to compare the accuracy and precision of ST estimates from the hip- and wrist-worn RGA to DO measured ST. Pearson correlation coefficients were used to determine the association between DO measured and RGA estimated ST.

RESULTS: The hip- and wrist-worn RGA estimates of ST were significantly overestimated compared with DO. Precision, assessed as the 95% CI for the bias, was similar between the RGA hip and RGA wrist. The RGA ST min was moderately (RGA hip) to highly (RGA wrist) correlated with DO. CONCLUSION: The accuracy of ST estimates from RGA were affected by wear location and data processing technique. These results demonstrate the need for more research to elucidate how these factors influence estimates of ST from RGA in free-living settings. Funded by: NIH: 1F31HL129802-01

<table>
<thead>
<tr>
<th>Mean min (SD)</th>
<th>Bias</th>
<th>95% CI</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>DO (Criterion)</td>
<td>42.8 (42.3)</td>
<td>50.7</td>
<td>43.3, 58.1</td>
</tr>
<tr>
<td>RGA hip</td>
<td>93.4* (24.0)</td>
<td>61.3* (25.2)</td>
<td>20.3</td>
</tr>
</tbody>
</table>

*significantly different than criterion (p<0.05).

The hip- and wrist-worn RGA estimates of ST were significantly overestimated compared with DO. Precision, assessed as the 95% CI for the bias, was similar between the RGA hip and RGA wrist. The RGA ST min was moderately (RGA hip) to highly (RGA wrist) correlated with DO. CONCLUSION: The accuracy of ST estimates from RGA were affected by wear location and data processing technique. These results demonstrate the need for more research to elucidate how these factors influence estimates of ST from RGA in free-living settings. Funded by: NIH: 1F31HL129802-01

(NO relevant relationships reported)
Consumer-grade physical activity monitors (PAMs) have been extensively examined for estimating energy expenditure (EE) in adults; however, few studies have examined their ability to estimate EE in youth. PURPOSE: The purpose of this study was to examine equivalence between predicted EE (consumer-grade PAMs) and measured EE (indirect calorimetry) in youth. METHODS: Ninety-five youth (mean(SD); age, 12.2(3.5) yr; 49% male) performed 30 min of supine rest and 16 structured activities for estimating energy expenditure (EE). All PAMs estimated gross EE, Oxygen consumption was converted to EE in kilocalories (kcal), then summed over the total time spent in ≥10min bouts of MVPA using Spearman’s correlations. EVS responses were used to predict subjects who were confirmed to meet current PA guidelines of ≥10 MVPA min/week via accelerometer using logistic regression. The EVS receiver operating characteristic area under the curve (AUC), sensitivity, and specificity were calculated. The concurrent validity of the EVS MVPA estimates was tested against accelerometer-derived steps/day using Spearman’s correlations. The intraclass correlation coefficient (ICC) was calculated between the EVS responses at T1 and T2 in order to evaluate questionnaire test-retest reliability. RESULTS: Reliability for the EVS questionnaire was strong (ICC= .98). There was a moderate correlation (rho=.58 at T1, p=.01) between the EVS-estimated PA minutes/week and the accelerometer-derived MVPA minutes/week. There was also a moderate correlation (rho=.43 at T2, p<.006) between EVS-determined PA minutes/week and the accelerometer-derived steps/day. The T2 EVS specificity and sensitivity were 56% and 78%, respectively, and the AUC was 0.74. CONCLUSIONS: In a diverse, urban sample, the EVS questionnaire has acceptable validity and high test-retest reliability. The EVS may be a useful tool for identifying ethnically-diverse individuals not meeting current PA guidelines. Further research in larger ethnically-diverse samples is needed.

**RESULTS**

**EVS** receiver operating characteristic area under the curve (AUC), sensitivity, and specificity were calculated. The concurrent validity of the EVS MVPA estimates was tested against accelerometer-derived steps/day using Spearman’s correlations. The intraclass correlation coefficient (ICC) was calculated between the EVS responses at T1 and T2 in order to evaluate questionnaire test-retest reliability. RESULTS: Reliability for the EVS questionnaire was strong (ICC= .98). There was a moderate correlation (rho=.58 at T1, p=.01) between the EVS-estimated PA minutes/week and the accelerometer-derived MVPA minutes/week. There was also a moderate correlation (rho=.43 at T2, p<.006) between EVS-determined PA minutes/week and the accelerometer-derived steps/day. The T2 EVS specificity and sensitivity were 56% and 78%, respectively, and the AUC was 0.74.

**CONCLUSIONS:** In a diverse, urban sample, the EVS questionnaire has acceptable validity and high test-retest reliability. The EVS may be a useful tool for identifying ethnically-diverse individuals not meeting current PA guidelines. Further research in larger ethnically-diverse samples is needed.

**PURPOSE:** To evaluate the accuracy of the Objective Physical Inactivity Risk Assessment for Toddlers (OPIRA-T), a brief (15-60min) screening test for physical inactivity.

**METHODS:** Families (N=119) with children 24-35 months-old were recruited from an Infant Early Head Start (IEHS). Children’s physical activity (PA) was measured for 7 days via hip-worn triaxial accelerometers. Cliff (2009) wear time criteria were applied to children’s 15s epoch PA data, and Trost (2012) cut points were applied. Children not meeting respective moderate-vigorous PA (MVPA) and total PA (TPA) guidelines of 60min/day and 180min/day were determined using 7-day wear time data. Brief raw accelerometer data segments [15, 30, 45, 60min] were randomly extracted from the full 7-day wear data from periods when children were in the EHS. The raw signals were scored using our novel signal analysis algorithm (OPIRA-T). A classification tree (CART) was used to fit OPIRA-T scores as a predictor of children not meeting PA guidelines during the 7-day wear period. CART algorithm ROC area under the curve (AUC) and bootstrapped 95% CI were evaluated. OPIRA-T scores were also used to classify children at risk of physical inactivity using a custom cascaded 2-step algorithm (OPIRA-T screening test). The bootstrapped sensitivity, specificity, positive and negative predictive values for the OPIRA-T screening test were calculated. Descriptive statistics are presented as Mean(SD) and Frequencies (%).

**RESULTS:** Children [n=60; F: 53%; age: 29.4 months] with valid 7-day wear time data were included. Respectively, 75% and 32% of toddlers did not meet MVPA and TPA guidelines. OPIRA-T score and OPIRA-T screening test validation results appear in Table 1.

**CONCLUSION:** Within the EHS setting, OPIRA-T accurately identified toddlers at risk of physical inactivity from a brief period (15min) of objectively measured PA. Further research is needed on which classroom periods are the most reliable testing times for using OPIRA-T.

---

**Table 1: Mean EE and MAPE for six PAMs in youth.**

<table>
<thead>
<tr>
<th>PAM</th>
<th>Apple Watch</th>
<th>Net EE (kcal)</th>
<th>MAPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>K4b2 EE</td>
<td>160±59</td>
<td>(143.9-175.9)</td>
<td>75±42</td>
</tr>
<tr>
<td>Miso/Fitbit</td>
<td>56±4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MyoShine</td>
<td>56±4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fitbit Charge</td>
<td>56±4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PAM</th>
<th>Miso/Shine</th>
<th>MAPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MyoTracker</td>
<td>21.8</td>
<td>33.9</td>
</tr>
<tr>
<td>Samsung Gear</td>
<td>21.8</td>
<td>33.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PAM</th>
<th>Miso/Shine</th>
<th>MAPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miso/Shine</td>
<td>21.8</td>
<td>33.9</td>
</tr>
<tr>
<td>Samsung Gear</td>
<td>21.8</td>
<td>33.9</td>
</tr>
</tbody>
</table>

* significantly equivalent to K4b2 (p<0.05) * values in parentheses are equivalence zone

---

**Validity and Reliability of the Exercise Vital Signs Questionnaire in a Diverse Urban Population**

Norberto Quiles1, Lin Piao1, Aston K. McCullough1, Queens College, Flushing, NY. Teachers College, Columbia University, New York, NY. (No relevant relationships reported)

The Exercise Vital Signs (EVS) is a new brief (~30 seconds) physical activity (PA) questionnaire used by the Exercise is Medicine initiative within the American College of Sports Medicine. While the criterion validity of the EVS has been evaluated in a select number of ethnic groups, research on the validity and reliability of the EVS questionnaire in a diverse, urban sample is lacking. PURPOSE: To determine the validity and reliability of the EVS in a diverse, urban sample.

METHODS: An ethnically-diverse sample (White 33%, Latino 31%, Asian 21%, Black 15%) of N=39 participants [age 31(10.4) yr] were asked to wear an accelerometer at the hip for 9 days and to complete the EVS at the beginning (T1) and end (T2) of the wear period. The criterion validity of the EVS-estimated minutes of weekly moderate-vigorous PA (MVPA) was determined against accelerometer-derived estimates of the total time spent in ≥10min bouts of MVPA using Spearman’s correlations. EVS responses were used to predict subjects who were confirmed to meet current PA guidelines of ≥10 MVPA min/week via accelerometer using logistic regression. The EVS receiver operating characteristic area under the curve (AUC), sensitivity, and specificity were calculated. The concurrent validity of the EVS MVPA estimates was tested against accelerometer-derived steps/day using Spearman’s correlations. The intraclass correlation coefficient (ICC) was calculated between the EVS responses at T1 and T2 in order to evaluate questionnaire test-retest reliability.

RESULTS: Reliability for the EVS questionnaire was strong (ICC= .98). There was a moderate correlation (rho= .58 at T1, p=.01) between the EVS-estimated PA minutes/week and the accelerometer-derived MVPA minutes/week. There was also a moderate correlation (rho= .43 at T2, p<.006) between EVS-determined PA minutes/week and the accelerometer-derived steps/day. The T2 EVS specificity and sensitivity were 56% and 78%, respectively, and the AUC was 0.74.

CONCLUSIONS: In a diverse, urban sample, the EVS questionnaire has acceptable validity and high test-retest reliability. The EVS may be a useful tool for identifying ethnically-diverse individuals not meeting current PA guidelines. Further research in larger ethnically-diverse samples is needed.
C-13  
**Free Communication/Slide - VO2max**

**Thursday, May 31, 2018, 8:00 AM - 10:00 AM**  
**Room: CC-Mezzanine M100F**

**1122**  
**Chair: Paul M. Gallo, FACSM. Norwalk Community College, Norwalk, CT.**  
(No relevant relationships reported)

**1123**  
**May 31 8:00 AM - 8:15 AM**  
**Fitness And Age-related Associations: Is VO2peak A Valid Measure For Older Adults?**

Ryan J. Dougherty, Jacob B. Lindheimer, Aaron J. Stegner, Stephanie Van Riper, Jacob V. Ninneman, Oziona C. Okonkwo, Dane B. Cook, FACSM. University of Wisconsin - Madison, Madison, WI. (Sponsor: Dane B. Cook, FACSM)  
(No relevant relationships reported)

Cardiorespiratory fitness (CRF) is routinely investigated in older adults; however, the most appropriate CRF measure to use for this population has received little attention. **Purpose:** To (i) evaluate the reliability and validity of the oxygen uptake efficiency slope (OUES) as a sub-maximal measurement of CRF, (ii) examine demographic, risk-factor, and exercise testing differences in older adults who satisfied standardized criteria for a peak oxygen consumption (VO2peak) test compared to those who did not, and (iii) determine the difference between directly measured VO2peak values and OUES-predicted VO2peak values. **Methods:** One hundred ten enrollees from the Wisconsin Registry for Alzheimer’s Prevention participated in this study. Participants performed a graded maximal exercise test and wore an accelerometer for 7 days. For each participant, the VO2peak was calculated at 75, 90 and 100% of exercise duration. VO2peak was recorded at peak effort, and one week of physical activity behavior was measured. **Statistical analyses:** Intraclass correlation coefficients (ICC), bivariate Pearson correlations and a one-way repeated-measures ANOVA examined the reliability and criterion validity. Independent samples t-tests and Cohen’s effect sizes examined between group differences and linear regression was used to obtain the formula for OUES-predicted VO2peak. **Results:** VO2peak values calculated at separate relative exercise durations displayed excellent reliability (ICC = .995; p < .001), and were strongly correlated with VO2peak calculated at 80% VO2peak (r = .91; p < .001). A higher percentage of participants who did not satisfy VO2peak criteria were significantly older than those who satisfied criteria (p = .049) and attained a directly measured VO2peak that was 2.31 mL·kg⁻¹·min⁻¹ less than their OUES-predicted VO2peak value (d = 7.2; p = .003). **Conclusions:** Older adults are less likely to satisfy VO2peak criteria, which results in an underestimation of their CRF. Without adhering to standardized criteria, VO2peak measurement error may lead to misinterpretation of CRF and age-related associations. Here, we conclude that OUES is a reliable, valid measurement of CRF which does not require consideration of standardized criteria.

May 31 8:15 AM - 8:30 AM  
**Evaluating The Influence Of Methodological Variables On The Determination Of VO2max And The Lactate Threshold.**

Nicholas Jannick1, Javier Botella2, David Pyne, FACSM3, David Pyne, FACSM4, David Bishop, FACSM3, David Bishop, FACSM4, Victoria University, Melbourne, Australia. 1Australian Institute of Sport, Canberra, Australia. 2University of Canberra, Canberra, Australia. 3Edith Cowan University, Joondalup, Australia. (Sponsor: Professor David Bishop, FACSM)  
(No relevant relationships reported)

Graded exercise tests (GXTs) can be used to determine peak oxygen uptake (VO2peak) and the lactate threshold (LT), and are commonly employed by sport scientists and coaches to evaluate and prescribe exercise training. Two critical methodological choices that influence these indices are GXT stage length (for VO2peak) and the LT, and the method used to calculate the LT. However, there has been little investigation of the effects of these choices on the validity of the derived indices. **Purpose:** To determine the influence of GXT stage length and method of calculation on the estimation of LT and VO2peak. **Methods:** Trained male cyclists (n=17) completed five GXTs of varying stage length (1, 3, 4, 7 and 10 min) on different days, each followed by a verification exhaustive bout (VEB) to confirm VO2peak and a series of 30-min constant power bouts to establish the maximal lactate steady state (MLSS). All tests except GXT (which was performed first) were performed in a randomized order. VO2 was assessed during each GXT and VEB, and 15 different LTs were calculated from four of the GXTs (3, 4, 7 and 10 min) – yielding a total 60 LTs. Agreement was assessed between the highest VO2 measured during each GXT (VO2peak) and between each GXT and subsequent VEB. Validity of the LTs derived from the GXTs was assessed using the MLSS as the criterion measure. VO2peak and LT data were analyzed

---

Table 1. Accuracy of OPIRA-T scores and screening test in identifying toddlers at risk of insufficient daily activity according to current physical activity recommendations

<table>
<thead>
<tr>
<th>Observation Length</th>
<th>n = 53</th>
<th>n = 60</th>
<th>n = 58</th>
<th>n = 55</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy Indices</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precision</td>
<td>98%</td>
<td>97%</td>
<td>93%</td>
<td>96%</td>
</tr>
<tr>
<td>Recall</td>
<td>97%</td>
<td>91%</td>
<td>92%</td>
<td>95%</td>
</tr>
<tr>
<td>Specificity</td>
<td>92%</td>
<td>93%</td>
<td>92%</td>
<td>70%</td>
</tr>
<tr>
<td>Positive Predictive Value</td>
<td>94%</td>
<td>96%</td>
<td>96%</td>
<td>86%</td>
</tr>
<tr>
<td>Negative Predictive Value</td>
<td>86%</td>
<td>88%</td>
<td>92%</td>
<td>90%</td>
</tr>
</tbody>
</table>

*American Heart Association. The AHA’s Recommendation’s for Physical Activity in Children

| *Institute of Medicine. Early Childhood Obesity Prevention Policies

---

**1121**  
**May 31 9:45 AM - 10:00 AM**

**Sensitivity of a Consumer Activity Tracker to Detect Changes In Lab-based and Free-living Activity Settings**

Greg J. Petrucci, Jr., Patty S. Freedson, FACSM, Brittany R. Masteller, Melanna F. Cox, John W. Staudenmeyer, John R. Sirard. UMass Amherst, Amherst, MA. (Sponsor: Patty S. Freedson, FACSM)

**Reported Relationships:** G.J. Petrucci: Contracted Research - Including Principle Investigator; Motif Shine™Wearables (Fossil Group, Richardson, TX, USA).

**PURPOSE:** Determine the sensitivity of a consumer activity tracker (CAT) to detect changes in physical activity (PA) measures during laboratory (LAB) and free-living (FL) conditions.

**METHODS:** Twenty-one participants wore the CAT and ActiGraph GT3X+ accelerometer (AG) at the hip and dominant wrist during three, 1-hour LAB sessions: sedentary (SS), sedentary plus walking (SW), and sedentary plus jogging (SJ). For SW and SJ, participants performed 30-minutes of sitting, then 30-minutes of walking or jogging at 5.15 or 8.0 kph, respectively. Direct observation (DO) of steps served as the criterion measure for SW and SJ sessions. Devices were also worn during two FL conditions: 1) active week where participants met activity guidelines (ACT); 2) sedentary week, absent of purposeful activity (SED). The PA measures were: CAT and AG steps and kCals, CAT “points”, and AG vertical axes counts. For LAB and FL, significant differences were examined by comparing non-overlapping 95% confidence intervals (C.I.’s) and linear mixed effects models, respectively. Linear mixed effects models were fit for differences (bias; absolute and percent) between CAT device estimated steps and DO step (α ≤ 0.05).

**RESULTS:** For all hip-worn CAT measures there was a significant step-wise increase from SS to SJ (p < 0.05), however estimates of steps were greater for SJ, compared to SS and SW, which were similar to each other [95% C.I.’s hip: step-wise increase from SS to SJ (p < 0.05), however estimates of steps were greater for SJ, compared to SS and SW, which were similar to each other [95% C.I.’s: hip: (2861, 3542) and (2863, 3463), wrist: (2068, 2063) and (1908, 2647)]. During FL conditions, all CAT and AG outcomes were sensitive to changes between ACT and SED (p = 0.0001).

**CONCLUSIONS:** The hip-worn CAT was sensitive to changes during LAB and FL. CAT may be a useful tool for interventions where PA measures are used as exposure and/or outcome measures. **FUNDING:** UMass Institute of Life Sciences and Fossil GroupTM
using mean difference (MD), effect size (ES), intraclass correlation (ICC), and the coefficient of variation (CV). RESULTS: The VO_{2max} value from GXT was 61.0 ± 5.3 mL kg⁻¹ min⁻¹ and the peak O_2 uptake was 55.2 ± 5.7 mL kg⁻¹ min⁻¹ (mean ± SD). The MLSS power was 264 ± 39 W; VO_{2peak} from GXT, VT, and underestimated VO_{2max} from GXT, VT (M = -1.2, -2.1, -3.7 and -4.8 mL kg⁻¹ min⁻¹ respectively). The VO_{2peak} values from the GXT and VEB during GXT and VT were within the error of the measurement (CV<3%). The Modified Dmax method (log-poly-MD) derived from GXT, with an alternate initial data point calculated using the log-log method, provided the most valid estimate of the MLSS (MD = 1.1 W; ES = 0.03; ICC = 0.96). CONCLUSION: The log-poly-MD derived from GXT yielded the most valid estimate of the MLSS; however, the VO_{2max} from the four longest GXTs (3, 4, 7 and 10 min) underestimated the VO_{2max} from GXT, VT.

**RESULTS**

May 31 8:30 AM - 8:45 AM

**Evaluation of VO_{2peak} Calculations for the Boer 2 Through 5 Protocols**

Nicholas F. Boer, Josh Johann, Gregory Heath, FACSM. Univ. of Tennessee, Chattanooga, TN.  
(No relevant relationships reported)

**PURPOSE:** The purpose of this investigation was to determine whether individuals of varying fitness levels would select an appropriate exercise test from the Boer 1 - 5 graded (maximal) exercise testing protocols. The protocols were developed to be used for exercise prescription for individuals of varying fitness levels (1: Moderate Fit, 3: Fit, 4: Highly Fit and 5: Elite). It is hypothesized that calculated VO_{2peak} in each group will be different, while testing time will be statistically the same.

**METHODS:** Students from an exercise prescription lab course completed one of the five Boer protocols as a class assignment. Subjects completed a short survey and listened to a lecture regarding protocol selection. Subjects completed the graded exercise test and stopped the test when volitional fatigue was achieved. Treadmill testing time and calculated VO_{2peak} (from the intensity reached during the last two minutes) was recorded. A one-way ANOVA was completed with treadmill time and calculated VO_{2peak} as dependent variables and protocol selection as the independent variable.

**RESULTS:** N=83 (33 Male, 50 Female) Age 21.8 years (1.3), BMI 24.9 (4.3) There were no statistical difference between male and female results. Therefore, all subjects were pooled into the respective protocol. (No subjects completed Boer 1.)

<table>
<thead>
<tr>
<th>Protocol</th>
<th>VO_{2Peak} (mL/kg/min)</th>
<th>Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boer 2 (N=9)</td>
<td>36.5 (2.5)*</td>
<td>14.9 (2.6)</td>
</tr>
<tr>
<td>Boer 3 (N=50)</td>
<td>43.3 (3.8)*</td>
<td>13.9 (2.1)</td>
</tr>
<tr>
<td>Boer 4 (N=20)</td>
<td>54.1 (4.5)*</td>
<td>13.5 (2.2)</td>
</tr>
<tr>
<td>Boer 5 (N=4)</td>
<td>64.0 (5.2)*</td>
<td>12.8 (1.5)</td>
</tr>
</tbody>
</table>

* (p<0.001) compared to each of the other groups)

Total time includes a three minute warm up.

**CONCLUSION:** Subjects were able to determine an appropriate Boer 1 - 5 protocol and calculated VO_{2peak} was discreet between participants in each protocol.

Treadmill time remained similar in each group, which does not occur when existing maximal protocols are used to determine aerobic fitness in subjects of varying fitness levels. Preliminary evidence would suggest that this is a viable method to test aerobic fitness in the population.

May 31 8:45 AM - 9:00 AM

**Change In VO_{2max} And Time Trial Performance To Interval Training Prescribed According To Ventilatory Threshold**

(No relevant relationships reported)

Research shows that about 20% of participants demonstrate no change in maximal oxygen uptake (VO_{2max}) in response to moderate intensity continuous training (MICT) (Bouchard et al 1999) or high intensity interval training (HIIT, Asturino & Schubert 2014). Approximately 50% of this non-response is hereditary (Bouchard et al 2000) although the other 50% is unexplored (Mann et al. 2015) and likely related to participants’ habitual physical activity and dietary patterns, sleep, and traits of the training regime. In unfit adults, Wolpeen et al. (2015) showed that MICT prescribed according to Ventilatory Threshold (VT) led to lower onset of individual non-response than when prescribed using HR. **PURPOSE:** To prescribe HIIT according to VT to monitor aggregate and individual responses in both VO_{2max} and time trial (TT) performance. **METHODS:** Eleven active (age and VO_{2max} = 28.9 ± 7.9 y and 38.4 ± 4.5 mL kg⁻¹ min⁻¹) were recomended baseline testing including a VO_{2max} test on a cycle ergometer to determine peak power output (PPO) and ventilatory threshold (Caiozzo et al. 1986). Each subject also performed a 8.2 km cycling TT over three separate trials. Over a 3 wk period, they underwent 9 d of HIIT consisting of 8 – 10 60 s bouts at work rate of 130% VT with a 75 s active recovery period. Training elicited an intensity ~ 89.2 ± 5.7 %PPO. VO_{2max} and TT were assessed within 96 h after training. Controls (CON) (n=5; age and VO_{2max} = 22.7 ± 2.3 y and 40.4 ± 8.7 mL kg⁻¹ min⁻¹) consisted of active individuals who completed two sessions of baseline testing separated by 3 wk. **RESULTS:** Data showed a significant groupXtime interaction for VO_{2max} (F(18, 4 ± 4 mL kg⁻¹ min to 40.7 ± 4.8 mL kg⁻¹ min vs 40.4 ± 8.7 mL kg⁻¹ min to 40.6 ± 8.7 mL kg⁻¹ min, p=0.017) and TT (F(23.1 ± 78.2 to 894.8 ± 67.2 s vs. 921.2 ± 110.5 s to 2311.4 ± 4 s, p=0.007) between HIIT and CON. With 2Xindividual error = 0.11 L/min for VO_{2max} and 18.0 for TT, 63 % of participants showed meaningful increases in VO_{2max} and TT in response to this low dose of HIIT. Two of 11 participants exhibited non-response in both variables. **CONCLUSION:** These preliminary data show that 9 d of HIIT at 130 %VT significantly increases VO_{2max} and TT performance, but these responses do not occur in everyone. It is possible that the volume or duration of HIIT used is inadequate to promote greater responses in habitually active individuals.

May 31 9:00 AM - 9:15 AM

**The Impact Of An Interval Training Program On Muscle And Cerebral Oxygenation Responses To Incremental Ramp Exercise.**

Jan Boone, Kevin Cao, Kobe Vermeire, Jan Bourgois. Ghent University, Ghent, Belgium.  
(No relevant relationships reported)

**PURPOSE:** To study the effects of interval training on cerebral and muscle (de)oxygenation and their relationship to improvements in VO_{2peak} obtained from incremental ramp cycle exercise.

**METHODS:** Ten male subjects performed incremental ramp exercise tests (50 Watt + 25 Watt.min⁻¹) prior to and following a six week training intervention. During the tests, muscle (M. Vastus Lateralis) and cerebral (de)oxygenation (O_2Hb and HHb) was recorded with Near-Infrared Spectroscopy (NIRS 200, Hamamatsu, Japan). The training sessions were performed 3 times a week and consisted of 6 bouts of 4 min cycling at the critical power, interspersed by 3 min recovery a work rate corresponding to the gas exchange threshold. The changes in the tissue oxygenation responses (muscle HHb and toHb, cerebral O_2Hb and toHb) was calculated by expressing these responses obtained from the posttest relative to those obtained in the pretest in which the amplitude was set to 100%.

**RESULTS:** Following the training intervention, the VO_{2peak} had increased from 52.4±3.5 mL min⁻¹ kg⁻¹ to 56.4±3.8 mL min⁻¹ kg⁻¹ (P<0.001) and peak power output from 384±36 Watt to 415±40 Watt (P<0.001). Muscle HHb amplitude had increased (P<0.01) with 64±50%, whereas also the muscle HHb work rate slope had increased (P<0.01) from 0.52±0.14%Watt⁻¹ to 0.99±0.57%Watt⁻¹. The change in muscle HHb amplitude was correlated to the increase in VO_{2peak} (r=0.75, P<0.03). Muscle toHb amplitude increased with 85±79%, although this was not correlated to VO_{2peak} increase (r=0.22, P=0.05). Cerebral O_2Hb amplitude had increased (P<0.019) by 50±57% with 0.94±0.22%Watt⁻¹ and work rate slope had increased (0.89±0.47%Watt⁻¹ vs. 1.00±0.42%Watt⁻¹, P=0.58). Cerebral toHb did not show a change in amplitude (28±46%, P=0.24) nor in slope (0.67±0.15%Watt⁻¹ vs. 0.73±0.27%Watt⁻¹, P=0.58).

**CONCLUSIONS:** This study showed that the improvement in VO_{2peak} was predominantly related to an improved fractional O2 extraction (i.e, amplitude of muscle HHb). However, interval training also increased an O2 diffusive capacity (i.e., amplitude of muscle toHb) and cerebral oxygenation which might also affect maximal exercise performance.
exercise across different populations. METHODS: 232 male subjects divided in 24 international-level professional cyclists (PC), 77 US domestic competitive cyclists (DC), 107 recreational cyclists (REC) and 24 sedentary men (SM) performed an incremental cycling test starting at 1.0 W·kg⁻¹ with increments of 0.5 W·kg⁻¹ every 5 min until volitional exhaustion. VO₂ and VO₂max (ml·kg⁻¹ and [La]max (mmol·L⁻¹) were measured at the end of each step. Comparisons were done for each group by means a Student t-test. Pearson correlation coefficient was used to verify the relationships between the different variables studied. Statistical significance was set at p<0.05.

RESULTS: The average correlations between the VO₂ and the [La] at each step of the cycling test were for PC (r = 0.10 ± 0.02, p<0.001), DC (r = -0.11 ± 0.12, p<0.001), REC (r = 0.17 ± 0.14, p<0.001) and SM (r = 0.13 ± 0.21, p<0.001). The average correlations between VO₂max and the [La] at each step of the incremental test was moderate for PC (r = -0.10 ± 0.14, p<0.001) while weak for DC (r = -0.36 ± 0.15, p<0.001), REC (r = -0.27 ± 0.26, p<0.001) and SM (r = -0.32 ± 0.28, p<0.001).

CONCLUSION: Our study shows weak to moderate correlations between VO₂, VO₂max, and [La] across different populations. Since lactate is a more descriptive parameter of the metabolic responses to exercise, measuring [La] over VO₂ and VO₂max is a more appropriate parameter to assess metabolic fitness and performance.

1129 May 31 9:30 AM - 9:45 AM
The Effect Of Stride Frequency Variations On Running Performance At The Velocity Of VO₂ Max
Boram Lim, Boe Burrus, Justus Ortega, Young Sub Kwon. Humboldt State University, Arcata, CA.

(No relevant relationships reported)

Running economy (RE) is considered to be a critical factor to improve running performance. Stride frequency (SF) is an important variable for determining RE. The importance of SF has gained more attention in recent years, especially for recreational runners. However, no previous research has investigated the interaction between running performance at the velocity of VO₂max and SF. PURPOSE: To investigate the effect of five different SF conditions on running performance at the velocity of VO₂max.

METHODS: Twelve male recreational runners (Age=25 ± 4.2y, Height=1.70 ± 0.06m, Body Mass=70.9 ± 8kg) measured VO₂max (53.1 ± 5.4 ml·kg⁻¹·min⁻¹) and preferred stride frequency (PSF; 89.5 ± 4.6 / min) through a graded exercise test (GXT) and running session, respectively. Running speed was determined based on each individual’s GXT results by using ACSM estimation equations for exercise test and running session, respectively. Data at each step of the test was for PC (r = -0.36 ± 0.15, p<0.001), REC (r = -0.27 ± 0.26, p<0.001) and SM (r = -0.32 ± 0.28, p<0.001).

CONCLUSIONS: The SF variations and RER were possibly related to the central governor theory to delay the onset of fatigue. These results suggest that recreational runners could use a 105% of PSF to improve performance with the better RE.

<table>
<thead>
<tr>
<th>Table 1. The relationship between SF, Distance, and RER</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF variations</td>
</tr>
<tr>
<td>Distance(mile)</td>
</tr>
<tr>
<td>RER</td>
</tr>
</tbody>
</table>

Note. Results reported in mean ± SD. *p < 0.05, vs. 105% SF conditions. **p < 0.05, vs. 100% PSF conditions.

1130 May 31 9:45 AM - 10:00 AM
Predictability Of VO₂max From Three Commercially Available Devices
Luke D. McCormick. Eastern Michigan University, Ypsilanti, MI. (Sponsor: Dr. Karin Pfifer, FACSM)

(No relevant relationships reported)

Sports watches have been developed with a feature that predicts VO₂max from a submaximal effort. PURPOSE: To examine the predictability of VO₂max from two heart rate monitors (Device A and V) and a global positioning system (GPS) watch compared to measured VO₂max. METHODS: Twenty-seven participants, 15 males and 12 females ages 18 to 55, came to the Running Science Laboratory at Eastern Michigan University on two occasions. During visit 1, participants arrived in a semi-fasted state (with no caffeine or caloric consumption for 3 hours) and comprised a maximal graded exercise test (GXT) to determine VO₂max. The participant then performed a self-selected speed which remained constant throughout the test while only grade increased by 2% every 2 minutes until volitional exhaustion. A VO₂max (ml·kg⁻¹·min⁻¹) was reached if heart rate was ≥95% of age predicted max, RER was ≥1.05, and there was a plateau in VO₂ (< 2 ml·kg⁻¹·min⁻¹). During visit 2, participants first wore two heart rate monitors simultaneously (Device A and V) and were instructed to lie still for 6 minutes to allow for the devices to estimate VO₂max. After these values were obtained, these two devices were replaced by a GPS watch. Participants then completed a 15-minute submaximal outdoor run, and the GPS watch estimated VO₂max. Pearson correlations and a Repeated Measures ANOVA were utilized to compare estimated VO₂max values from the three studies to measured VO₂max from the GXT (p<0.05). RESULTS: Six participants were excluded due to having a VO₂max less than 35mm·kg⁻¹·min⁻¹, not returning for the second visit, or a device malfunctioning. Device A (r = 0.66; p<0.001), Device V (r = 0.80; p<0.001), and the GPS watch (r = 0.72; p<0.001) were associated with measured VO₂max. A significant main effect was found among VO₂max values (F(2, 38) = 9.04, p<0.001). There was a significant difference (p<0.01) between measured VO₂max (51.0 ± 9.1 ml·kg⁻¹·min⁻¹) compared to Device A (44.0 ± 5.5), Device V (45.3 ± 5.6), and the GPS watch (45.7 ± 5.3). CONCLUSIONS: Even though there were moderate to strong relationships, all three watches underestimated VO₂max compared to measured VO₂max. However, the difference between measured VO₂max and all three devices may fall within daily variation of VO₂max. The three devices may serve as an appropriate measure of cardiorespiratory fitness from a submaximal effort.

C-14 Clinical Case Slide - Cardiovascular II

1131 Chair: Paul D. Thompson, FACSM. Hartford Hospital, Hartford, CT.

(No relevant relationships reported)

1132 Discussant: Benjamin D. Levine, FACSM. Texas Health Presbyterian Hospital Dallas, Dallas, TX.

(No relevant relationships reported)

1133 Discussant: Rachel Lampert. Yale University, New Haven, CT.

(No relevant relationships reported)

1134 May 31 8:00 AM - 8:20 AM
Left Arm Cramping and Prominent Veins in a 19-year-old Women's Collegiate Soccer Player
Andrew Schleihau, Kimberly Kaiser, Robert Hosey, FACSM. University of Kentucky, Lexington, KY.

(No relevant relationships reported)

History: 19-year old female collegiate soccer goalie with PMXH iron-deficiency anemia due to heavy menses presents with left arm cramping, numbness, and purple discoloration. She was doing an overhead weightlifting workout and felt numbness and a cramping sensation in her left arm while performing front squats. She then noticed a purple discoloration of her left arm along with prominent veins and presented to the training room. After being examined, she was sent to the emergency department. She denied having any previous episodes similar to this. She was on oral contraceptives due to heavy menses but has no personal or family history of clotting disorders.


Differential Dx: Neurogenic thoracic outlet syndrome, vascular thoracic outlet syndrome, complex regional pain syndrome.

Tonsil results: Left UE Venous Doppler: Occlusive DVT in mid subclavian vein near the clavicle extending to the axillary, proximal basilic and proximal brachial veins. There is thrombus in the proximal cephalic vein. The jugular, radial and ulnar veins were patent with normal augmentation, compressibility, and flow. Left UE Arterial Doppler: Normal flow and waveforms throughout.

Final working diagnosis: Paget-Schroetter syndrome

Treatment and Outcome: She was placed on a heparin drip and underwent thrombolysis with catheter directed tPA. A balloon angioplasty was done of the left subclavian vein for a 3 cm occlusion and then she underwent a first rib resection with catheter directed tPA. A balloon angioplasty was done of the left subclavian vein for a 3 cm occlusion and then she underwent a first rib resection. After continuing to get discoloration of her arm walking across campus, she underwent a venogram two months after surgery that showed a well-adhered thrombus in her subclavian vein. She is scheduled for a repeat angioplasty and has been unable to return to full soccer activity after 5 months.

Abstracts were prepared by the authors and printed as submitted.
1. Left Ventricular Hypertrophy

FINAL/WORKING DIAGNOSIS: bridge 15%; FEV1 decreased 14%; FEF 25-75% decreased 39%

gadolinium enhancement LV wall mass. Borderline LAE. No regional wall motion abnormalities or delayed CARDIAC MRI: borderline concentric LVH (max 12.8 mm: Z score 2.2), borderline Borderline LAE.

ECHOCARDIOGRAM: LVH with notable hypertrophy of left posterior wall (14 mm).

2. Palpitations—probably benign

DIFFERENTIAL DIAGNOSIS:

SEM heard at LUSB and RUSB in the supine position. Pulses 2+ and equal. Abdomen pallor. Lungs clear. Regular rate and rhythm. Normal S1 and S2. I-II/VI nonspecific presyncope or syncope. Also denies effort intolerance.

Outcomes: After being withheld from football during this evaluation, he has since been Exercise Stress Test (1) No ischemic ECG changes or arrhythmia with stress. Final Strain imaging with normal strain-derived left ventricular systolic function. 3. Septal hypertrophy, septal thickness 1.6 cm, posterior wall thickness 1.3 cm. (2) No evidence of left ventricular outflow tract obstruction. (4) Normal global longitudinal strain imaging with normal strain-derived left ventricular systolic function. 3. Exercise Stress Test (1) No ischemic ECG changes or arrhythmia with stress. Final Diagnosis: Physiologic Left Ventricular Hypertrophy (Athlete’s Heart) Treatment and Outcomes: After being withheld from football during this evaluation, he has since been cleared for participation and has not demonstrated any unusual symptoms, including lightheadedness, dizziness, syncope, chest pain or shortness of breath. He is scheduled for follow-up in 6 months with a repeat echocardiogram.

1. Left Ventricular Hypertrophy

Chest Pain, Palpitations and Heart Murmur In A Basketball Player

Colin L. Conner1, John Stock2, Mitchell Cohen1. 1Arizona Pediatric Cardiology, Phoenix, AZ. 2Pediatric Cardiac Care of Arizona, Phoenix, AZ.

HISTORY: A 16 year old male competitive basketball player referred for a 3 month history of intermittent palpitations associated with chest pain at rest. Initially the symptoms were occurring once or twice a week, then once every 2 days, then occurring almost daily. The episodes are characterized by irregular heartbeat, followed by chest pain, with occasional shortness of breath. There is also chest pain associated with exercise. Characterized as burning which lasts 15-20 seconds. It does not change with activity level. He can usually play through the pain. He denies dizziness, presyncope or syncope. Also denies effort intolerance.


DIFFERENTIAL DIAGNOSIS:

1. Musculoskeletal chest pain
2. Palpitations—probably benign
3. Innocent murmur

TESTS AND RESULTS: ECG: sinus bradycardia, LVH, ST elevation right precordial leads, T wave inversion inferior leads

ECHOCARDIOGRAM: LVH with notable hypertrophy of left posterior wall (14 mm). Borderline LAE.

HOLER MONITOR: rare PVC’s and PAC’s. One polymorphic couplet CARDIAC MRI: borderline concentric LVH (max 12.8 mm: Z score 2.2), borderline LV wall mass. Borderline LAE. No regional wall motion abnormalities or delayed gadolinium enhancement.

METABOLIC STRESS: peak VO2 93% predicted. Ventricular ectopy at rest, with exercise and in recovery: suppressed at max HR, PFT (post exercise): FVC decreased 15%; FEV1 decreased 14%; FEF 25-75% decreased 39% CARDIAC CATHETERIZATION: normal LV end diastolic pressures. No myocardial bridge.

GENE DX: negative

FINAL/WORKING DIAGNOSIS:

1. Left Ventricular Hypertrophy
2. Premature Ventricular Contractions
3. Exercise Induced Bronchospasm

TREATMENT AND OUTCOMES:

1. Implantable loop recorder
2. Allowed to return to play with AED on site
3. Albuterol MDI prior to exercise
4. Repeat Metabolic Stress in 6 months

New Heart Murmur in a Male Basketball Player

Emily Miller, Dena Florczyk. UCLA, Los Angeles, CA.

HISTORY: 20 year old African American male presents for his pre-participation examination. Upon reaching the cardiovascular screening questions answers yes to both “have you ever been told you have a heart murmur” and “sudden death before the age of 50 in a relative.” At a visit two days prior he was told he had a heart murmur. His estranged father, with whom he had no relationship, passed away in his forties secondary to unknown heart disease. His father was reportedly born with “blue heart disease with a hole in his heart.” The etiology behind his father’s passing was unknown but he had a history of incarceration, alcohol and substance abuse. No other family history of cardiac disease. The athlete himself specifically denies any personal history of pre-syncpe, syncope, chest pain with exercise, dyspnea on exertion, palpitations.

PHYSICAL EXAMINATION:

BP: 130/70 General: alert and oriented, no stigmata of Marfan’s Cardiac: regular rate and rhythm, S1 S2, 1/6 systolic murmur when supine, resolved when standing or sitting, no increase with valsalva. Normal radial and femoral pulses Respiratory: clear to auscultation bilaterally.


FINAL WORKING DIAGNOSIS: Non-compaction of the left ventricle

TREATMENT AND OUTCOMES:

Clinically asymptomatic. Increased trabeculations noted on echo consistent with non-compaction of the LV but with preserved ejection fraction and without evidence of dilation. CM scan for week - no evidence of arrhythmias. Treadmill stress test with stress echocardiogram - no evidence of ischemia or exercise induced arrhythmias; normal cardiac response to exercise. ASA 81 mg daily to reduce risk of stroke associated with LV non-compaction. Reassurance provided that while being physically active this risk is minimal. Cleared to participate in athletics. Repeat echocardiogram in one year.

Misleading Congenital Brain and Heart Abnormalities in a Synocopal Soccer Player

Michael E. Pitzer1, Heather Bauby2, Virginia Commonwealth University, Richmond, VA. 1Randolph-Macon College, Ashland, VA.

HISTORY: A 19-year-old female collegiate soccer player reported recurrent fainting episodes during a pre-participation physical examination after transferring from another school. She reported sustaining a sports-related concussion in December 2014 and subsequently developed frequent fainting spells, headaches, and recurrent numbness in her arms and legs. Fainting spells were not provoked by Valsalva-like circumstances. Fainting spells were not associated with chest pain, palpitations, racing heart, shortness of breath, or diaphoresis. During fainting spells altered cognition may last only a few seconds or up to thirty minutes. Fainting spells are not associated with tonic-clonic movements, tongue biting, bowel incontinence, or bladder incontinence. She had already undergone evaluation for these symptoms including a Neurology evaluation that included a normal electroencephalogram and a Cardiology evaluation that included an electrocardiogram and echocardiogram. Echocardiogram revealed an atrial septal defect (ASD) which was subsequently closed and fainting spells became less frequent after ASD closure. Prior clearance to participate in soccer was provided by all evaluating providers including Cardiologist, Neurologist, and Primary Care Physician.

PHYSICAL EXAMINATION: Normal cardiac and neurologic examination.

DIFFERENTIAL DIAGNOSIS: Vasovagal syncope, postural orthostatic tachycardia syndrome, migraine variant, postconcussion disorder, psychogenic seizures, and somatization disorder.

TEST AND RESULTS: Brain MRI: The cerebellar tonsils descends below the foramen magnum, consistent with a Chiari I malformation. No upper cervical cord syrinx. Brain MRI with CSF flow sequences: The ventral foramen magnum...
remains patent and the ventricles are normal. There is decreased flow across the foramen magnum at the fourth ventricular outflow and posterior to the cerebellar tonsils. **Cervical spine MRI:** No syrinx. Neurosurgical evaluation: Asymptomatic Chiari 1 malformation. **FINAL WORKING DIAGNOSIS:** 1. Vasovagal syncope. 2. ASD status post closure. 3. Asymptomatic Chiari 1 malformation. **TREATMENT AND OUTCOMES:** The athlete was allowed to participate when she expressed understanding of the associated risks. Episodes of syncope continued to occur.

## C-15 Clinical Case Slide - Knee II

**Thursday, May 31, 2018, 8:00 AM - 10:00 AM**  
**Room: CC-200F**

### 1140 Chair: Aaron Rubin, FACSM. Kaiser Permanente Sports Medicine Program, Fontana, CA.  
(No relevant relationships reported)

(No relevant relationships reported)

### 1142 Discussant: Cindy Y. Lin. University of Washington Medical Center, Seattle, WA.  
(No relevant relationships reported)

### 1143 May 31 8:00 AM - 8:20 AM  
**Knee Pain - Exercise**  
Samuel T. Dona, Dean Padavan, Robert Monaco, Steven Selafani. Atlantic Sports Health, Morristown, NJ.  
(No relevant relationships reported)

**HISTORY:** A 15-year-old high school sophomore presented to the ED with palpitations, chest pain, and lightheadedness that began during volleyball conditioning. She reported one similar episode several months earlier and was seen by pediatric cardiologist for outpatient evaluation, which included resting ECG, 24-hour Holter monitor, and echocardiogram. While participating in consecutive scrimmages, she felt her heart racing and experienced dull, non-radiating substernal chest pain. Her symptoms prevented further participation and did not resolve with rest. Her heart rate was recorded as 195bpm at home.

**PHYSICAL EXAMINATION:** HR 186, RR 22, BP 107/68. Patient was diaphoretic but generally well appearing and in no acute distress. Cardiovascular exam revealed rapid heart rate with regular rhythm and identifiable S1 and S2 heart sounds without murmurs or clicks. Peripheral pulses were 2+ and symmetric, no JVD. Chest pain was not reproducible. Lungs were clear to auscultation bilaterally. Abdomen was soft and non-distended. Thyroid was symmetric and without nodules.

**DIFFERENTIAL DIAGNOSIS:**

1. Supraventricular tachyarrhythmia (SVT)  
   - AVNRT  
   - MAT  
2. Sinus tachycardia  
3. WPW syndrome  
4. Ventricular tachycardia  
5. Atrial fibrillation

**TESTS AND RESULTS:**

1. ECG  
2. CMP  
3. Troponins  
   - T0 < 0.010

**FINAL WORKING DIAGNOSIS:**

Exercise-induced SVT likely secondary to AVNRT

**TREATMENT AND OUTCOME:**

1. 1L IV fluid bolus  
2. Vagal maneuvers - modified Valsalva technique (strain followed by passive leg raise for 15 seconds at 45 degrees)  
   - synchronized cardioversion was considered unnecessary with stable vital signs  
   - normal sinus rhythm (NSR) was achieved after 3 attempts  
3. Outpatient referral to pediatric cardiology before return to activity  
4. Interim ED visit for refractory SVT  
   - vagal maneuvers were unsuccessful - adenosine was required to achieve NSR  
   - patient was ultimately trialed on metoprolol while awaiting EPS and ablation
who referred them in to sports medicine clinic. She does endorse similar swelling and pain 6 weeks ago that responded to ibuprofen and ice and resolved in 2-3 days. Denies locking, catching, popping or instability episodes in knee. Family history: unknown; adopted

**PHYSICAL EXAMINATION:** Inspection: Moderate sized effusion, no erythema. Range of motion full in flexion and extension with mild discomfort in full flexion. Palpation: Mild tenderness around patellar facets, mild medial joint line tenderness. Special Tests: Negative Lachmans, Negative McMurray’s, Negative patellar apprehension. Mild pain with valgus stress at 30degrees. Proprioception: Engaged Hip exam normal

**DIFFERENTIAL DIAGNOSIS:** 1. Patellofemoral Syndrome. 2. MCL sprain. 3. Inflammatory process: JIA, Synovitis. 4. Patellar instability

**TEST AND RESULTS:** X-rays 4 view Within normal limits. MRI with and without contrast: Findings consistent with an inflammatory synovitis with a moderate knee effusion and moderate synovitis. 2. Signal abnormality both deep and superficial to the medial collateral ligament may be secondary to strain. Labs: ESR 20mm/h, CBC normal, CRP: normal, ANA positive, Lyme serology positive

**FINAL WORKING DIAGNOSIS:** 1. Lyme Synovitis 2. Grade I MCL sprain

**TREATMENT AND OUTCOMES:** Currently undergoing antibiotic treatment with doxycycline 75mg BID for 4 weeks. Is also going through physical therapy in regards to MCL sprain.

**Acceptable Knee Pain in Adolescent Basketball Player**

**Kristopher Paultr. IMH/UM, Miami, FL.**

(No relevant relationships reported)

**History:**

14 y/o male basketball player presents to ED after sustaining an injury to his left lower extremity. This occurred during a school basketball game while landing from a jump shot. Patient stated he felt a pop in his left knee upon landing and rated pain a 9/10 severity. Immediately after, he had swelling with decreased ROM and was unable to flex/extend his knee due to pain.

**PE:**

- Left Knee: Edema was present with mild discoloration over the anterior of knee and severe tenderness upon palpation over anterior patellar tendon. Patient unable to perform active ROM. Passive ROM limited secondary to pain. Full scope of exam, including assessment of ligaments, menisci, and ROM also limited secondary to pain. Bilateral Ankles: No deformity noted b/l. Non-tender on palpation. Neurovascular intact.

**Differential Diagnosis:** Patellar dislocation

ACL tear Patellar tendon rupture Proximalibia fracture Distal femur fracture Meniscal tear

**Tests and Results:**

- X-rays of left femur (3 view), left knee (AP/ lateral), and left tibia/fibula (3 view):
  - Findings showed a displaced type-3a tibial tuberosity avulsion fracture, displaced 1.5 cm with an associated knee effusion and intra-articular extension. No additional fractures noted on left femur, knee, tibia, or fibula.

**Final/Working Diagnosis:**

- Closed left tibial tubercle avulsion fracture, displaced type-3A with avulsion of left quadriceps infrapatellar tendon.

**Treatment and Outcome:**

1. Open reduction and internal screw fixation of tibial tuberosity with repair of infrapatellar tendon
2. Long leg walker cast placed
3. At 6 week follow-up visit, repeat x-rays showed anatomic alignment of the fracture site, good positioning of 2 fixation screws, and articular surface which was realigned. Knee immobilizer was discontinued and he was given walker for stability. Instructed to d/c use of walker once left knee felt stable and remain out of athletic activities until further evaluation. Referred to PT for Quad strengthening and ROM exercises.
4. At 5 month post injury visit, patient showed favorable progress. He had full ROM, improved strength, and was cleared to resume sports starting at a low level intensity. He was advised to gradually increase the duration and intensity of his training. Patient advised to continue knee mobility exercises and to use with PCP for routine Health care.

**Acute Knee Pain in Adolescent Basketball Player and Marching Band Member**

Nicholas E. Anastasio, David Hryniak. University of Virginia, Charlottesville, VA. (Sponsor: Robert Wilder, MD, FACS)

(No relevant relationships reported)

**History:**

Patient 1:

- A 17 year-old female collegiate marching band player presented with insidious onset right medial knee pain for the last 8 months. Pain waxed and waned with activity. No history of swelling, instability or locking. No numbness or weakness. Pain located diffusely over the medial knee and proximal medial tibia. Symptoms refractory to PT, patellofemoral kinesiotaping, medial arch support orthotics and NSAIDs. No relief following Medrol dose pack, intraarticular corticosteroid injection, or pes anserine bursa corticosteroid injection.

Patient 2:

- A 19 year-old female collegiate marching band member presented with insidious onset right medial knee pain present for 4 years. Patient reported intermittent swelling but denied instability or locking. Symptoms were worse with walking and marching. Previous Rheumatologic consult unrevealing. Symptoms refractory to PT, knee sleeve, and patellar straps. No relief following right pes anserine bursa corticosteroid injection.

**Physical Examination:**

Patient 1 - Knee without effusion. Diffuse tenderness to palpation over the medial knee at and below mid medial joint line. ROM and strength normal. No laxity. Neurovascular intact

Patient 2 - Knee without effusion. Tenderness to palpation over the medial joint line and distally over pes anserine. Tinel’s sign positive over the medial femoral condyle. ROM and strength normal. No laxity. Neurovascular intact

**Differential Diagnosis:**

1. Pes anserinus bursitis
2. MCL bursitis
3. Patellofemoral syndrome
4. Medial meniscal tear
5. Patellar patellar plica
6. Saphenous neuralgia

**Test and Results:**

**Patient 1:**

- XR Knee - No fracture or joint effusion.
- MRI knee - No menisci tear. No internal derangement. Mild increased T2 signal within the superior lateral aspect of Hoffa’s fat.
- Diagnostic saphenous nerve block - 0.5% bupivacaine injected 2 inches cephalad to the medial joint line - 24 hours of relief.

**Patient 2:**

- XR Knee - No fracture or malalignment.
- MRI knee - Unremarkable MRI of the knee.

**Final/Working Diagnosis:** Saphenous Neuralgia
Title: Lingering right knee pain - mountain biking Authors: Andrew McBride, John Hill, FACSM, Michelle Wolcott Sponsor: John Hill, FACSM Institutions: University of Colorado - School of Medicine History: Patient is a 32 y/o previously healthy male who presented to sports medicine clinic with one month of right knee anterior pain. Pain began after he swerved to avoid dogs while mountain biking. He fell from his bike and directly struck his anterior right knee on a rock. He had immediate pain and swelling but continued riding. His pain did not resolve with ice and ibuprofen, if fact it gradually worsened especially with deep knee bending and mountain biking. He felt the knee was unstable but denied locking or catching. Physical Exam: Right knee: Neutral alignment; Normal gait; No effusion; Patellar apprehension with medial facet tenderness and patellofemoral crepitus; swelling of patellar tendons; Lachman with soft endpoint; slight Anterior drawer; medial joint line pain; Normal neurovascular exam Differential Diagnosis: ACL sprain/tear, Patellar tendonitis, Medial meniscus tear, Patellofemoral syndrome, Fat pad impingement Tests and Results: X-ray of right knee showing soft tissue edema with small osseous fragment around distal patella; MRI right knee showing severe patellar tendinosis with no internal knee derangement; Diagnostic U/S showing severely thickened (1.2 cm) patellar tendon derangement with near complete disorganized fiber pattern with only mild neovascularity seen. Final Diagnosis: Traumatic patellar tendonitis Treatment and Outcomes: The patient initially tried rest, ice and ibuprofen with minimal relief. He later tried 4 visits with PT but pain worsened during these sessions. He was referred to U/S clinic for possible patellar derangement; Full knee U/S showed no sonographic signs of patellar tendinosis. Over next 3 weeks of conservative treatment, patient noted pain resolution. He was able to return to mountain biking without pain. He subsequently returned for 2 follow-up visits by PT and remained pain free. managed with spironolactone, OCP, and metformin. Medications were discontinued 2 months prior to presentation, as they were no longer effective. Simultaneously, patient was started on bupropion as an appetite suppressant, but has not noticed any weight change once initiation.

HISTORY: A 24-year-old male singer presented symptoms of trunk and abdominal pain, reduced breathing capacity and limited trunk mobility after six months of a laparoscopic Nissen fundoplication due to gastric volvulus associated with a paraesophageal hiatal hernia. His pain made it difficult to sing and perform sustained quality notes. He was referred to respiratory physical therapy. He was a non-smoker and not taking any medications. PHYSICAL EXAMINATION: Height 173 cm, weight 76 kg, body mass index 25.3 kg/m². Abdominal and thoracic examination revealed limited thoracic amplitude, diaphragmatic hypertonicity, altered sensitivity from T7 to T10, limited range of motion and pain during right and left trunk rotations and trunk extensions. Mild epigastric tenderness. Hernia reduced stable.

1154 May 31 8:40 AM - 9:00 AM Syncopal Episode in a College Football Player
Bjorn A. Jacobson, Richard A. Okragly. TrillHealth Bethesda Primary Care Sports Medicine Fellowship, Cincinnati, OH. (Sponsor: Henry Stiene, FACSM) (No relevant relationships reported)

HISTORY: A 20 year old African American college football player started to feel faint, walk slowly and then collapse during the end of a fitness session. Immediately triaged by his AT he was unresponsive to verbal or noxious stimuli, demonstrating brief decorticate posturing, tachypneic, with palpable pulses. The episode lasted 90 seconds. I arrived to find an alert and oriented male in no distress. Initially resistant, he did eventually agree to go to the ED. He stated he had taken 5 decongestant pills in the preceding 24 hours. He denied any preceding chest pain or palpitations, but did feel short of breath and light headed prior to collapsing. He said that he had a previous syncopal episode during exercise years ago that was reportedly secondary to dehydration.

Physical Examination: Initial exam on the field showed an alert, fully coherent and oriented well appearing male in no distress; pupils equal/reactive to light; no foaming of the mouth or tongue bite wounds; a regular rate and rhythm with no murmurs/galllops; lungs clear to auscultation; overall a benign physical examination. VS - BP 133/69, HR 63, RR 18, T 97.9°F, SpO2 98%.

DIFFERENTIAL DIAGNOSIS: 1) Vasovagal syncope or other reflex (neurally mediated syncope) 2) Cardiovacular syncope 3) Hypertrophic Cardiomyopathy 4) Metabolic (drug induced syncope) 5) Volume depletion orthostatic syncope 6) Seizure

TEST AND RESULTS: BMP, CBC, Cardiac Enzymes - Normal; Chest XR AP and Lateral - Normal; EKG - Sinus Rhythm, Normal Axis, ST elevation in leads V1-V5 followed by T wave inversions, Prominent QRS complexes (unchanged on 4 EKGs over 3 weeks); 2D Echo - LV EF 55-60%, mild concentric LVH, bicuspid aortic valve; Cardiac MRI - LV EF 55%, no LVH (wall thickness less than 11 mm), tricuspid aortic valve; Stress EKG (GXT) - Baseline EKG abnormalities normalized, negative for ischemia, Duke treadmill score 14 (low risk)

FINAL WORKING DIAGNOSIS: Vasovagal syncope possibly related to pseudohyponatremia.

TREATMENT AND OUTCOMES: After extensive cardiac work up, baseline EKG repolarization abnormalities normalized with exercise testing. Given his normal cardiac MRI and normal stress testing he was cleared by cardiology for full athletic participation. He was advised to immediately notify us if he develops any recurrent symptoms. He is now completing his college football season without incident.

1155 May 31 9:00 AM - 9:20 AM Headache and Near Syncope in a Soldier After Training
Robert H. Lutz, Duke Sports Science Institute, Durham, NC. (Sponsor: Shawn F. Kane, FACSM) (No relevant relationships reported)

HISTORY: A 34 y/o male active duty Soldier presented to an Army clinic with headache, nausea and lightheadedness around 1000 in the morning. Symptoms started indoors in a classroom environment, two hours after conducting a challenging obstacle course. On a bathroom break he felt like he was going to pass out after urinating and knelt to the ground. He denied falling off an obstacle, striking his head or sustaining any injuries on the morning obstacle course. He was weak, nauseous, and dizzy, with a 4/10 headache. He had been previously well and reported no history of head injury, fever, or neck stiffness. He denied peri-orbital tingling or numbness. During the evaluation, his headache increased in severity. Past medical history significant for radio frequency ablation for SVT 2007. The course medic verified there was no injury and reported the Soldier had recently been drinking a lot of water and protein shakes. Training for the three days prior to presentation included several prolonged, physically demanding events.

General: Pt on gurney with eyes closed, responding appropriately to questions. Respiratory rate rapid and deep. The physical exam to include a complete neurologic exam was only remarkable for mild photophobia and a lack of carpal pad spasm.


TESTS AND RESULTS: -Glucose: 90, CMP and CBC normal. UA: 2+ ketones, myoglobin negative. -ECG: sinus tachycardia, normal axis, normal intervals, no ischemic changes.
-Head CT: right-sided 2.8 cm epidural hematoma with 8mm of midline shift. No skull fracture identified.

TREATMENT AND OUTCOME: 1. Transfer to a tertiary care center for craniotomy and hematoma evacuation of the hematoma. There was a fine, non-displaced fracture of the temporal bone discovered at the time of surgery. 2. No neurologic sequelae.
3. Cleared to return to training after 6 months of healing.
4. Investigation after the injury revealed the Soldier had sustained minor blow to the right side of the head 3 days prior to presentation.

1156 May 31 9:20 AM - 9:40 AM Going the Distance Makes Me Tired: Seizure in a Cross Country Runner
Caitlin G. Waters, James Broadhurst, John H. Stevenson. UMass Memorial Medical Center, Worcester, MA. (Sponsor: Pierre Rouzier, FACSM) (No relevant relationships reported)

HISTORY: 21 y/o M collegiate cross country runner presents to team doctor with hand shaking and body cramping after a strenuous 12 mile run. Complained of generalized weakness, abdominal and leg cramping, nausea, diarrhea, slight shaking of his hands, and thirst. Felt well prior to the run. Endorsed increased thirst this week and had been drinking water. Sent to the ER for IV hydration. On his way to the ER, he suddenly became unresponsive with stiffness, shaking, and frothing at the mouth.


DIFFERENTIAL DIAGNOSIS: Metabolic Derangement, Hyponatremia, Hyperkalemia, Hypoglycemia, Rhabdomyolysis/Dehydration, Toxie Encephalopathy; Drug Withdrawal; Intracranial Mass; CNS Infection; Epilepsy

TEST AND RESULTS: Initial Na 118, Anion Gap 17, Magnesium 1.5, Initial CPK 917, CK rose to greater than 60,000 despite IV hydration, Toxicology Negative, CT head: questionable hypodensities in the medial temporal lobe, MRI Brain: normal, EEG: negative.

FINAL WORKING DIAGNOSIS: Seizure induced by Hyponatremia Secondary to Psychogenic Polydipsia; Hyponatremia Induced Myopathy

TREATMENT AND OUTCOMES: Sodium corrected in the ICU over a few days. Patient drank a total of 48 oz prior to his run, and 160 oz post-run. Despite hydration and gentle correction of sodium, CK continued to rise. Rhabdomyolysis thought initially due to seizure and muscle breakdown in the setting of aggressive exercise; however, the delayed clearance of CPK raised concerns for glycogen storage deficiency vs genetic dysfunction. Referred to Genetics for a muscle biopsy to rule out glycogen storage deficiency, biopsy pending. Returned to cross country running with strict instructions regarding hydration, runs 5-8 miles without any issues.

1157 May 31 9:40 AM - 10:00 AM Cotton Mouth in A Cross Country Runner
Jason A. Kirkbride, Siobhan Statuta. University of Virginia, Charlottesville, VA. (Sponsor: John MacKnight, FACSM) (No relevant relationships reported)

HISTORY: A 21-year-old Division I cross-country runner presented to the athletic training room the day he was to leave for ACC championships, concerned about his intolerable dry mouth, leg heaviness and worsening fatigue. He had an unintended weight loss of 15 pounds despite working with Sports Nutrition over the summer due to a baseline BMI of 17.9 and a history of a sarcal stress fracture the prior year. He endorsed normal eating pattern, but often felt full secondary to increased fluid intake from his dry mouth. Over the past few days, he also noted the onset of blury vision. His only medication was an Omega-3 supplement and he denied a family history of autoimmune diseases, but did have an uncle with Type II diabetes mellitus.


DIFFERENTIAL DIAGNOSIS: Relative energy deficiency in sport Overtraining syndrome Thyroid disease Anemia Viral illness/ Mononoculeosis Diabetes Mellitus Type 1 Malignancy Diabetes Insipidus

FINAL WORKING DIAGNOSIS: Epideral Hematoma

TREATMENT AND OUTCOME: 1. Transfert to a tertiary care center for craniotomy and hematoma evacuation of the hematoma. There was a fine, non-displaced fracture of the temporal bone discovered at the time of surgery. 2. No neurologic sequelae.
3. Cleared to return to training after 6 months of healing.
4. Investigation after the injury revealed the Soldier had sustained minor blow to the right side of the head 3 days prior to presentation.
**C-33** Free Communication/Poster - Acute Exercise - Cardiorespiratory Physiology

**Thursday, May 31, 2018, 7:30 AM - 12:30 PM**

**Room: CC-Hall B**

**1193** Board #1

**May 31 8:00 AM - 9:30 AM**

**Aerobic Exercise Reduces The Pro-thrombotic Potential Of Circulating Microparticles in Healthy Individuals**

Patrick J. Highton 1, David J. Stensen 1, Fernanda R. Goltz 1, Naomi Martin 1, Niccolore C. Bishop 1. Loughborough University, Leicester, United Kingdom. 2 De Montfort University, Leicester, United Kingdom.

(No relevant relationships reported)

**PURPOSE:** Microparticles (MPs) are extracellular vesicles shed upon cellular activation or apoptosis that possess pro-thrombotic functions via Tissue Factor (TF) expression. Aerobic exercise (AE) may impact circulating MPs, though recent research is conflicting. Previous other results may also reflect underlying circadian variations. This study investigated the impact of AE or rest with a standardized meal on MP phenotypes and pro-thrombotic potential over a morning period.

**METHODS:** 15 healthy males (22.9 ± 3.3 years; 81.9 ± 11.4 kg; VO2 max: 54.9 ± 6.5 mL kg⁻¹ min⁻¹; mean ± SD) completed 1 hr of AE (70% VO2max) at 9am, and consumed a standardised meal (1170 kcal, 43% CHO, 17% PRO, 40% fat) at 10:45am. Venous blood samples were taken at 9am, 10am and 11:30am. Control trials included no exercise. MP phenotypes (platelet, neutrophil, monocyte and endothelial cell) and TF expression were assessed by flow cytometry.

**RESULTS:** Data are presented as mean ± SEM. Effector sizes are presented as % (0.2 = small, 0.5 = moderate, 0.8 = large; Statistical Power Analysis for the Behavioral Sciences, Cohen, 1988). Total numbers of MP increased from 9am to 10am (1.62 ± 0.59 to 1.74 ± 0.70 × 10⁶, p = .016, n² = .105) in both conditions, but was unaffected by trial (No relevant relationships reported).

**CONCLUSION:** The increase in total MP count was not affected by exercise and may be due to diurnal variation – this warrants further investigation over a 24h period. Moderate intensity AE with a standardized meal seem to have little effect on absolute circulating MP phenotype counts in this population. However, AE induced a large reduction in the percentage of platelet and neutrophil MPs that express TF, suggesting a mechanism via which AE can reduce cardiovascular risk via reduced TF-stimulated coagulation and thrombosis. This effect requires more investigation in clinical populations at greater cardiovascular risk via reduced TF-stimulated coagulation and thrombosis.
Blood pressure (BP) is an important marker of cardiovascular (CV) health. Aquatic (AQ) exercise training has been shown to reduce BP reactivity to exercise to a greater degree than land treadmill (LT) training. Furthermore, an acute bout of AQ exercise tended to elicit a greater post-exercise hypotensive response and augmentation in flow-mediated dilation (FMD). However, it is unclear how long the post-exercise hypotensive benefits last following an acute bout of AQ exercise. **Purpose:** To determine the effects of acute bouts of deep water aqua-jogging and land treadmill exercise on daytime ambulatory BP (AMBp) in pre-hypertensive, physically untrained men and women. **Methods:** All results are displayed in Table 1. *p < 0.05* (No relevant relationships reported)

### Table 1. Ambulatory Blood Pressure Response

<table>
<thead>
<tr>
<th>Variable</th>
<th>Aquatic</th>
<th>Land</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP (mmHg)</td>
<td>136 ± 9</td>
<td>140 ± 9</td>
<td>0.051</td>
</tr>
<tr>
<td>DBP (mmHg)</td>
<td>76 ± 6</td>
<td>81 ± 6</td>
<td>0.006*</td>
</tr>
<tr>
<td>MAP (mmHg)</td>
<td>96 ± 7</td>
<td>101 ± 6</td>
<td>0.007</td>
</tr>
<tr>
<td>HR (bpm)</td>
<td>78 ± 12</td>
<td>78 ± 11</td>
<td>0.964</td>
</tr>
</tbody>
</table>

All values represent Mean ± SD, *p < 0.05*
Acute resistance exercise (RE) with blood flow restriction (BFR) on pulse wave reflection is unclear. **PURPOSE:** To evaluate the differences between acute upper-body RE (URE) and lower-body RE (LRE) with and without BFR on pulse wave reflection in resistance-trained individuals. **METHODS:** Pulse wave reflection was assessed at rest, and during recovery at 10 (R10), 25 (R25), 40 (R40), and 55 (R55) minutes after either URE or LRE with or without BFR in twelve resistance-trained individuals. The URE consisted of the pulldown and chest press while the LRE consisted of knee extension and knee flexion. The BFR condition consisted of 4 sets of 30, 15, 15, and 15 repetitions at 30% 1-repetition maximum (1RM) while the non-BFR condition consisted of 4 sets of 8 repetitions at 70% 1RM. A 2x2x3 repeated measures ANOVA was used to evaluate the effect of group across conditions and time on pulse wave reflection. **RESULTS:** There were no differences for any variable between conditions. There were significant group by time interactions for brachial systolic blood pressure (BSBP), brachial diastolic blood pressure (BDBP), aortic systolic blood pressure (ASP), and aortic diastolic blood pressure (ADBP) such that BSBP (rest: 120±8mmHg, R10: URE: 115±12mmHg, LRE: 126±8mmHg, p=0.001) and ASP (rest: 104±8mmHg, R10: URE: 102±10mmHg, LRE: 109±8mmHg; p=0.005) were increased at R10 from LRE compared to URE and rest, with no difference from rest to R25, R40, or R55. BDBP (rest: 64±7mmHg, R10: URE: 60±6mmHg, LRE: 67±6mmHg, p=0.001; R25: URE: 62±5mmHg, LRE: 67±7mmHg, p=0.001) and ADBP (rest: 77±9mmHg, R10: URE: 69±6mmHg, LRE: 75±9mmHg, p=0.001; R25: URE: 63±5mmHg, LRE: 69±7mmHg, p=0.001) were increased at R10 and R25 from LRE compared to URE and rest, and no difference at R40 or R55. There were significant group by time interactions for augmentation index (Alx) (rest: 13.3±9.8%, R10: URE: 10.5±10.5%, LRE: 15.7±8.4%; p<0.001) and Alx normalized to 75bpm (rest: 3.7±11.7%, R10: URE: 25.4±14.0%, LRE: 15.8±13.5%; p=0.001) such that they were increased at R10 from URE compared to LRE and rest, and were fully recovered by R25. **CONCLUSIONS:** These data suggest that LRE significantly elevated blood pressure more so than URE, and that URE significantly increased pulse wave reflection more than LRE, regardless of whether they were completed with or without BFR.

Dehydration reduces plasma volume and concentrates electrolytes, increasing plasma osmolality (pOsm). Water deprivation (WD) studies in animals demonstrate that elevated pOsm is associated with altered heart rate, blood pressure and blood pressure (BP) regulation. However, it remains unclear if WD augments BP responses to sympathetic stimuli in humans. **PURPOSE:** To determine the influence of WD and a comparable amount of HIIE on post-exercise brachial artery FMD in patients diagnosed with secondary Stage 3 or 4 CKD. **METHODS:** Twenty participants (n = 6 men; n = 14 women; age 62.0±9.9 yr; weight 80.9±16.2 kg; body fat 37.3±8.5% of weight; VO2max 19.4±4.7 mL/kg/min) completed 30 min of WD at 65% VO2 reserve or HIIE by treadmill walking (90% and 20% of VO2 reserve in 3:2 min ratio) in a randomized crossover design. Both exercise conditions averaged 65% VO2 reserve. Ultrasound measurements of brachial artery FMD were obtained by the same technician under standardized conditions just before, 1 hr and 24 hrs after exercise. FMD responses were analyzed using 2 (condition) by 3 (sample point) repeated measures ANOVA. **RESULTS:** Brachial artery FMD responses were augmented 1 hr after exercise in both exercise conditions (p < 0.005 versus pre-exercise FMD). FMD (pre-exercise = 11.5±1.3; 1 hr = 17.2±1.8; 24 hr = 14.0±2.1; 1%) HIIE (pre-exercise = 12.5±1.3; 1 hr = 15.6±2.5; 24 hr = 15.8±1.2%) **SUMMARY:** We report for the first time that brachial artery FMD can be augmented by a single episode of exercise in mid-spectrum CKD. SRE and HIIE, averaging ~65% of VO2 reserve, is equally effective at transiently improving conduit arterial vascular function in this clinical population.
Exercise during water immersion results in a significantly lower mean VO$_2$ relative to a land exercise of equivalent power output. No differences were detected in the respiratory parameters indicating that the lower VO$_2$ reached with IE is not attributed to changes in ventilation, but rather to central or peripheral convection (cardiac output) or diffusion (capillary O$_2$ extraction) factors. We have previously shown that hemodynamic factors (convection) are modestly improved, but not sufficiently to explain the large gap in VO$_2$ between IE and DE. We hypothesize that diffusion is improved by an unknown mechanism that remains to be explained.

A repeated measures ANOVA with two repeated measure factors was computed for following exercise every 10 minutes for a total of 60 minutes in a seated position. (BSBP) and diastolic blood pressure (BDBP) were measured prior to exercise and augmentation index (Alx), pulse pressure (PP), heart rate (HR), and brachial systolic = 24.26±10.27%) participated in Tai Chi (TC) and walking (WK) for 30 minutes on each exercise type. TC = 6.63±3.258 mmHG, p < .05; WK = 7±4.144 mmHG, p < .05), and 40 min (TC = 8.46±3.07 mmHG, p < .05). There were no significant changes in Alx, PP, or diastolic blood pressure. CONCLUSIONS: Central aortic pressure exhibits a post exercise hypotensive (PEH) effect similar to that of peripheral blood pressure. Both Tai Chi and walking elicited similar PEH effects on systolic blood pressure in prehypertensive individuals.

RESULTS: Across all time points, there were no significant between-condition differences observed in blood pressure (DBP) (sedentary: 101±2 mmHg; low:105±2 mmHg; moderate:102±2 mmHg; high:105±2 mmHg; p = .05). SBP did however decrease significantly throughout the day for all conditions (morning:106±1 mmHg; midday:101±2 mmHg; end-of-day:103±1 mmHg; p = .01). OW/0B children displayed a greater decline in SBP throughout the day compared to HW children (p = .01). Across all time points, no significant between-condition differences were observed in diastolic blood pressure (DBP) (sedentary: 61±2 mmHg; low:63±2 mmHg; moderate: 61±2 mmHg; high: 65±2 mmHg; p = .05). No significant effects of time were observed in DBP (morning:63±1 mmHg; midday:62±1 mmHg; end-of-day:62±1 mmHg; p = .05). At all time points, higher DBP were observed in OW/0B compared to HW children (HW:60±1 mmHg; OW/0B:64±2 mmHg; p = .03).

CONCLUSION: Contrary to previous findings in adults, both interrupted and uninterrupted sitting resulted in a similar decrease in SBP throughout the day. The decline in SBP was greater in OW/0B children compared to HW children. Future research should examine the long-term effects of interrupted and uninterrupted sitting on resting BP in preadolescent children.

RESULTS: Across all time points, no significant between-condition differences were observed in blood pressure (DBP) (sedentary:101±2 mmHg; low:105±2 mmHg; moderate:102±2 mmHg; high:105±2 mmHg; p = .05). SBP did however decrease significantly throughout the day for all conditions (morning:106±1 mmHg; midday:101±2 mmHg; end-of-day:103±1 mmHg; p = .01). Across all time points, no significant between-condition differences were observed in diastolic blood pressure (DBP) (sedentary: 61±2 mmHg; low:63±2 mmHg; moderate: 61±2 mmHg; high: 65±2 mmHg; p = .05). No significant effects of time were observed in DBP (morning:63±1 mmHg; midday:62±1 mmHg; end-of-day:62±1 mmHg; p = .05). At all time points, higher DBP were observed in OW/0B compared to HW children (HW:60±1 mmHg; OW/0B:64±2 mmHg; p = .03).

CONCLUSION: Contrary to previous findings in adults, both interrupted and uninterrupted sitting resulted in a similar decrease in SBP throughout the day. The decline in SBP was greater in OW/0B children compared to HW children. Future research should examine the long-term effects of interrupted and uninterrupted sitting on resting BP in preadolescent children.

RESULTS: Across all time points, no significant between-condition differences were observed in blood pressure (DBP) (sedentary:101±2 mmHg; low:105±2 mmHg; moderate:102±2 mmHg; high:105±2 mmHg; p = .05). SBP did however decrease significantly throughout the day for all conditions (morning:106±1 mmHg; midday:101±2 mmHg; end-of-day:103±1 mmHg; p = .01). Across all time points, no significant between-condition differences were observed in diastolic blood pressure (DBP) (sedentary: 61±2 mmHg; low:63±2 mmHg; moderate: 61±2 mmHg; high: 65±2 mmHg; p = .05). No significant effects of time were observed in DBP (morning:63±1 mmHg; midday:62±1 mmHg; end-of-day:62±1 mmHg; p = .05). At all time points, higher DBP were observed in OW/0B compared to HW children (HW:60±1 mmHg; OW/0B:64±2 mmHg; p = .03).

CONCLUSION: Contrary to previous findings in adults, both interrupted and uninterrupted sitting resulted in a similar decrease in SBP throughout the day. The decline in SBP was greater in OW/0B children compared to HW children. Future research should examine the long-term effects of interrupted and uninterrupted sitting on resting BP in preadolescent children.

RESULTS: Across all time points, no significant between-condition differences were observed in blood pressure (DBP) (sedentary:101±2 mmHg; low:105±2 mmHg; moderate:102±2 mmHg; high:105±2 mmHg; p = .05). SBP did however decrease significantly throughout the day for all conditions (morning:106±1 mmHg; midday:101±2 mmHg; end-of-day:103±1 mmHg; p = .01). Across all time points, no significant between-condition differences were observed in diastolic blood pressure (DBP) (sedentary: 61±2 mmHg; low:63±2 mmHg; moderate: 61±2 mmHg; high: 65±2 mmHg; p = .05). No significant effects of time were observed in DBP (morning:63±1 mmHg; midday:62±1 mmHg; end-of-day:62±1 mmHg; p = .05). At all time points, higher DBP were observed in OW/0B compared to HW children (HW:60±1 mmHg; OW/0B:64±2 mmHg; p = .03).

CONCLUSION: Contrary to previous findings in adults, both interrupted and uninterrupted sitting resulted in a similar decrease in SBP throughout the day. The decline in SBP was greater in OW/0B children compared to HW children. Future research should examine the long-term effects of interrupted and uninterrupted sitting on resting BP in preadolescent children.
LONG. However, mean RER (1.02 ± 0.09 vs. 0.99 ± 0.04; p=0.002) was significantly lower and energy expenditure (287 ± 81 vs. 473 ± 93 kcal; p<0.001) was significantly greater following LONG. SHORT was preferred to LONG by 9 out of 10 participants.

CONCLUSIONS: LONG elicited significantly different metabolic responses with similar cardiovascular responses to SHORT but was perceived as less enjoyable.

Near-infrared spectroscopy (NIRS) has been used to quantify oxygenation characteristics of skeletal muscle during exercise. Changes in total-[heme] and deoxy-[heme] have been used as an indices of diffusive and perfusive conductance, respectively. Total-[heme] and deoxy-[heme] have been shown to reach similar values at end exercise following exercise in the severe intensity domain. It has further been suggested that time of exercise tolerance (T_{m}) in the extreme domain (T_{m} < 2 min) is too short for VO_{2} kinetics to reach maximum values. It is unknown if total-[heme] and deoxy-[heme] characteristics reach similar values after exercise in the extreme domain as exercise in the severe domain.

PURPOSE: We hypothesized that total-[heme] and deoxy-[heme] would be lower following exercise in the extreme domain than compared to exercise in the severe domain.

METHODS: Six men (age 22 ± 3.1 yrs, 72.5 ± 6.5 kg; 178 ± 2 cm) performed 8 bi-lateral knee extension tests to task failure. First, one-repetition maximum (1RM) was determined by progressively increasing weight until a pre-determined range of motion (30°) could not be achieved. Subjects then performed 3 exercise tests in the severe intensity domain (T_{m} = 2 – 15 min; S1 = 25.8 ± 2.7, S2 = 33.5 ± 4.3, S3 = 44.3 ± 6.9 % 1RM) and 4 in the extreme domain (60, 70, 80, 90% 1RM), in random order on non-consecutive days. A 1RM was performed 5 min before each exercise bout. Changes total-[heme], deoxy-[heme], and Sat% were measured on the L vastus lateralis.

RESULTS: Total-[heme] at end exercise was not different between exercise intensities (p = 0.05). Total-[heme] at end exercise was not different (p > 0.05) than peak total-[heme] of the 1RM for the extreme domain exercise tests. However, total-[heme] at end exercise was greater than peak total-[heme] following severe intensity exercise (S1, p = 0.002; S2, p = 0.025; S3, p = 0.02). End exercise deoxy-[heme] and Sat% were not different (p > 0.05) compared to peak deoxy-[heme], and Sat%, respectively, of the 1RM.

CONCLUSIONS: The current study showed that total-[heme], but not deoxy-[heme] or Sat%, is intensity- or time-dependent. These data suggest that diffusive O_{2} conductance is compromised during extreme intensity exercise, whereas perfusive O_{2} conductance is able to reach similar values regardless of intensity.

Compression socks have become increasingly popular with athletes due to perceived enhancement of exercise performance and recovery. However, research examining the efficacy of compression socks to reduce exercise-associated muscle damage has been equivocal, with few direct measurements of markers of muscle damage.

PURPOSE: We investigated the influence of wearing compression socks during a marathon run on creatine kinase (CK) levels in endurance athletes running the 2013 Hartford Marathon.

METHODS: Adults (n=20) were randomized to compression sock (SOCK; n=10) and control (CONTROL; n=10) groups. SOCK was naïve to wearing compression socks, and wore them during the marathon only. Age, anthropometrics, vital signs, training mileage, and finishing time were collected. Venous blood samples were collected 1 d before, immediately after, and 1 d following the marathon for analysis of plasma CK, a marker of muscle damage.

RESULTS: Baseline plasma CK levels did not differ between CONTROL (89.3±41.2 U/L) and SOCK (100.0±56.2 U/L; p=0.633), and were within normal reference ranges for males and females. Immediately following the marathon (>1 hr), CK increased 273% from baseline (p<0.001), with no difference in % change induced changes in CK from baseline between CONTROL (1.29±2.78 U/L) and SOCK (1.23±2.53 U/L; p=0.598 for time x group). The day following the marathon (≤24 hr), CK further increased 1094% from baseline (p<0.000 for time), with no difference in changes in CK from baseline between CONTROL (1191.9±1194.8 U/L) and SOCK (889.1±760.1 U/L; p=0.529 for time x group). These similar trends between CONTROL and SOCK persisted despite controlling for potential covariates such as age, body mass index, and race finishing time (p=0.291), which was also similar between groups (CONTROL: 4:20:42±0:38:33 hr vs. SOCK: 4:02:33±0:38:39 hr; p=0.333).

CONCLUSIONS: Our results suggest the use of compression socks during a marathon do not appear to mitigate objectively measured markers of muscle damage (i.e., exercise-induced increases in CK) immediately following and 24 hr after a marathon.

Insulin resistance can contribute to endothelial dysfunction and subsequent cardiovascular disease. An acute bout of exercise has been shown to attenuate insulin resistance and enhance endothelial function, yet the underlying molecular mechanism(s) for this benefit in smooth muscle remains unclear. PURPOSE: To examine key proteins in the Akt/eNOS signaling pathway in response to an acute session of exercise with and without the presence of insulin.

METHODS: Female Sprague-Dawley rats (n=25) were assigned to one of four groups: 1) sedentary control group without insulin injection (CON-inds), 2) control group with insulin injection (10mU/g; CON+inds), 3) exercise group without insulin injection (EX-inds), and 4) exercise group with insulin injection (EX+INS). Insulin or saline injections were administered 5-min prior to sacrifice. Under isoflurane anesthesia, blood and the descending aorta was harvested. Exercise cohorts were sacrificed 3-hr after a 60-min swimming protocol. Plasma samples were analyzed for glucose, insulin concentrations, and markers of endothelial function (i.e., intracellular adhesion molecule, E-selectin, von Willebrand factor, and adiponectin) using commercially available kits. Western immunoblotting was used to determine Akt (Akt), phosphorylated Akt (pAktSer473), and pAktSer473 levels (p=0.047).
total eNOS (eNOS), and phosphorylated eNOS (p-eNOSSer1177). RESULTS: Akt, eNOS, plasma glucose, and markers of endothelial function were similar among both cohorts. As expected, plasma insulin concentration was significantly (p<0.05) higher under insulin stimulated compared to non-insulin stimulated conditions, however exercise blunted this increase (CON+ins > EX+ins; p<0.05). Similarly, pAktSer473 was significantly (p<0.05) higher under insulin stimulated compared to non-insulin stimulated conditions, this effect was also attenuated with exercise (CON+ins > EX+ins; p<0.05). Conversely, p-eNOSSer1177 was only significantly (p<0.05) enhanced in the EX+ins versus the EX-ins group. CONCLUSIONS: Insulin and acute exercise resulted in the greatest enhancement of p-eNOSSer1177, signifying enhanced endothelial function. This response cannot be completely attributed to increased pAktSer473 suggesting that other kinases are likely responsible for the improvement in p-eNOSSer1177 in the aorta.

1212 Board #20 May 31 8:00 AM - 9:30 AM
Effect of Aerobic Exercise on Artery Stiffness and Cerebrovascular Pulsatility in Hypertensive and Non-Hypertensive Adults

Wesley K. Jefferts, Jacob D. DeBlois, Girolamo L. Mammolito, Elizabeth A. Dressel, Candace N. Receno, Kevin S. Heffernan. Syracuse University, Syracuse, NY. (Sponsor: Bo Fernhall, FACSM)

(No relevant relationships reported)

Large elastic arteries (i.e., aorta, carotid) buffer pulsatile hemodynamics by dampening changes in pressure and flow. Stiffer central arteries, as seen in hypertension, transmit greater pulsatile hemodynamics into fragile cerebral vessels. Aerobic exercise is recommended for hypertensives (HTN), but its effects on artery stiffness and pulsatility in this group are unclear. PURPOSE: Investigate the effect of acute aerobic exercise on artery stiffness and cerebrovascular pulsatility in HTN and non-HTN adults. METHODS: 30 medicated HTN and 30 age, sex, and body mass index (BMI)-matched non-HTN adults (56±6 yrs, BMI 28.2±2.9 kg/m²; 32 men) underwent hemodynamic measures pre and 10 min post a 30-min cycling bout (55% peak oxygen consumption). Aortic stiffness was measured using carotid-arterial femoral pulse wave velocity (cf PWV) and carotid artery (CA) stiffness was assessed with PWV-β via Ultrasound. Aortic mean (MP) and pulse pressure (PP; via radial generalized transfer function), and CA PP were measured by tonometry. CA and middle cerebral artery (MCA) blood velocity pulsatility index (PI) were measured using Doppler. RESULTS: cf PWV, MCA PI and CA PI increased and aortic PP decreased, post exercise compared to pre in both groups (p<0.05). Aortic MP and CA PP, PWV, PWV-β were unaltered post-exercise. Aortic MP was greater in HTN vs non-HTN. No other significant effects were detected. CONCLUSION: Acute aerobic exercise increases aortic stiffness and cerebrovascular hemodynamic pulsatility in both non-HTN and HTN individuals. These data suggest medicated HTN have similar vascular responses to early recovery from acute aerobic exercise as non-HTN.

Supported by a Foundation Research Grant from ACSM and AHA Pre-doctoral Fellowship

Table 1: Arterial stiffness and hemodynamic pulsatility pre/post acute exercise in non-HTN and HTN subjects.

<table>
<thead>
<tr>
<th>Measure</th>
<th>non-HTN</th>
<th>HTN</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>G</td>
</tr>
<tr>
<td>Aorta</td>
<td>91±8</td>
<td>92±7; 96±10; 95±9</td>
<td>0.047</td>
</tr>
<tr>
<td>Mean pressure, mHg</td>
<td>33±9</td>
<td>32±7; 33±7; 30±7</td>
<td>0.175</td>
</tr>
<tr>
<td>cf PWV, m/s</td>
<td>7.9±1.1</td>
<td>8.1±0.9; 8.2±1.3; 8.7±1.5</td>
<td>0.081</td>
</tr>
<tr>
<td>Carotid artery</td>
<td>37±10</td>
<td>36±8; 37±8; 35±8</td>
<td>0.816</td>
</tr>
<tr>
<td>Pulse pressure, mHg</td>
<td>1.43±0.34</td>
<td>1.49±0.34; 1.34±0.26; 1.42±0.26</td>
<td>0.356</td>
</tr>
<tr>
<td>Blood velocity PI</td>
<td>6.3±1</td>
<td>6.3±0.9; 6.6±1.3; 6.8±1.5</td>
<td>0.209</td>
</tr>
<tr>
<td>Middle cerebral artery</td>
<td>0.78±0.12</td>
<td>0.82±0.12; 0.76±0.11; 0.78±0.11</td>
<td>0.314</td>
</tr>
</tbody>
</table>
| HTN, hypertensive; cf, carotid-femoral; PWV, pulse wave velocity; PI, pulsatility index; G, group; T, time; GxT, group-by-time interaction.

1213 Board #21 May 31 8:00 AM - 9:30 AM
Kinetics of High-Sensitivity Cardiac Troponin Release Following a Strenuous Swimming Test

Karen Schulz, Jorge Jorge Diaz-Garzon, Ricardo Navarro-Orocio, Luis E. Carranza-Garcia, Alejandro Legaz-Arrese, Eloy Cardenas-Estrada, Fred Apple, FACSM. 1Minneapolis Medical Research Foundation of Hennepin County Medical Center, Minneapolis, MN. 2Hospital Universitario La Paz, Madrid, Spain. 3Autonomous University of Nuevo Leon, Monterrey, Mexico. 4University of Zaragoza, Zaragoza, Spain. 5Hennepin County Medical Center, Minneapolis, MN. (Sponsor: Fred Apple, FACSM)

(No relevant relationships reported)

PURPOSE: Athletes are susceptible to muscle injury during strenuous exercise. Exercise-induced release kinetics of high sensitivity cardiac troponin I (hs-cTnI) and hs-cTnT are unclear. We analysed hs-cTnI and hs-cTnT kinetics after a maximal swimming test and examined differences between age and gender. METHODS: Fifty adolescents (25 males, 25 females) and 16 adults (7 males, 9 females) participated in a 60-min maximal swimming test. hs-cTnI (Roche, 99th percentiles male=22, female=14 ng/L; and hs-cTnT (Beckman Coulter, 99th percentiles male=11, female=9 ng/L) were measured at rest, immediately post-exercise, and at 1, 3, 6, 12, and 24 h post-exercise. RESULTS: Mean baseline (0h) concentrations were: hs-cTnI male 3.4 ng/L, female 3.1 ng/L; hs-cTnT male 0.5 ng/L, female 0.5 ng/L. We observed a greater percentage of hs-cTnT results > 99th percentile vs. hs-cTnI for both genders. For males, this was at 6h (44% vs. 60%); 12h (20% vs. 44%) and 24 h (18% vs. 28%). For females this was at 6h (32% vs. 39%), 12h (3% vs. 19%) and 24h (6% vs. 10%). Until 3h both hs-cTnT and hs-cTnT presented similar percentages and no result over the 99th percentiles was observed for any hs-cTnT value at rest. 13 subjects (10 males; 84.6%) had a maximum hs-cTnI over 50 ng/L. Medians were: hs-cTnI, 146 (IQR 89-247) ng/L and hs-cTnT, 77 (73-123) ng/L. There were no significant correlations between hs-cTnT maximum concentration and age. However, significant differences (Mann-Whitney) in maximum concentration due to gender: hs-cTnT, (p=0.004) and hs-cTnT (p=0.018): hs-cTnT, (p=0.004) and hs-cTnT (p=0.018). CONCLUSIONS: We observed parallel increases, but different kinetics, between hs-cTnT and hs-cTnT in swimmers during maximal efforts. hs-cTnT appeared to increase earlier than hs-cTnT. Both assays peaked at 3h post-exercise, with higher hs-cTnT concentrations. Higher values were found in men, but no differences were found due to age. Clinicians need to be educated regarding these observations in healthy athletes.

1214 Board #22 May 31 8:00 AM - 9:30 AM
The Effects of Caffeine Ingestion on the Hemostatic Response to Simulated Firefighting Activities

Sierra D. Wassell, Elizabeth S. Edwards, Michael J. Saunders, FACSM, Christopher J. Wonnack, FACSM. James Madison University, Harrisonburg, VA.

(No relevant relationships reported)

PURPOSE: Sudden cardiac events are the leading cause of death among firefighters, a population that commonly overuses caffeine. The objective of this study was to examine the potential effects of caffeine on the hemostatic response to simulated firefighting activity.

METHODS: Twelve healthy male firefighters, wearing full personal protective equipment (PPE) and self-contained breathing apparatus (SCBA), completed two trials of a simulated firefighting activities course one hour after consuming either 6mg/kg body weight of caffeine or placebo. Blood samples and air levels from the SCBA were obtained pre-exercise and post-exercise. The effects of caffeine and simulated firefighting on outcome variables were assessed using repeated measures ANOVA.

RESULTS: Factor VIII increased more in the caffeine trial (Pre = 0.20 ± 0.13 IU/mL, Post = 0.43 ± 0.15 IU/mL) than the placebo trial (Pre = 0.21 ± 0.11 IU/mL, Post = 0.38 ± 0.15 IU/mL). IPA activity increased significantly (P < 0.05) by the same magnitude in both the placebo (Pre = 0.18 ± 0.18 IU/mL, Post = 3.23 ± 3.21 IU/mL) and caffeine (Pre = 0.18 ± 0.31 IU/mL, Post = 3.97 ± 3.53 IU/mL) conditions. PAI-1 activity significantly (P < 0.05) decreased from pre- to post-exercise in both the placebo (Pre = 33.86 ± 21.29 U/mL, Post = 28.77 ± 21.21 U/mL) and caffeine (Pre = 37.34 ± 28.81 U/mL, Post = 23.71 ± 19.42 U/mL) conditions. There was a trend (p = 0.05) for increased air consumption in the caffeine condition versus placebo condition.

CONCLUSIONS: Results from the present study suggest that caffeine elicits a higher coagulation response without concomitant increases in fibrinolysis during simulated firefighting.
Blood pressure is a universal measurement used to aid in appropriate clinical decision-making and monitor safe exercise participation. Inter-arm systolic blood pressure difference (SBPD; difference of ≥10mmHg between arms) at rest is associated with vascular disease, arterial stiffness, and premature morbidity and mortality. The incidence of SBPD at rest is low (i.e. commonly reported as 10%), though the occurrence of SBPD is known to increase with age (i.e. <5 min at metabolic equivalents) moderate-intensity aerobic exercise. PURPOSE: To determine the exercise-induced SBPD response during a prolonged steady-state bout of aerobic exercise. METHODS: Fifty-four individuals were studied on two separate occasions. On an initial visit, anthropometric measures and a VO\textsubscript{2}\text{peak} test on a cycle ergometer were completed. On a subsequent visit, participants cycled at a workload equivalent to 50% of their VO\textsubscript{2}\text{peak} for 30 min. Heart rate (HR) and systolic blood pressure difference (SBPD; measured sequentially using standard auscultation in both arms) were measured at rest, 5, 10, 20, and 30 minutes of exercise (EX-5, EX-10, EX-20, EX-30), and during an active recovery (AR). Descriptive and comparative (one-way ANOVA) statistics were generated. A binary logistic regression analysis was used to determine the threshold for the optimal dose and/or combination in that the drop in IL-6 did not approach significance and IL-10 levels were actually increased (IL-6) and a significant increase in anti-inflammatory marker (IL-10). Curiously, the addition of vibration were combined.

RESULTS: The incidence of SBPD at rest was 19%. The occurrence of SBPD increased to 35% at EX-5 and EX-10, and 46% at EX-20 and EX-30. Occurrence decreased to 20% during AR. Interestingly, each additional 1mmHg difference in SBPD at rest was associated with an increased OR of SBPD at EX-5 (1.139), EX-10 (1.335), EX-20 (1.220), and EX-30 (1.196; p<0.05). Individuals in the highest tertile of systolic blood pressure (SBP) response during exercise presented with the greatest SBPD (10.7 mmHg) at EX-5. Finally, individuals identified as underweight and obese class II were more likely to present with SBPD at rest and EX-20. CONCLUSION: The occurrence of SBPD during moderate-intensity aerobic exercise increased with prolonged steady-state aerobic exercise. Body mass index and the magnitude of the SBP response to exercise may be linked to SBPD incidence.

Endothelial progenitor cells (EPCs) are thought to play a key role in vascular regeneration, endothelial repair, and restoration of endothelial function. While studies have confirmed a relationship between exercise and EPCs, the mechanisms by which exercise mobilizes EPCs into circulation remains unknown. PURPOSE: To evaluate the effects of vibration training (VT) on the mobilization of angiogenic circulating progenitor cells (CPCs) and hematopoietic progenitors. We hypothesized that VT would increase the acute mobilization of angiogenic CPCs and decrease inflammatory marker levels. METHODS: 11 healthy males [18-30 yr (n=6) and 50-65 yr (n=5)] performed each of the following in random order on separate days: 1) standing on a vibrating platform only; 2) dynamic leg squat exercise (without vibration); and 3) in combination. i.e. leg squat with vibration. Blood samples were taken pre-and post-activity. RESULTS: Angiogenic CPCs increased 33% with vibration alone (p=0.02), 21% with exercise alone (p=0.02), and 34% with exercise plus vibration (p=0.004). VEGF levels were higher with vibration alone (p=0.005); TNFα increased with vibration (p=0.01); interleukin-6 (IL-6) approached a significant drop during vibration (p=0.056); and higher levels of IL-10 were found with vibration alone (p=0.03) and exercise alone (p=0.05). A decrease in IL-10 level was found when exercise and vibration were combined. CONCLUSIONS: Our findings suggest vibration alone may have a pro-angiogenic effect taken together with higher VEGF and TNFα levels; more than with exercise alone or in combination. Furthermore, vibration alone may have greater anti-inflammatory effects, evidenced by a trend toward decreased inflammatory marker (IL-6) and a significant increase in anti-inflammatory marker (IL-10). Curiously, the anti-inflammatory effect was dampened when vibration was combined with exercise in that the drop in IL-6 did not approach significance and IL-10 levels were actually lowered, suggesting there may be a threshold for the optimal dose and/or combination effects. VT may be a viable option to increase stem/progenitor cell circulation levels and decrease inflammation with possible health benefits in multiple health conditions.
1219 Board #27 May 31 8:00 AM - 9:30 AM
Heart Rate Variability During Submaximal Exercise And The Impact Of Gender And Race
Kate S. Early1, Conrad P. Earnest, FACSM2, Nathaniel P. Lemoine1, Damon L. Swift1, Neil M. Johannsen1. 1Columbus State University, Columbus, GA. 2Texas A&M, College Station, TX. Louisana State University, Baton Rouge, LA. East Carolina University, Greenville, NC. (Sponsor: Conrad Earnest, FACSM)

Purpose: To examine the effect of exercise duration on heart rate variability (HRV) and whether race or sex alters HRV during exercise. METHODS: Untrained participants (n=26, 46% male, 50% African-American [AA]) underwent fasting blood lipid and glucose tests and cardiovascular assessments (flow-mediated dilatation [FMD], pulse wave analysis, and HRV). Maximal oxygen consumption (VO2peak) was used to prescribe a 30-min cycling bout at 50%VO2peak. Exercise intensity was similar across sex (Male 1.3±0.2L/min; Female 0.9±0.1L/min, P=0.001) and race (AA 1.1±0.3L/min; Cau 1.1±0.2L/min, P=0.23). HRV during exercise was assessed in 2 min increments before exercise (Pre-EX) and during steady-state submaximal exercise from 14-16 min (Mid-EX) and 25-30 min (End-EX). RESULTS: At rest, no race or sex differences were observed in blood lipids, fasting glucose, PWF or FMD (all P>0.05). VO2peak was significantly greater in males (29.9±6.7 vs. 23.5±1.4 ml/kg/min, P=0.001). During exercise, heart rate was higher in females than males at Mid-EX and Post-EX (P<0.01). The natural logarithm of root mean square of successive differences (lnRMSSD) and high frequency (lnHF) significantly decreased from Pre-EX to Mid-EX and was similar from mid-EX to End-EX (lnRMSSD P=0.47; lnHF P=0.35). No race differences were observed in HRV during exercise (P>0.05). CONCLUSION: HRV was similar during exercise past 15 min, suggesting the time course of autonomic changes occurs early during exercise. No sex or race differences were observed in HRV during exercise, suggesting sex and race have similar cardiovascular responses during 30 min of submaximal exercise. However, it is plausible that intensity of exercise was not a sufficient stimulus for the sympathetic activity to observe differences between sex and race.

1220 Board #28 May 31 8:00 AM - 9:30 AM
Graduated Compression Socks Does Not Improve Cardio-respiratory Responses To Maximal Exercise
Rodrigo Villar, Alison Staniewicz, Victoria Vargas, Devin Neary, Nathaniel Presti, Stephanie Priest, Drew Bois, Robert Anzalone. Franklin Pierce University, Rindge, NH.

(no relevant relationships reported)

Cardiovascular and Respiratory Research Laboratory, Franklin Pierce University, Rindge, NH

Purpose: The purpose of this study was to determine if the use of graduated compression socks (GCS) would improve cardio-respiratory responses to maximal exercise. METHODS: Eight healthy young participants (4 men and 4 women; age = 20.50 ± 1.41 years; height = 1.71 ± 0.12 m; weight = 72.34 ± 12.53 kg; body mass index = 20.50 ± 1.41 years; height = 1.71 ± 0.12 m; weight = 72.34 ± 12.53 kg; body mass index = 24.65 ± 3.15 kg/m²) were randomly assigned to either a graduated compression sock (GCS) or no compression sock (NCGS) group. In order to maintain a counterbalanced order, participants performed a graded exercise test in two different conditions: (1) wearing graduated compression socks (GCS); or (2) wearing no compression socks (NCGS). Test protocol included a 6 minute warm up at 60% VO2peak, 8 minutes at 75% VO2peak, 6 minutes at 90% VO2peak, and a 2 minute cool down at 50% VO2peak. RESULTS: There were no statistical differences in VO2peak (NGCS = 49.94 ± 8.34 ml/kg·min; GCS = 50.55 ± 8.67 ml/kg·min); VO2peak (NGCS = 4.19 ± 1.17 L/min; GCS = 4.34 ± 1.38 L/min; RERpeak (NGCS = 1.41 ± 0.17 and GCS = 1.45 ± 0.16); Heart Rate (HRpeak), and exercise time to exhaustion (ETE) were performed a Cardiopulmonary Maximal Exercise Test (CPET) on a treadmill that consisted of 3 minutes warm-up at a speed of 4 mph at 0° grade followed by an increase in speed to 6 mph for 1 minute and then increasing 1 mph every minute until 8 mph. After that, the grade increased 2° every minute until exhaustion, but the speed of the treadmill was kept constant. Each participant visit the laboratory twice to perform the CPET test in two different conditions: (1) wearing graduated compression socks (GCS); and (2) not wearing the graduated compression socks (NCGS) in a randomized and counterbalanced order. Peak oxygen consumption (VO2peak), peak carbon dioxide production (VO2peak), peak respiratory exchange ratio (RERpeak), peak Heart Rate (HRpeak), and exercise time to exhaustion (ETE) were collected via metabolic cart analysis. RESULTS: There were no statistical differences in VO2peak, VO2peak, peak carbon dioxide production, RERpeak, peak Heart Rate, and exercise time to exhaustion were collected via metabolic cart analysis. CONCLUSIONS: Based on the results, there were no statistically significant differences in any variables indicating that there was no effect of the passive external compression on the cardio-respiratory responses during maximal exercise. The conclusions drawn from our data need to be analyzed with extreme caution due to small sample size (n=8). Therefore, more research need to be done to support these initial findings. Research supported by New Hampshire-INBRE through an Institutional Development Award (IDSA), P20GM103506, from the National Institute of General Medical Sciences of the NIH.

C-34 Free Communication/Poster - Respiratory
Thursday, May 31, 2018, 7:30 AM - 12:30 PM
Room: CC-Hall B

1221 Board #29 May 31 8:00 AM - 9:30 AM
Easy Breather Exercise Table: A Feasibility Evaluation Of a Medical Device to Facilitate Gravity Powered Ventilation
David J. Giordano, Jared G. Kerr, Robert W. Boyce, FACSM, Justine J. Reel, Lisa K. Sprod, Susan M. Sinclair, Savannah L. Knight, Stephanie N. Spencer. University of North Carolina at Wilmington. Wilmington, NC. (Sponsor: Robert W. Boyce, FACSM)

(no relevant relationships reported)

Gravity powered ventilation is a concept that utilizes visceral pressure to facilitate pulmonary ventilation. Such a procedure may provide a form of complementary therapy for those with Chronic Obstructive Pulmonary Disease (COPD). METHODS: The EBET bed uses arm power to tilt the supine subject from a Trendelenburg to a reverse-Trendelenburg position with the goal of assisting breathing. Healthy volunteers (N=40) operated the device for 15 minutes. Variables of interest: A body part discomfort scale (0 = no discomfort to 5 = very uncomfortable) administrated at 0 and 13 minutes, a Borg scale rating of perceived exertion (0 to 10) at 14 minutes, and an end-of-session safety rating. RESULTS: Areas with the greatest discomfort at minute 13 and the associated percent reaching ≥ level 3 follow: Left elbow (5%), right elbow (5%), left wrist (23%), right wrist (28%), left hand (16%), and right hand (15%). Only 12% of body parts, there was a significant (p ≤ 0.01) increase in discomfort from 0 to 13 minutes. Regarding exertion: 33% reported moderate to somewhat strong levels, while 13% reported strong levels. In terms of safety, 98% felt safe on the device, and 2% were undecided. CONCLUSION: Further clinical studies with the current EBET in COPD patients are not advised due to the discomfort and exertion in healthy volunteers. Safety data indicates tilting may be a viable means to achieve gravity powered ventilation, thus device modification is recommended. Supported by grants from Exhale Fully, LLC, and University of North Carolina Wilmington.

1222 Board #30 May 31 8:00 AM - 9:30 AM
Three Weeks of Respiratory Muscle Endurance Training Decrease the O2 Cost of Walking In Obese Adolescents
Hailu K. Alemayehu1, Desy Salvador2, Miriam Isola1, Gabriella Tringali2, Robert De Micheli1, Mara Caccavale3, Alessandro Surtoria1, Bruno Grassi, FACSM4. 1University of Udine, Udine, Italy; 2Istituto Auxologico Italiano, IRCCS, Milan. and Piancavallo (VB), Italy.

(no relevant relationships reported)

Obese adolescents have increased O2 cost of exercise, attributable at least in part to an increased O2 cost of breathing. In a previous work a short (3-7 weeks) program of respiratory muscle endurance training (RMET) slightly reduced the O2 cost of high-intensity cycling in these patients. PURPOSE: We hypothesized that the effects of RMET would be more pronounced during walking on a treadmill compared to those described during cycling. METHODS: Sixteen obese patients (age 16.0±0.8 yrs; height 1.80±0.05 m; body mass 127.7±14.2 kg; BMI 40.7±4.0 kg/m²) participated to the study. In the experimental group (RMET, n=8), subjects followed for 3 weeks a standard RMET protocol in addition to a multidisciplinary body mass reduction program, whereas controls (CTRL, n=8) did only the latter. Among other variables, heart rate (HR), and pulmonary O2 uptake (VO2) were measured during incremental exercise and 12-minute constant work rate (CWR) exercises at a moderate-intensity and 120% (high-intensity) of the gas exchange threshold (GET), determined before the interventions. The O2 cost of walking (aerobic energy expenditure per unit of covered distance) was calculated as VO2walking velocity.

RESULTS: Body mass decreased both in CTRL (−4 kg) and in RMET (−5 kg). All subjects completed 12 moderate-intensity and 5 high-intensity tests. VO2 was not affected by both interventions. Both during moderate- and high-intensity walking, VO2, the O2 cost of walking and HR decreased in RMET, but not in CTRL. During heavy-intensity walking the positive slopes of the VO2 and HR vs. time linear relationships from the 3rd to the 12th minute of exercise decreased in RMET, but not in CTRL.

CONCLUSION: In obese adolescents a short RMET program significantly lowered the O2 cost of moderate- and high-intensity walking and improved exercise tolerance. Funding by “Progetti di Ricerca Corrente” from the Istituto Auxologico Italiano Istituto di Ricovero e Cura a Carattere Scientifico (Milan, Italy).
BACKGROUND. Fatiguing inspiratory muscle work initiates the inspiratory muscle metaboreflex causing a time-dependent increase in muscle sympathetic nerve activity (MSNA) and a decrease in leg blood flow (Q_L). Fatiguing contractions of the expiratory muscles also facilitates an increase in MSNA. However, the effect of fatiguing expiratory muscle work on Q_L is somewhat unknown. PURPOSE. To determine the effect of inspiratory resistive loading (IRL) compared to expiratory resistive loading (ERL) on Q_L in healthy humans. METHODS. Five healthy men (n = 5, 20 ± 6 y) and women (n = 3, 29 ± 5 y) performed ERL and IRL at 65% of maximal expiratory and inspiratory mouth pressure (MEP, MIP) to task failure. Respiratory frequency was maintained at 15 breaths/min with an inspiratory duty cycle of 0.5. Q_L (via Doppler ultrasound) and mean arterial pressure (MAP) (via finger photoplethysmography) were measured before, during and up to 3 min after ERL and IRL. Expiratory and inspiratory muscle fatigue was assessed by measuring the reduction in MEP and MIP from pre- to post-ERL and IRL. EMG was measured in each leg to ensure no muscular contraction occurred. RESULTS. Task failure occurred at 10.6 ± 2.4 min for ERL and at 20.6 ± 8.8 min for IRL. Each subject performed ≥ 7 min of ERL and IRL. There was a ± 4% reduction in MEP and a 7 ± 5% reduction in MIP from before to after ERL and IRL, respectively (p = 0.05). Despite an increase in group mean MAP from rest to during ERL (14 ± 14 mmHg, p = 0.035) and IRL (12 ± 6 mmHg, p = 0.021), there was no change in group mean Q_L across task duration during either ERL or IRL (p > 0.05). The remaining 3 subjects. There was no significant change in group mean MAP or Q_L during ERL and IRL trials at 2% of MEP and MIP. CONCLUSION. Leg blood flow appears to decrease in some but not all healthy humans in response to ERL. Indeed, we report substantial individual variability in the leg blood flow response to both ERL and IRL.

METHODS. Previously published dissertations and peer-reviewed manuscripts (N=25) were used to obtain subjects’ responses (N=312, age = 29.4 ± 13.2 y). HCVR tests (n=262) were analyzed using the slope of the linear regression line relating P_CO2 to minute ventilation (VE). The mean ± SD was the normal range standard deviation from the regression line. A V̇E ≥ 25 L/min was considered a significant increase in ventilation above baseline. RESULTS. Data are presented mean ± median. 95% CI with HCVR values displayed a right skewed normal distribution (skew = 5.25, p <.05) mean 2.67 ±.70 (V̇E=15+mmHg), median 2.00; ±.51 (V̇E=15+mmHg) (IQR: 1.50). HVR values showed a non-normal right skewed distribution (skew = 9.2, p <.05), mean 131.8 ±23.6 (V̇E=15+mmHg), median 112.50; ±58.25 (V̇E=15+mmHg) (IQR: 118.99). Linearized HVR values using %SaO2 was also a right skewed non-normal distribution (skew=1.33, p<.05), mean 0.35; ±0.10 (V̇E=15+mmHg), median 0.26; ±0.23 (V̇E=15+mmHg) (IQR: 0.31). CONCLUSION. This analysis allows researchers to better place into context assessments of HCVR and HVR by providing distribution parameters derived from the literature. However, as HVR measures contrast due to methodological differences, distribution parameters remain infirm. In an effort to strengthen these distributions, researchers should include individual responses when reporting results of studies.

When athletes have the ability to self-select their work rate, it is unknown how the addition of external dead space (DS), a potent ventilatory stimulus, will influence cycling power and ventilatory dynamics. PURPOSE: To examine mechanical power, ventilatory dynamics, and perceptual responses during a fixed-work cycling time trial (TT) in trained male cyclists under a condition of increased DS. METHODS: Eleven trained cyclists completed pulmonary function testing and a peak aerobic capacity (VO2peak) test on a cycle ergometer during the initial visit. During the second visit, subjects completed a fixed workload trial (TT) at 40-100% of VO2peak completion with TT (Δ=10.2±8.7%). Additionally, minute ventilation (V̇E), mouth pressure (Pm) (cmH2O), and tidal volumes (VT) were collected in the last minute of exercise. Results: V̇E was not significantly different (p = 0.919) between the mouthpiece (158.1 ± 18.4 L/min) and mask (158.9 ± 11.2 L/min). Furthermore, no significant differences were observed in Pm (p = 0.54), VT (p = 0.303), and percent flow limitation (%FL) (p = 0.98) between the two breathing devices. Conclusion: The extra dead space in the Hans Rudolph mask does not significantly alter breathing mechanics. Therefore, the mask can be used as a more comfortable alternative to the mouthpiece during near maximal exercise.

When athletes have the ability to self-select their work rate, it is unknown how the addition of external dead space (DS), a potent ventilatory stimulus, will influence cycling power and ventilatory dynamics. PURPOSE: To examine mechanical power, ventilatory dynamics, and perceptual responses during a fixed-work cycling time trial (TT) in trained male cyclists under a condition of increased DS. METHODS: Eleven trained cyclists completed pulmonary function testing and a peak aerobic capacity (VO2peak) test on a cycle ergometer during the initial visit. During the second visit, subjects completed a fixed workload trial (TT) at 40-100% of VO2peak completion with TT (Δ=10.2±8.7%). Additionally, minute ventilation (V̇E), mouth pressure (Pm) (cmH2O), and tidal volumes (VT) were collected in the last minute of exercise. Results: V̇E was not significantly different (p = 0.919) between the mouthpiece (158.1 ± 18.4 L/min) and mask (158.9 ± 11.2 L/min). Furthermore, no significant differences were observed in Pm (p = 0.54), VT (p = 0.303), and percent flow limitation (%FL) (p = 0.98) between the two breathing devices. Conclusion: The extra dead space in the Hans Rudolph mask does not significantly alter breathing mechanics. Therefore, the mask can be used as a more comfortable alternative to the mouthpiece during near maximal exercise.
During freestyle swimming, the hydrostatic pressure of water limits expansion of the lungs and chest wall, and narrows airways >2 mm in diameter. Moreover, the horizontal body position causes blood to shift from the extremities to the chest, which reduces lung compliance. Thus, during freestyle swimming, the mechanics of breathing are altered, which likely increases the work of breathing (W\textsubscript{b}). However, no previous studies have quantified W\textsubscript{b} during freestyle swimming.

**PURPOSE:** To compare W\textsubscript{b} during freestyle swimming to cycling, and to characterize the differences in the cardiorespiratory responses to swimming relative to cycling in the same individuals.

**METHODS:** Seven collegiate swimmers (n=4 male, n=3 female; age=22±2 y) performed a graded swim test while tethered to a resistance apparatus. On a separate day subjects performed a graded cycle test. During swimming and cycling, metabolic and ventilatory parameters were measured using a customized metabolic cart, and inspired W\textsubscript{b} was quantified using an esophageal balloon catheter.

**RESULTS:** Swimming and cycling elicited statistically similar maximal oxygen uptakes (3.87±0.92 vs. 4.20±0.83 l/min \(p=0.143\)). However, minute ventilation (V\textsubscript{E})(118±3 vs. 154±25 l/min \(p<0.05\)) and heart rate (164±19 vs. 183±8 beats·min\(^{-1}\)) were significantly lower during swimming relative to cycling (both \(p<0.05\)). Total inspired W\textsubscript{b} was higher at a V\textsubscript{E} of 50 l·min\(^{-1}\) (+27±16 J·min\(^{-1}\)) and a V\textsubscript{E} of 100 l·min\(^{-1}\) (+53±22 J·min\(^{-1}\)) during swimming compared to cycling (both \(p<0.05\)). Periods of inter-breath apnea were observed at lower ventilations while swimming, resulting in decreased breathing frequency (V\textsubscript{E}=50 l·min\(^{-1}\), 19±6 vs. 22±4 breaths·min\(^{-1}\), \(p<0.05\)), and were not observed at higher ventilations (V\textsubscript{E}=100 l·min\(^{-1}\), 37±11 vs. 35±7, \(p=0.05\)). Peak inspired flow was greater while swimming, when matched for V\textsubscript{E} (.02±0.73 l·sec\(^{-1}\), \(p<0.05\)).

**CONCLUSION:** We found that swimming resulted in a higher inspired W\textsubscript{b} at a V\textsubscript{E} of 50 and 100 l·min\(^{-1}\) compared to cycling. We interpret our findings to mean that the horizontal body position and hydrostatic pressure on the chest wall requires swimmers to generate greater inspiratory pressures to sustain adequate V\textsubscript{E} during exercise.

**Funding:** Natural Sciences and Engineering Research Council of Canada

**Pleural Apparent Compliance and Subjective Fatigue in the context of Exercise and Return to Play in Elite Rugby Players**

**PURPOSE:** To examine the relationship between subjective fatigue and pleural apparent compliance (PAC) in elite rugby players.

**METHODS:** Nine elite rugby players (age=23±5 years, height=1.85±0.07 m, mass=92±11 kg) performed a 4-hour rugby game. PAC was measured using a body plethysmograph pre- and post-exercise.

**RESULTS:** Pre-game PAC was significantly lower than post-game PAC (34.7±2.3 vs. 35.9±2.3 cmH\textsubscript{2}O/L, \(p<0.05\)). Subjective fatigue scores also increased significantly from pre- to post-game (3.5±1.3 vs. 4.7±1.3, \(p<0.05\)).

**CONCLUSION:** The decrease in PAC post-game was likely due to increased intrathoracic pressure resulting from the increased abdominal pressure required for coughing and shortness of breath.

**Funding:** This study was supported by the Australian Institute of Sport and the Australian Rugby Union.
RESULTS: The post-race forced expiratory volume in 1 second (FEV₁) and forced vital capacity (FVC) were statistically lower by ~10% compared to pre-race, and peak expiratory flow decreased by ~8% compared to pre-race. About 30% of the participants, regardless of sex, demonstrated a post-exercise reduction in FEV₁ by at least 10% compared to pre-race. EIB was the most probable explanation for the reduction in FEV₁ post-race. There was no difference in spirometric lung function changes between men and women, nor between participants completing the marathon versus half-marathon. Presence or absence of a post-exercise reduction in FEV₁, (i.e., EIB) did not predict finishing time, only the distance run, age, body mass index, and sex affected finishing time (adjusted R² = 0.82).

CONCLUSIONS: Prolonged endurance exercise reduced spirometric lung function by about 10%, but did not affect finishing times among recreational runners/walkers.

The turbine spirometer is a popular laboratory device used to measure respiratory volumes and flows during exercise, and while performing gross, voluntary respiratory maneuvers (i.e., inspiratory capacity efforts). Indeed, these devices have been incorporated into many commercially-available pulmonary function and metabolic systems. Yet, while the turbine spirometer may provide accurate/reliable measurements of respiratory volumes at modest-to-high flows, these devices perform poorly at low flow rates. PURPOSE: To improve the accuracy of a turbine spirometer over an extended range of low flows using the “weighted averaging technique” described by Yeh et al. (J. Appl. Physiol., 53(1): p280, 1982).

METHODS: A commercially-available turbine spirometer was interfaced with a custom-designed microcontroller unit (MCU). The MCU recorded discrete rotations of the turbine rotor, and the corresponding rotational frequency (rpm). Repeated 5-fold cross-validation was used to determine the optimal number of bins in ft and iterations used in the Weighted Averaging algorithm. This method yielded a discrete array of calibration constants (K) across a relevant range of rpm (~1-1800 Hz). The accuracy of this “nonlinear” calibration curve was compared to that obtained by assuming a constant K across all frequencies (i.e., flows). Over 200 calibrations were recorded using a 3 L syringe. RESULTS: By assuming a constant K (15.6 mL/pulse), the turbine spirometer exhibited an average volume error of +94 mL (+5.1%) over a 95% confidence interval (CI₀) of -856 to +375 mL (-28.5 to 12.5%). Conversely, applying the nonlinear K curve resulted in an average volume error of ~0.001 mL (<0.001%) and a CI₀ ranging from -60 to +60 mL (-2.0 to 2.0%). Importantly, the nonlinear K curve provided accurate (within ±3%) volume measurements down to 0.33 Hz (~7 mL/s). CONCLUSIONS: The “weighted averaging technique” improved the accuracy/reliability the turbine spirometer to within ±3% across an interval of flows ranging between ~0.01 to 20 L/s.

CONCLUSIONS: Target-HR based HIT improves VO\textsubscript{2peak} in middle-aged individuals with obesity independently of the VTs location. However, the extent of the widening of exercise workloads tolerated after the onset of metabolic acidosis (i.e., improvements above VT) and exercise workloads supplied solely with oxidative metabolism (i.e., improvements at VT) depends if the workload chosen for training fall above or below the workload at both VTs.

PURPOSE: Apnea training has recently been proposed as a simple and cheap method to stimulate erythropoietin (EPO) production and increase hemoglobin (Hb) concentration and hematocrit (Hct). This study aimed to investigate both acute and chronic effects of apnea on spleen volume and hematological values through an 8-week apnea training program.

METHODS: Thirteen subjects daily performed five static apneas. Before, halfway through and after the apnea training period, subjects performed five maximal breath-holds at the laboratory. Baseline values for and changes in spleen volume, [Hb], Hct, reticulocyte count (RET%) and EPO were assessed.

RESULTS: A strong positive correlation in response to acute apnea was observed with volume reductions of $50 \pm 10\%$ ($p < 0.001$). An acute increase in [Hb] from $155 \pm 11$ g L$^{-1}$ to $159.9 \pm 5$ g L$^{-1}$ ($2\%$, $p = 0.05$) was seen immediately after the last apnea. Apnea training did not improve acute effects for neither spleen volume ($p = 0.068$), [Hb] ($p = 0.358$) nor Hct ($p = 0.421$). Although no differences in baseline Hct, RET% and EPO were found ($p = 0.05$), the apnea training program increased baseline spleen volume by $24.27\%$ ($p = 0.05$) and baseline [Hb] by $3.3\%$ ($p = 0.05$).

CONCLUSIONS: Our results show an apnea-specific training effect, as it was demonstrated that both baseline spleen volume and [Hb] had increased after eight weeks of apnea training. These increases suggest improved oxygen transport and storage capacity which might be beneficial for both elite athletes and anemic patients. In contrast, acute splenectomy and temporarily increases in Hb remained unaltered after training.

Inspiratory muscle fatigue (IMF) is associated with a sympathetically mediated metaboreflex, resulting in time-dependent sympathoexcitation, including increased heart rate, mean arterial pressure and limb vascular resistance that impairs tolerance to exercise. Women may be more resistant to IMF relative to men and therefore, may experience an attenuated inspiratory muscle metaboreflex. PURPOSE: To examine sex-based differences in a) the cardiovascular response to inspiratory pressure-threshold loading (PTL) and b) the effect of prior-induced IMF on subsequent exercise performance. METHODS: Healthy men ($n = 9$) and women ($n = 9$) completed a maximal incremental cycle test on day 1. On day 2, subjects performed PTL to task failure followed by a constant load submaximal time-to-exhaustion (TTE) exercise test (85% peak work rate). On day 3, subjects performed the same exercise test without prior-induced IMF. Diaphragmatic fatigue was assessed by measuring transdiaphragmatic twitch pressure ($P_{di,tw}$) in response to cervical magnetic stimulation. Heart rate (HR) and mean arterial pressure (MAP) were measured beat-by-beat throughout PTL via plethysmography, and low-frequency sympathetic (LF) and high-frequency sympathetic (HF) power (LF/HR and LF/HF) measured from heart rate variability (HRV) at rest and after PTL. Maximum voluntary contraction (MVC) was measured at pre- and post-training time points. Muscle fatigue was quantified as the percent difference between pre- and post-training MVC.

CONCLUSIONS: Inspiratory muscle endurance time is significantly longer in women than men. Fatiguing contractions of the diaphragm elicited a blunted cardiovascular response in women, whilst IMF contributes to exercise impairment independent of sex.

Low-intensity exercise with blood flow restriction (BFR-LI) may be used as an alternative to high-intensity (HI) exercise. The underlying neurophysiological mechanisms of adaptation remain elusive. PURPOSE: To examine corticomotor and metabolic function during HI and BFR-LI arm ergometry. METHODS: Twelve males (age: 23.9±3.75 yrs, BMI: 25.3±4.26 kg/m$^2$) completed three 15-minute arm ergometry conditions: HI, low-intensity (LI), and BFR-LI. HI was completed at 60% of maximal power output, while LI and BFR-LI were completed at 30% of maximal power output. In the BFR-LI condition, cuff pressure to the proximal biceps brachii was set to 70% of occlusion pressure. Single-pulse transcranial magnetic stimulation was delivered to the left primary motor cortex to test corticospinal motor evoked potentials (MEPs) in the right biceps brachii at baseline, 1, 10, and 15 minutes post-exercise. Blood lactate (BL) was measured at baseline, immediately and 5-minutes post-exercise. Relative VO$_2$ and HR were recorded at 2 minute intervals during the exercise protocol. Each dependent variable was analyzed using within-subject repeated-measures ANOVA and Bonferroni post-hoc analysis. RESULTS: MEP amplitudes throughout exercise were not different between conditions ($p=0.883$). A significant main effect of time indicated an overall elevation in all conditions in MEP compared to baseline (0.80±0.51 mV), 10 minutes (1.16±0.74 mV), and 15 minutes (1.04±0.47 mV; $p < 0.001$). BL following HI was 45% greater ($p=0.03$) and 50% greater ($p<0.001$) than the BFR-LI and LI conditions, respectively. A similar trend was seen at 5-minutes post-exercise. The HI condition resulted in HR values of (162 bpm±4 bpm) at the completion of exercise. This was higher than LI (117±5 bpm) and BFR-LI (125±5 bpm; $p<0.001$). VO$_2$ values were significantly higher with HI (24.0±1.1 ml•kg$^{-1}$•min$^{-1}$) when compared to LI (11.4±1.2 ml•kg$^{-1}$•min$^{-1}$) and BFR-LI (13.7±0.6 ml•kg$^{-1}$•min$^{-1}$) ($p<0.001$). CONCLUSION: High intensity arm ergometry elicited the highest VO$_2$, HR, and BL values, suggesting greater metabolic demands. Despite higher physical demands, MEP amplitudes increased for all conditions, suggesting similar responses in corticospinal excitability. Supported by: 2017 International Research Opportunities Program from the University of New Hampshire.

Low intensity blood flow restricted exercise (LIBFRE) elicits acute changes in torque output and muscle activation. The magnitude of these changes affect the chronic adaptations to this type of training. Despite its widespread use by men and women, it is not known whether the acute impact of LIBFRE follows a sexually dimorphic pattern. This is important because, when compared to men, women have muscle fibers of smaller diameter, higher density of type I muscle fibers, higher muscle capillarization and heightened muscle perfusion. All these factors likely influence blood flow, as well as acute muscle fatigue, during LIBFRE. PURPOSE: To explore whether muscle fatigue post-acute LIBFRE and high intensity resistance (HI) training follows a sexually dimorphic pattern. METHODS: 62 healthy young persons (31 men: 21.7 ± 2.3; 31 women: 22.0 ± 2.0 yrs) were included in this study. One-repetition maximum (1RM) was determined in each participant before training. Participants completed 4 sets of unilateral biceps curls with (50±15;15±15 reps) and without BFR (10±10;10±10 reps). HI was performed at 75% 1RM and LIBFRE at 20% 1RM with BFR (60% of arterial occlusion pressure). Maximum voluntary contraction (MVC) was measured at pre- and post-training time points. Muscle fatigue was quantified as the percent difference between pre- and post-training MVC. RESULTS: Both HI and LIBFRE training protocols induced significant muscle fatigue in men and women from pre- to post-training (p<0.05). HI was more fatiguing than LIBFRE in both sexes (HI: ~ 35 vs. LIBFRE: ~ 25%, p<0.05). These results were sustained even after controlling...
Complex training incorporates a high-load (HL) resistance exercise, such as the back-squat, with a biomechanically similar plyometric exercise, like a vertical jump (VJ), to elicit postactivation potentiation (PAP). This often results in an enhanced rate of muscular force development in the form of a higher third set. Low-load blood flow restricted (BFR) resistance exercise is an alternate modality to HL resistance exercise, but its use during complex training has never been evaluated. PURPOSE: To compare how HV, BFR complex training induced muscle thickness and electromyography (EMG). METHODS: Twelve healthy males that had been resistance training at least 3 times per week for the past 2 years (mean ± SD; age: 20.4 ± 0.9 years, body mass: 83.6 ± 6.7 kg, stature: 1.81 ± 0.5 m, back-squat 1-RM: 147.9 ± 25.2 kg) completed two randomized exercise sessions separated by ~1-week. Prior to each session, the VJ (2 sets of 5 repetitions at 85% 1-RM) or BFR (2 sets of 30% 1-RM with BFR) complex training sessions, with a VJ 4-minutes after each set were performed. EMG data of the left vastus lateralis and hamstrings were collected, quantified to root-mean square values, and expressed as a percentage of the 1-RM squat. PAP percent was defined as the post-squat VJ height divided by the pre-squat VJ height multiplied by 100. Data were analyzed using a within-subjects repeated-measures ANOVA between the two conditions and sets. Post-hoc tests in the form of t-tests were conducted if data reached significance. RESULTS: Neither condition induced PAP (PAP percent > 100%), but the HL condition was greater than the BFR condition (96.1 ± 4.8% vs. 90.8 ± 8.5%, p = 0.034). EMG activation was shorter during the HL condition than the BFR condition (HL: 104.6 ± 27.7% to BFR: 79.6 ± 33.4%, p = 0.002) and the hamstrings (HL: 112.3 ± 59.6% to BFR: 51.9 ± 30.2%, p = 0.001). CONCLUSION: Despite EMG amplitude being greatest for the HL condition, PAP did not occur. Similarly, BFR complex training also did not produce PAP. Fatigue and unsatisfactory rest periods should be investigated in future protocols. Supported by: 2017 Summer Undergraduate Research Fellowship Grant from the University of New Hampshire.

Low load exercise performed to failure appears to elicit a similar skeletal muscle response to that of high load exercise. There may be a point where a load becomes too low to elicit an anabolic response. In situations where the load becomes too low, blood flow restriction (BFR) might augment the response. PURPOSE: Examine the acute skeletal muscle response to high load exercise and low load exercise with and without BFR. METHODS: 20 participants completed four conditions in the upper body (one condition per arm) over 2 visits. Conditions consisted of elbow flexion exercise to failure using a traditional high load [70% 1RM (HL)], low load [15% 1RM (LL)], low load with moderate BFR [15% 1RM + 40% BFR (BFRL40)], or low load with greater BFR [15% 1RM + 80% BFR (BFRL80)]. Torque and muscle thickness were measured prior to, immediately post, and 15 min post exercise. Muscle electromyography (EMG) amplitude was measured throughout. Repeated measure ANOVA was used to determine differences. Results are displayed as mean (SD).

RESULTS: There was an interaction (p < 0.001) for changes in muscle thickness. Immediately post-exercise all low load conditions demonstrated greater swelling compared to the HL condition [Pre to Post Change: LL = 0.56cm (0.22), BFRL40 = 0.53cm (0.19), BFRL80 = 0.55cm (0.20), HI = 0.28cm (0.13)]. Muscle thickness remained elevated above baseline 15 min post exercise in all conditions, but was maintained to a greater extent in the low load conditions relative to HL exercise [Pre to 15 min post difference: LL = 0.46cm (0.16), BFRL40 = 0.39cm (0.13), BFRL80 = 0.44cm (0.19), HI = 0.21cm (0.12)]. There was an interaction for acute changes in torque (p ≤ 0.001). The LL, BFRL40 and BFRL80 conditions decreased 20 Nm (11), 24 Nm (11), 26 Nm (13) respectively, and the HI condition remained unchanged (p = 0.19). Torque remained depressed at 15 min post. In the last three repetitions, there was a main effect of time (p < 0.001). EMG amplitude was higher during set 2 (70% MVC) to compare to set 1 (65% MVC), set 3 [62 (20% MVC) and set 4 (64 (21% MVC)]. CONCLUSIONS: Very low load exercise (with or without BFR) appears to be performed, greater acute muscle fatigue and similar EMG amplitude compared to HI exercise. Further study is needed to determine if these acute changes would manifest muscular adaptations.
not in CON-leg (p=0.05). Before training, NAC attenuated K+ release in Ex1 (p=0.05), but not in Ex2 (p=0.05), in both legs. After training, the effect of NAC was blunted and catechol activity increased in the BFR-leg only (p=0.05). NKA isoform and antioxidant content are currently being analysed. CONCLUSION: BFR training augments improvements in muscle K+ handling and exercise performance in men. These effects are related to an increased muscle antioxidant capacity. In addition, ROS appear involved in the regulation of muscle K+ release during submaximal exercise in humans. Supported by the Danish Ministry of Culture (FKK-2015-0017)

Methods: A search of peer reviewed literature published 1999-2009 was conducted. Measurement experts reviewed and abstracted articles meeting inclusion criteria in four domains: physical activity, diet, physical activity environment, and food environment. The Registry was launched in 2011 and has been updated on an ongoing basis since August 2015. In 2017, subject matter experts authored four User Guides for the measurement domains. The Guides include case studies to help users’ select appropriate measures. The number of web visitors to the Registry and Guides was tracked providing an indicator of reach. Results: The Registry contains 1207 published studies of validation research using measures of physical activity (n=403), diet (n=330), physical activity environment (n=273), and food environment (n=331). Measures include GIS (n=127); 24-hour dietary recall (n=69); electronic monitor (n=121); environmental observation (n=153); questionnaire (n=498); record or log (n=97), and other (n=207). Over 17,100 unique visitors have accessed the Registry since its launch, including visitors from 41 countries. Since their release there have been over 8000 page views of the User Guides from 3633 unique visitors.

Recent research indicates that 51.7% of adults meet the 2008 Physical Activity (PA) Guidelines (Tairay et al., 2017). Activity courses are offered at 87% of 4-year colleges and Universities which directly facilitate some increase levels of PA during class time (Strand et al., 2010) and have been shown to increase PA outside of class (Anesi et al., 2017). The Physical Activity Vital Sign is a clinical tool designed to screen for PA in adults. PURPOSE: The aim was to use PAVS to analyze the relationship between PA level changes throughout the semester, PA intensities spent in class, and how many students meet the 2008 PA Guidelines for Americans. METHODS: Subjects self-enrolled in one PA course. Each subject (n=41; 31 females, 10 males, 21.4 years ± 4.50) completed an emailed questionnaire (Qualtrics) at the beginning, middle, and end of the class term (weeks 2-3, 8, and 16), and wore an accelerometer (Actigraph wGXT3X-BT accelerometers with a 15 second epoch collection rate) while in the class at the same three timepoints (Feed福德 1998 counts). The Quatrck McClusky included: Demographic information (at timepoint 1 only), and PAVS Survey. RESULTS: The mean PAWS score was 180.1 minutes ± 146.6, 217.2 minutes ± 167.5, and 226.76 minutes ± 173.3 for each timepoint respectively. The percent of subjects who met PA recommendations increase from 41.6% to 63.4%. PA VS Score was not significantly different from time point one to timepoint three (t_{1;12} = -0.050, p=0.864, r_{1;12} = 0.28, p=0.078, r_{1;12} = -0.111, p=0.491, r_{1;12} = 0.021, p=0.893, r_{1;12} = -0.050, p=0.757, r_{1;12} = -0.144, p=0.370, r_{1;12} = -0.081, p=0.613; r_{1;12} = 0.022, p=0.890; r_{1;12} = 0.222, p=0.757; r_{1;12} = 0.144, p=0.370; r_{1;12} = -0.081, p=0.613; r_{1;12} = 0.022, p=0.890; r_{1;12} = 0.222, p=0.757; r_{1;12} = 0.144, p=0.370; r_{1;12} = -0.081, p=0.613; r_{1;12} = 0.022, p=0.890; r_{1;12} = 0.222, p=0.757; r_{1;12} = 0.144, p=0.370; r_{1;12} = -0.081, p=0.613; r_{1;12} = 0.022, p=0.890; r_{1;12} = 0.222, p=0.757; r_{1;12} = 0.144, p=0.370; r_{1;12} = -0.081, p=0.613; r_{1;12} = 0.022, p=0.890; r_{1;12} = 0.222, p=0.757; r_{1;12} = 0.144, p=0.370; r_{1;12} = -0.081, p=0.613). CONCLUSION: PAVS was not a significant predictor of PA intensity in college level activity course nor did it significantly change throughout the semester. However, students who met PA requirement increased from (41.6%) to (63.4%) at the end of the semester.

Global Positioning System (GPS) receivers plus accelerometer can identify how physical activity (PA) varies by schoolyard location, but the accuracy and comparability of existing approaches to analyzing this data are unknown. PURPOSE: To compare previously used methods for analyzing GPS plus accelerometer data from four domains: physical activity, diet, physical activity environment, and food environment. METHODS: Children (N=30) wore an accelerometer and GPS on their hip for two recesses to determine location and PA intensity (counts/sec or classified by cut-points). Recesses were videoed, and location and PA intensity were coded. Five approaches for interpreting GPS and accelerometer data were used and compared to the video: 1) graduated color dot map, 2) in fishnet grid, 3) hot spot analysis with
getis ord G* statistic, 4) zonal approach, and 5) interpolation of a continuous surface of intensity over the schoolyard. For the zonal approach, weighted kappa compared GPS and video location second-by-second, and paired t-tests compared proportion of time in each location and intensity for GPS plus accelerometry versus video (p=0.05).

RESULTS: Hot spot analysis revealed significant (p<0.01) clusters of high counts/sec on the field and court and near the swings, which was supported by dot and grid maps. Interpolation indicated a high intensity peak in the court. These patterns were supported by rapid observation. Weighted kappa was 0.76, and there were no differences in time spent in each zone according to GPS versus video (court: 45.2±43.7%, fixed equipment: 31.1±33.2%, field: 23.7±26.2%). Sedentary behavior was higher according to GPS versus video overall (22.1±12.1%) and for court (21.9±10.1%) and fixed equipment (19.7±7.1%). Moderate-to-vigorous PA was lower according to GPS versus video overall (42.6±8.6%) and fixed equipment (45.2±8.0%).

CONCLUSIONS: GPS plus accelerometry accurately classified location, and the PA patterns identified by dot, grid, and hot spot were similar to video. Quantification of the proportion of time in each intensity by location was not similar to video, possibly due to missing data or differences in how accelerometer and video intensity are classified. Interpolation is not an appropriate analysis for this research question and is not recommended for future use.

Funded by OU Interdisciplinary Research Grant

1247 Board #55 May 31 9:00 AM - 10:30 AM Implications Of Direct Observation Methods For Describing Drivers Of Children’s Physical Activity Chelsey R. Schlechter1, Justin M. Guagliano2, Richard R. Rosenkranz, FACSMM1, David A. Dzewaltowski1, 1Kansas State University, University of Nebraska Medical Center, Manhattan, Kansas, KS. 2Kansas State University, Manhattan, KS. 1University of Nebraska Medical Center, Omaha, NE. (Sponsor: Richard R. Rosenkranz, FACSMM)

(no relevant relationships reported)

Direct observation (DO) is a popular objective method to describe children’s physical activity (PA) and setting context. DO is a category of methodologies that vary by the time unit of analysis (e.g., total setting time or segmented setting time) and sampling method (e.g., momentary or continuous). We propose that the DO method determines the temporal variability in data collected, and therefore defines the ecological processes that can be studied.

Purpose: To examine implications of DO methods for observing drivers of children’s PA.

Methods: Research assistants (RA) video-recorded basketball practices (n=24) from 12 boys’ and girls’ teams (2 practices/team) where children (n=105, 7-12y, mean ± SD = 9.4 ± 1.1y) wore ActiGraph GT1M accelerometers. RA coded each practice using two DO systems. SOFIT uses momentary time sampling and observes every 20 seconds over total practice time (TPT) to assess percentage of TPT in PA, in different contexts types (e.g., fitness, skill), and in PA within context across TPT. Our alternate method (CLOUDEE) uses continuous sampling to define continuous context time segments during practice. Metrics calculated from CLOUDEE were frequency, duration, and order of segments, and %time spent in PA within segments. Inter-rater reliability was calculated on a subset of practices (n=5/system). We analyzed accelerometer data from Benson et al., cut-points, and segmented the data with context time segments from CLOUDEE.

Results: Inter-rater reliability was >95% for both systems. Most TPT, assessed by SOFIT, was spent in skill (mean ± SE = 47.4 ± 0.8%). Fitness had the greatest percentage of MVPA (moderate-to-vigorous physical activity) (mean ± SE = 81.6 ± 5.2%) across TPT. Using CLOUDEE, we identified 256 time segments (mean ± SE = 10.7 ± 2.5) during practices. Skill segments occurred most frequently (mean ± SE = 3.5 ± 2.3; mean length ± SE = 4.75 ± 3.41 minutes). Free-play segments were the most frequently occurring first segment in the practice routine (81.8%; mean length ± SE = 4.32 ± 2.51) and had the greatest %time spent in MVPA (mean ± SE = 57.7 ± 2.8%).

Conclusion: The systems comprise different data points and thus esteem different processes as drivers of children’s PA. When using DO, researchers should ensure appropriate methods are used to examine the ecological process of interest.

1248 Board #56 May 31 9:00 AM - 10:30 AM Evaluation Of In-School Physical Activity During Recess, P.E., And Academically-Related Movement Activities Robert Booker, Riley Galloway, Trisha Doering, Missouri State University, Springfield, MO. (Sponsor: Barbara A Bushman, FACSMM)

(no relevant relationships reported)

PURPOSE: Schools provide ample opportunity to address physical inactivity patterns, which have been established as a crucial risk factor of health concerns. As evidence of associations between morbidity and progression of childhood obesity to adult obesity expand along with the inverse relationship between school year and physical activity (PA), an urgency remains for schools to implement mandatory policies addressing the accumulated moderate-to-vigorous physical activity (MVPA) per week. The purpose of this study was to quantify in-school PA levels among elementary students during recess, P.E., and academically-related movement activities (ARMA) and determine if state-wide recommended levels of MVPA are being met.

METHODS: Third through sixth grade students (N=71) volunteered to participate in the evaluation of PA levels during recess, P.E., and ARMA during summer school. Accelerometry data was obtained to quantify the amount of PA being achieved. Data collection commenced at the beginning of and ceased at the end of each school day for five consecutive days. Accelerometers were used to provide tri-axial movement analysis according to 5-second ‘epochs’ to quantify levels of PA. A one-way ANOVA was employed to examine PA between grades.

RESULTS: Of the weekly recess minutes offered (332.39 ± 24.49), 31% classified as MVPA while 35.4% was completely sedentary. Combining sedentary and light accounted for 68.9% of the total time. Of the weekly P.E. minutes offered (72.75 ± 31.29), 23.83% classified as MVPA while 41.4% was completely sedentary. Combining sedentary and light accounted for 72.8% of the total time. Of the weekly ARMA minutes offered (149.3 ± 17.6), 15% classified as MVPA while 35.37% was completely sedentary. Combining sedentary and light accounted for 63.5% of the total time. Percentages significantly increased across each category after omitting 6th grade due to inflation.

CONCLUSION: Overall, students failed to achieve recommended amounts of MVPA during school hours and recommended amounts of P.E. of at least moderate intensity although there was opportunity to achieve both. This research provides insight to PA levels and potential health status of children during school hours, which confirms the need for enhanced attention to meeting state standards of school-related PA.

Grant Funding: N/A

Activity monitors are used to track activity and exercise intensity in the bi-pedal population, however, there is a lack of studies examining these devices for those using manual wheelchairs.

PURPOSE: To assess activity monitor accuracy during wheelchair use (WC).

METHODS: Forty-four subjects (non-wheelchair users; age=26.7±9.4 y, ht=168±7.6 cm, wt=74.7±16.7 kg) were six commercially-available wrist activity monitors (FF, FC, & PL on the right wrist; GV, MV, & LT on the left wrist) and a heart rate (HR) monitor while walking 150m in an indoor hallway at a self-selected pace. Subjects traversed the same path in a wheelchair. Video was used to determine actual counts using a hand tally (AC). During WC, a count was recorded as the hand went forward and again as the hand recovered for each hand. Repeated measures ANOVA determined significant differences between the counts. Error was calculated as (monitor counts-actual counts)/actual counts*100. Alpha was set at .05 for all tests. RESULTS: During walking, FF, FC, PL and MV (263.7±37.3, 270.5±29.6, 228.5±49.9, & 264.6±30.3 counts, respectively) were significantly lower than AC (286.4±24.4 counts), p<.05, except for LT (267.3±4.0 counts) and GV (281.2±24.4 counts), p>.05. During use, FC (305.7±83.7 counts) and FF (306.6±80.8 counts) were significantly greater than AC (273.9±101.3 counts), p<.05. PL (201.2±97.2 counts) was not significantly different than AC. Similarly, MV (248.1±63.8 counts) and LT (344.6±128.2 counts) were significantly different than AC (263.7±37.3 counts) and GV (281.2±24.4 counts), p<.05. Similarly, MV was not significantly different than AC during walking. PL had greatest error (20.8±15.3%), followed by FF (7.8±11.3%), LV (7.4±8.2%), LT (6.8±13.5%), FC (5.9±7.4%), and GV (2.3±4.1%). Error was high in all conditions during WC use, with LT exhibiting the greatest error (29.6±21.0%), followed by FC (23.5±20.3%), FF (21.9±20.1%), GV (18.9±21.7%), MV (18.5±14.3%), and PL (16.2±12.8%).

CONCLUSION: Although substantial error is still evident, PL seems to be the most accurate for wheelchair use among the devices assessed. Manufacturers should consider developing an activity monitor specifically for wheelchair users.

1250 Board #58 May 31 9:00 AM - 10:30 AM Assessment Of Physical Activity & Sedentary Behavior In Individuals with Chronic Low Back Pain Jeni E. Lansing, Maria Perez, Kathryn J. Southard, Laura D. Ellington. Iowa State University, Ames, IA. (No relevant relationships reported)

Low back pain affects >80% of adults in their lifetime, with 4-14% experiencing chronic low back pain (CLBP). Exercise training can reduce pain in CLBP patients, but activity patterns in this population have yet to be well-described, with existing data coming solely from self-report measures.

PURPOSE: Our aim was to describe physical activity (PA) and sedentary (SED) behaviors and compare patterns assessed using objective vs. self-report measures in individuals with CLBP.

METHODS:

Abstracts were prepared by the authors and printed as submitted.
MEICINE & SCIENCE IN SPORTS & EXERCISE®

Participants were a convenience sample of 2,119 children (mean age = 8.5 (1.9) years) recruited from 5 schools from the Mountain West region of the U.S. Step counts and time in sedentary were assessed using ActiGraph wGT3X-BT triaxial accelerometers that were worn during the entire course of a 7-hour school day for one school week. Average censored step counts and minutes in sedentary behavior were calculated across 3 to 5 days. Receiver operating characteristic (ROC) curves were employed to derive step counts discriminating children that met 3-hours (180 minutes) to 6-hours (360-minutes) of sedentary time (≤100 accelerometer counts per minute) per school day via calculation of the maximum Youden’s J statistic. The sedentary cut-point derivations were derived from Evenson et al. (2008) using 15-second epochs (25 counts per 15-seconds). However, within the ActiLife software, sedentary cut-points were multiplied by four to align with 60-second epochs.

RESULTS: Area-under-the-curve (AUC) scores ranged from AUC = 0.92 (95% CI: 0.90-0.94; p < 0.001) for meeting 3-hours at school day to AUC = 0.78 (95% CI: 0.75-0.81, p < 0.001) for meeting at least 6-hours of school day sedentary. Approximately 4,090 steps best-discriminated children meeting 3-hours of school day sedentary (Sensitivity = 87.4%, Specificity = 78.3%, Accuracy = 85.5%) and provided improvement metrics. Our plans are to target special aging populations as a means to promote healthy physical activity.

CONCLUSIONS: After applying a calibration formula, the 7164 and wGT3X-BT are comparable for total wear time, count based estimates, and average time/day in physical activity of different intensities. METHODS: Data are from 87 CARDIA participants, aged 48-60 years, who simultaneously wore the 7164 and wGT3X-BT accelerometers at the wrist in 2015-16, with wear time ≥4 of 7 days, ≥10 hr/ day. Freedson cut points (ct/min) were used to define sedentary (<100), light (100-1951), moderate (1952-5724), and vigorous activity (≥5725). Paired difference tests were used to compare mean or median values between the two accelerometers.

Agreement was evaluated using intra-class correlation coefficients and Bland-Altman plots. A calibration formula applied to the wGT3X-BT values was obtained by linear regression. RESULTS: Minute by minute within-person correlations of ct/min/day averaged r=0.74, despite the ≥20 year age of the 7164 devices. Total recorded wear time/day was nearly identical between the 7164 and wGT3X-BT (881 ± 7.09 vs. 880.3 ± 7.81, p<0.72). Linear regression of the wGT3X-BT on the 7164 ct/min/day passed very close to the origin; therefore, the slope of the 7164 ct/min/day (1.088) was the calibration proportionality. After calibrating the wGT3X-BT values (dividing by 1.088), no differences were observed between the 7164 and wGT3X-BT in total accelerometer ct/day (310,184 ± 129,189 vs. 307,085 ± 135,362, p=0.48), average ct/min/day (349.5 ± 139.5 vs. 346.5 ± 147.2, p = 0.54), sedentary (513.2 ± 93.6 vs. 509.6 ± 98.6, p=0.23), light (335.3 ± 81.5 vs. 338.7 ± 81.1, p=0.02), or moderate min/day (31.0 ± 21.9 vs. 30.3 ± 23.3, p=0.31). A significant difference was observed for vigorous min/day in the total sample. (0.2 ± 0.0 vs. 0.0 ± 0.3, p<0.01), and also among those with >0 vigorous min/day (N=28, 2.8 ± 4.5 vs. 1.3 ± 2.9, p<0.01).

Intra-class correlation coefficients showed excellent agreement for all measures (ICC range = 0.97-0.99). Bland-Altman plots demonstrated acceptable levels of agreement. CONCLUSIONS: After applying a calibration formula, the 7164 and wGT3X-BT are comparable for total wear time, count based estimates, and average min/day in sedentary, light, and moderate activity, but not for vigorous activity.

Many innovative information technology applications use gestures as input. We are exploring gesture analysis for incorporation into exergames for personalized medical interventions using yoga as therapy (YT). PURPOSE: A data-driven machine learning solution for gesture detection was used to classify captured yoga poses with high accuracy. The research goal is to test whether a machine learning algorithm in a basic computer video exergame can assess yoga skill acquisition in targeted select populations as a means to promote healthy physical activity. METHODS: Convenience sample of 20 adult students, male and female of any race/ethnicity, were briefly instructed and shown poses to perform, while recorded by the Kinect attached to a PC. Three yoga sessions (pre-test, mid-way and a post-test) were captured during the regularly scheduled yoga class which met twice weekly for 75 minutes, over a 10-week period. RESULTS: We recorded 6 yoga instructors while performing a series of yoga postures, and recorded clips were tagged or labelled in all of the frames in the recordings that defined a yoga posture by consensus of two yoga instructors. Default settings produced solutions with high True Positives (99.5%) and low False Positives (0.03%) for most yoga postures sampled. Deph stream and skeleton coordinates for the 20 participants were acquired and analyzed against the previous trained solution. Analysis of summary statistics was done for five yoga poses comparing initial, mid-session, and final session captures. Sensitivity showed consistent trends for Mountain, Forward Bend, and Upward Salute. For Mountain, Sensitivity went from 0.78 to 0.87, while the expert test clip scored 0.94. Informedness also showed similar consistent trends for those poses. Based on these results the higher sensitivity score predicts greater training and closer the postures were to the “gold standard”. CONCLUSIONS: Gesture analysis for yoga alignment training may be a useful tool for the development of home and clinical yoga therapy for hard to reach populations. The experimental exergame developed here provides a tool that scores the performance of yoga postures and provides improvement metrics. Our plans are to target special aging populations with YT, and study the potential effects of body mass and age on posture alignment and limb stretch.
CONCLUSION: The differing trajectories, and the differential relationships between VM and MVPA estimates across wear locations, highlight the need for standardized methods to compare accelerometer output in free-living environments. The use of a standardized methodology, such as the one proposed in this work, can help attenuate cardiometabolic risk that is associated with being overweight and obese, and further attenuate adverse effects of obesity.

Acknowledgments: The authors acknowledge the contributions of all study participants and the financial support from the National Institutes of Health (R01-DE09551, R01-DE12101, R01-DE-09551, and R01-DE-09551, and the General Clinical Research Centers Program from the Government, the National Institute of Dental and Craniofacial Research R01-DE12101 and R01-DE-09551).

Sponsor: Todd Alan Hagobian, FACSM

No relevant relationships reported

Purpose: To evaluate measures of physical activity in women varying body mass index (BMI) categories using accelerometers worn on the wrist and thigh. In addition, to determine if measures of sedentary time among women are similar among BMI categories using the International Physical Activity Questionnaire (IPAQ) and an accelerometer worn on the thigh. Methods: Thirty five women (24.0 ± 0.7 y) participated in this study. There were 13 normal weight (18.5-24.9 kg/m²), 10 overweight (25.0-29.9 kg/m²), and 12 obese (≥30.0 kg/m²) participants that wore the ActiCal (AP) on the thigh and ActiGraph GT3x-BT (AG) on the wrist for twenty four hours per day for seven consecutive days. After seven days participants completed the IPAQ. Results: The AG recorded significantly more steps per day than the AP within each BMI category (p<0.01). There were no differences among BMI categories for physical activity or sedentary time using objective measures (p>0.05). There was an insignificant trend for IPAQ Met minutes to increase with higher BMI categories. Sedentary time was similar among BMI categories using IPAQ (p>0.05). Conclusion: Steps per day may vary depending on the location of the accelerometer which may limit comparisons to other reported findings. Obese groups may tend to report more physical activity when using questionnaires. However, physical activity recorded using objective monitors may tend to find smaller differences among BMI categories. BMI category does not appear to impact measures of sedentary time by objective monitor (AP) or questionnaire (IPAQ).

CONCLUSION: These results suggest that adequate muscular strength may help to attenuate cardiometabolic risk that is associated with being overweight and obese, and that weight loss could be recommended to all individuals with obesity, including those who are currently defined as fit.

PURPOSE: Muscle strength attenuates adverse effects of overweight on cardiometabolic risk factors but not in its counterparts with higher fat among collegiate students. The aims of the study were to: 1) analyze differences in composite metabolic syndrome score (MetScore) and fatness across body mass index (BMI) categories in college students; and 2) determine whether fit individuals have significantly lower MetScore, fewer individual metabolic syndrome components, and less fatness than unfit individuals in each BMI category. METHODS: A total of 1,795 college students (61.4% female, mean age = 20.7 ± 2.9 years old), ranging between the ages of 18 and 30 years participated in the study. Muscular strength was estimated using a hand-held dynamometer and used to classify adults as fit or unfit. A MetScore was computed as a sum of the typicalized Z-scores per age and gender from the following components: waist circumference, triglycerides, high-density lipoprotein cholesterol, glucose, and systolic and diastolic blood pressure. RESULTS: MetScore, percentage of body fat, and visceral adiposity increased linearly across the BMI categories among college students (all p<0.001). Individuals who were overweight and fit had lower MetScore (-0.6 SD; P <0.02), body fat percentage (-2.6%; P <0.001) and visceral adiposity (-0.2; P <0.01) than unfit peers. Moderately fit, obese individuals had significantly lower visceral fat levels than unfit, obese peers (-3.0; P <0.03).

Conclusions: These results suggest that adequate muscular strength may help to attenuate cardiometabolic risk that is associated with being overweight and obese, and that weight loss could be recommended to all individuals with obesity, including those who are currently defined as fit.
RESULTS: Correlation between wrist RF and the hip methods ranged from R=0.63-0.66, while hip/thigh methods were all highly correlated (R=0.94-0.99). The AL domain had the highest mean in MVPA (606.0 min), while SL (range: 1.3-15.8 min) and W (range: 2.0-23.5 min) were the lowest. Wrist estimates of MVPA were significantly higher than the S3x (+10.8 min), F (+15.3 min), AP (+12.7 min), and VM (+12.1 min), all p<0.01. The estimates of MVPA from the RF were not significantly different than C2, p=0.11. Agreement between methods did not differ by activity domain (p>0.05).

CONCLUSIONS: The wrist RF method was moderately correlated with hip/thigh measures and consistently produced higher estimates of MVPA compared to hip/thigh algorithms, across all activity types. Future research using direct observation as a criterion measure is needed. Supported by Bill and Linda Frost Fund.

1259 Board #67 May 31 9:00 AM - 10:30 AM
Pregnancy Walking Cadence Does Not Vary By Trimester
Mallory R. Marshall, Alexander H.K. Montoye, Ashley J. George. \textit{Samford University, Birmingham, AL.} \textit{Alma College, Alma, MI.}

**PURPOSE:** Walking is the most commonly reported mode of physical activity among the general population and also among pregnant women. Pregnancy-related changes in walking speed, cadence, and step length may vary by trimester. The current study aimed to assess changes in walking speed, cadence, and step length by trimester.

**METHODS:** A total of 104 pregnant women were recruited from the community and were divided into four trimester groups: 1st trimester (13-25 weeks) while 53.3% were third trimester (≥26 weeks). Participants completed a survey of demographic characteristics and wore an accelerometer on their wrist for four minutes during two minutes of each stage by dividing VO\textsubscript{2}. The accelerometer data were downloaded in free-living stepping cadence in pregnant women and examine differences between pregnancy have not been studied. The purpose of this study was to describe free-living stepping cadence in pregnant women and examine differences between first and second trimester women.

**METHODS:** Fifty pregnant women were recruited for this study and n=45 was an analytic sample size; 46.7% were in their second trimester (13-25 weeks) while 53.3% were third trimester (≥26 weeks). Participants completed a survey of demographic characteristics and wore an accelerometer on their non-dominant wrist for 7-8 days; they were instructed to wear the device as much as possible during waking hours. These accelerometer data were downloaded in 60-sec epochs, allowing for determination of min-by-min walking cadence, defined as steps/min. Mean steps/day, mean cadence, median cadence, maximum cadence, peak cadence (average cadence over the 30 minutes of highest cadence in each day), mean time spent in moderate- to vigorous-intensity physical activity (MVPA, time spent with cadence ≥100 steps/min), and mean daily time spent in several cadence ranges (0-9, 10-19, 20-29, 30-39, 40-49, 50-59, 60-69, 70-79, 80-89, 90-99, 100-109. 110-119, 120-129, 130-139, 140-149, 150-159, 160-169, <50, <100, ≥100, and ≥130 steps/min) were calculated for each participant. Between-trimester differences were determined using independent-samples t-tests. **RESULTS:** Average daily steps were 11,060.1±2,953.3; 66.2% of second trimester and 54.2% of third trimester women met daily step recommendations of 10,000 steps/day, but 0.0% of the sample accumulated the recommended 150 min/wk of MVPA. There were no differences by trimester for cadence at any step rate. **CONCLUSIONS:** Pregnancy does not alter free-living step cadences and their rates of change from those observed in non-pregnant women.
all 80 participants (40 men, 40 women; age = 50.2±1.5 years; BMI = 26.0±0.4 kg/m²; height = 171.0±9.2 cm). ROC cadence thresholds for moderate and vigorous intensity were 98.5 and 117.3 steps/min, respectively. All sensitivity values were overall, ENMO and GVM are excellent classifiers of SB in youth across all attachment sites. GVM is less effective than ENMO for classifying CWR, but has potential for future use and should be continued.

When classifying CWR after removing SB, ENMO CV had AUC between 85.0%-87.9%, while GVM was lower and more variable with AUC between 53.3%-74.7%. CONCLUSION: Overall, ENMO and GVM are excellent classifiers of SB in youth across all attachment sites. GVM is less effective than ENMO for classifying CWR, but has potential for future use and should be continued.

The Actigraph GTx9 includes an inertial measurement unit (IMU) equipped with a triaxial gyroscope which has been shown to be a perfect classifier of sedentary behavior (SB) in adults. To date, there has been no research to explore the application of these two methods for use in estimating compliance to current physical activity guidelines. METHODS: Participants (N=69) were 26.3 ± 8.7 years old, had a BMI of 23.8 ± 4.0 kg/m², and were 60.9% female. Participants reported an average rating of perceived exertion of 11.9 (6 - 19). The percentage of correctly identified activities by the four trackers was 44.1 - 97.1 for outdoor cycling, and 87.5% for swimming. Lower accuracy for outdoor walking, 100% for outdoor running, 70.4% (3.1 - 93.9) for the elliptical, 83.1% (44.1 - 97.1) for outdoor cycling, and 87.5% for swimming. Lower accuracy for the elliptical was driven down by a low accuracy of 3.1% for one tracker. Module D consisted of 15 min of freestyle swimming (only one tracker was used in Module D as others are not waterproof). The actual activity type, duration, and start/stop times were recorded, then compared to device data (recognized activity type, duration, and start times).

RESULTS: Participants (N=69) were 26.3 ± 8.7 years old, had a BMI of 23.8 ± 4.0 kg/m², and were 60.9% female. Participants reported an average rating of perceived exertion of 11.9 (6 - 19). The percentage of correctly identified activities by the four trackers was 44.1 - 97.1 for outdoor cycling, and 87.5% for swimming. Lower accuracy for outdoor walking, 100% for outdoor running, 70.4% (3.1 - 93.9) for the elliptical, 83.1% (44.1 - 97.1) for outdoor cycling, and 87.5% for swimming. Lower accuracy for the elliptical was driven down by a low accuracy of 3.1% for one tracker. Module D consisted of 15 min of freestyle swimming (only one tracker was used in Module D as others are not waterproof). The actual activity type, duration, and start/stop times were recorded, then compared to device data (recognized activity type, duration, and start times).

CONCLUSION: The four wearable activity trackers were best at detecting outdoor running and worst at detecting running in the 25-minute treadmill series. Overall, the trackers were better at detecting ambulatory activities, apart from running in the treadmill series, than detecting swimming, cycling, or using an elliptical. This research was funded through startup funds through UW - Madison.

THURSDAY, MAY 31, 2018

With the increased popularity of activity monitors over the past decade, step counting has become a prevalent method of assessing physical activity. Although most manufacturers suggest to wear monitors on the non-dominant (ND) wrist, some consumer-grade devices can be initialized to be worn on the dominant (D) wrist. Only one study has compared the step count accuracy of devices worn on the D and ND wrists across various treadmill speeds and it found no significant differences between the D and ND wrist step counts. However, the actual rate of D vs ND wear on step count may be different under free-living conditions. PURPOSE: To compare...

Abstracts were prepared by the authors and printed as submitted.

Vol. 49 No. 5 Supplement S245

Official Journal of the American College of Sports Medicine
Physical activity is an important risk factor for disease and functional outcomes across the age spectrum. Measurement of objective physical activity by accelerometry has become common in recent years and is often reported as total or average daily physical activity. Measurement of objective physical activity by accelerometry has been shown to be a valid and reliable method for assessing physical activity. This method allows for the classification of physical activity into different categories based on energy expenditure. However, the accuracy of accelerometry-based measurements can be affected by factors such as device calibration and user activity patterns. Therefore, it is important to consider these factors when interpreting accelerometer data.
While wrist-worn physical activity monitors have been used to quantify exercise volume for aerobic activities, limited research has utilized activity monitors to quantify resistance training exercises. PURPOSE: The purpose of this study was to develop an improved method for predicting repetitions during resistance training exercises. The validity of this method was tested during an unstructured training session. METHODS: While wearing a wrist-worn, accelerometer-based activity monitor, 144 participants (73 M, 71 F) completed 12 different upper- and lower-body dumbbell resistance training exercises. Each participant completed one set of 12 repetitions using a lightweight (~7 kg) set of dumbbells. This data was used to develop a repetition counting algorithm by comparing minimum and maximum values for the largest X, Y, or Z plane acceleration peak/valley during each exercise. Participants were then asked to complete an unstructured, free-living resistance training exercise session. Within the training session, they were asked to complete at least one set of at least five reps of the original 12 dumbbell resistance training exercises used in the algorithm development phase of the study. A research assistant observed the training session and recorded details about the exercises, resistance, and repetitions for each exercise. A mixed-model RM ANOVA was utilized to compare the predicted repetitions to the observed repetitions for the 12 exercises. Pairwise comparisons with Bonferroni adjustment were utilized to identify the location of differences. RESULTS: During the free-living training sessions, a total of 2293 sets of the 12 dumbbell exercises were completed by the study participants. Mixed-model RM ANOVA indicated a significant main effect (p<0.05). Post-hoc analysis indicated significant differences between the predicted and observed repetitions for five of the 12 exercises. However, the differences for all exercises were within 1.2 repetitions of the actual repetitions. Across all exercises, the predicted algorithm was within 0.3 repetitions of the actual repetitions (range: 0.0 to 1.2 reps). CONCLUSION: While some significant differences occurred for five of the 12 exercises, the repetition prediction model was a valid method for predicting repetitions for the selected dumbbell exercises.
Purpose: Physical activity (PA) provides important health benefits such as improved cardio-metabolic health, mental health, and cognitive functioning. However, the majority of this evidence is based on research conducted in ambulatory populations. Research informing the relationship between PA and health among manual wheelchair users (MWUs) is limited. One of the barriers is the lack of valid and reliable PA measures for the population. In the current study, machine learning (ML) techniques were used to develop activity recognition models to automatically identify episodes of active self-propulsion in manual MWUs's wearing a single wrist-mounted accelerometer.

Methods: 11 adult MWU's (males= 8; 7 paraplegic; 4 tetraplegic) completed a series of activity trials while wearing an ActiGraph GT9X accelerometer on the non-dominant wrist. Activities included: sitting quietly, being pushed, self-propulsion, and completing manual tasks such as drinking water, working on an iPad, and folding laundry. Trials were categorised into 3 classes: sedentary (SED), manual tasks (MT), and self-propulsion (SP). 15 time-domain features from the X, Y, and Z axis were extracted from 1 s windows with 50% overlap and inputted into 3 supervised learning algorithms (Decision Tree (DT), Random Forest (RF), and Support Vector Machine (SVM)). Performance was evaluated using leave-one-subject-out (LOSO) cross-validation. To determine if the resultant models generalized to new data, performance was also evaluated in an independent sample of MWU's (n = 14).

Results: Cross-validation F1-scores for the DT, RF, and SVM classifiers were 0.83, 0.84 and 0.85, respectively. Classification accuracy was consistently good to excellent for SED (86.0% - 92.7%), MT (76.0% - 82.4%), and SP (76.0% - 76.8%). In the independent sample, F1-scores for the DT, RF, and SVM classifiers were, 0.80, 0.81, and 0.82, respectively. Classification accuracy remained good to excellent for SED (83.9% - 92.0%), MT (70.5% - 79.3%), and SP (74.2% - 77.6%).

Conclusion: ML models trained on simple time-domain features from a single wrist-worn accelerometer can be used to differentiate active self-propulsion from other activities in MWU's. The models generalized well to new data and could help researchers evaluate the effectiveness of interventions to promote PA in MWU's.

Purpose: To determine the validity and reliability of the Past-day Adult Sedentary Time (PAST) questionnaire using the activPAL (AP) as the criterion measure.

Methods: Thirty-four women (23.7 ± 4.6 y; 25.4 ± 6.2 kg m-2) wore the AP on the thigh and Actigraph GT3X-BT (AG) on the wrist for twenty-four hours. The PAST was administered the day after the assessment day (T1) and within twenty-four hours of T1 (T2). The AG was used to determine sleep time for the day assessed, which was then subtracted from the total sit/lie time recorded by the AP (sit/lie time-sleep time) to determine total sedentary time. Spearman correlation coefficients and Bland-Altman plots were calculated to determine validity and reliability of the PAST using AP.

Results: The correlation between T1 and T2 for all PAST questions demonstrated good positive correlations (p < 0.01) including total sedentary time except for the last question on “sitting/lying for other purposes” which was fair (r = 0.431, p = 0.011). The Bland-Altman plot revealed a mean difference of 33.7 minutes of T2 and T1 of the PAST with no significant bias (p > 0.05). However, using the AP as the criterion the mean difference for T1 (T1-AP) was 167.0 mins while the mean difference for T2 (T2-AP) was 200.7 mins with both demonstrating significant positive bias (p < 0.001).

Conclusion: The PAST is a reliable instrument when re-administered within twenty four hours. However, participants tend to over-report their sedentary time especially once reported sedentary time is >600 minutes per day. Therefore, researchers should be cautious when using the PAST in populations that report a high amount of sedentary time (e.g., >600 minutes).

Table 1. Confusion Matrix for each method with percent (%) overlap between methods for each minute of PA and differences (%) between methods for total minutes/day at baseline

<table>
<thead>
<tr>
<th>Method</th>
<th>Individual 400MW</th>
<th>Evenson</th>
<th>Activity Index</th>
<th>1041cpm</th>
<th>ML</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual 400MW</td>
<td>31%*</td>
<td>25%*</td>
<td>42%*</td>
<td>69%*</td>
<td>42%*</td>
</tr>
<tr>
<td>Evenson</td>
<td>61%</td>
<td>63%</td>
<td>60%</td>
<td>43%</td>
<td></td>
</tr>
<tr>
<td>Activity Index</td>
<td>63%</td>
<td>60%</td>
<td>43%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1041cpm</td>
<td></td>
<td></td>
<td></td>
<td>43%</td>
<td></td>
</tr>
<tr>
<td>ML</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: * indicate significant differences based on total minutes/day (p < 0.05); cpm: counts per minute; ML: Machine Learned; MW: meter-walk.

Purpose: The purpose of this pilot study was to evaluate the accuracy and reliability of step counts from a consumer-grade activity tracker by comparing step counts to a research-grade accelerometer and video recording. METHODS: Ten volunteers (mean age = 71.20 ± 6.00 years) agreed to participate. Two participants did not complete the second round of testing. Researchers collected height, weight, and age. The activity tracker and accelerometer were set-up using manufacturer’s procedures. Participants wore the activity tracker and accelerometer as they walked 96 meters around an indoor gym floor at their normal walking pace. The walk was also video recorded to determine observational step count confirmed by two researchers. The same procedures were repeated on a second, non-consecutive day. Data collected from the activity tracker were compared to the accelerometer and observed step count. In addition, step counts from the first walk were compared to step counts from the second walk.

RESULTS: At
the first walk, the activity tracker was found to significantly underestimate step counts by 16.00 steps when compared to the observed step count, t(7) = -2.69, p < .031. The activity tracker step count was not different than the accelerometer step count. At the second walk, no differences in step counts were observed between the activity tracker and the accelerometer or the observed step count (p > .05). In addition, no differences in step counts were observed between walk 1 and walk 2 using the activity tracker, accelerometer, and observed step count. CONCLUSION: Although preliminary, these data indicate fair accuracy and good reliability of a consumer-grade activity tracker when compared to the research-grade accelerometer and observed step count. We suggest this pilot study be extended to include additional participants and comparisons of other activity trackers. Activity trackers are widely used to measure physical activity, but their accuracy and reliability remains questionable especially among older people. Additionally, products and upgrades are made available so quickly that research on the accuracy and reliability of these devices is difficult to obtain.

1276 Board #84 May 31 9:00 AM - 10:30 AM
Accuracy of Fitbit Surge and Smartphone Apps at Measuring Cycling Distance and Speed
Jose L. Gamez, Ivan A. Figueroa, Merrill D. Funk. University of Texas Rio Grande Valley, Brownsville, TX.

(No relevant relationships reported)

Purpose
To determine the accuracy of Fitbit Surge and two smartphone applications at measuring distance and speed while cycling outside.

Methods
Thirteen college-aged students (Mean±SD; BMI: 25.2±3.0kg/m²; 10 males, 3 females) consented to participate in one measurement session. A 0.75 mile trail along a sidewalk around the university campus was used for 3 separate trials using a mountain bike, Android smartphone running Google-Fit (G-Fit) and S-Health (SH), and Fitbit (FB) provided to each participant. A researcher rode along with each participant the entire study using a cycle computer as the standard for speed and distance. The first lap consisted of walking 0.25 miles, cycling 0.15 miles at a slow speed, cycling 0.20 miles at a fast speed, and cycling 0.15 miles at a moderate speed. The second lap consisted of 1 lap at a moderate speed. The third lap consisted in 1 lap at a slow speed. After every lap a researcher recorded the data from the phone and the Fitbit. Mean bias and mean absolute percent error (MAPE) were calculated to describe speeds and distances recorded on each device compared to the cycle computer.

Results
Thirteen participants completed all 3 trials though 2 were excluded due to a malfunction with the smartphone apps causing partial data to be collected, leaving 11 included in this analysis. Results are as follows:

<table>
<thead>
<tr>
<th>Trial 1</th>
<th>FB Mean Bias±SD</th>
<th>FB MAPE</th>
<th>G-Fit Mean Bias±SD</th>
<th>G-Fit MAPE</th>
<th>SH Mean Bias±SD</th>
<th>SH MAPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance (miles)</td>
<td>0.02±0.01</td>
<td>2.5</td>
<td>0.03±0.06</td>
<td>7.7</td>
<td>0.02±0.01</td>
<td>2.75</td>
</tr>
<tr>
<td>Average Speed (mph)</td>
<td>0.41±0.27</td>
<td>6.1</td>
<td>0.93±0.6</td>
<td>13.2</td>
<td>0.63±0.4</td>
<td>0.1</td>
</tr>
<tr>
<td>Max Speed (mph)</td>
<td>0.83±0.53</td>
<td>6.5</td>
<td>4.17±0.6</td>
<td>33.0</td>
<td>1.65±1.36</td>
<td>14.1</td>
</tr>
<tr>
<td>Trial 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance (miles)</td>
<td>0.02±0.02</td>
<td>4.9</td>
<td>0.02±0.06</td>
<td>7.0</td>
<td>0.02±0.02</td>
<td>3.5</td>
</tr>
<tr>
<td>Average Speed (mph)</td>
<td>0.45±0.2</td>
<td>4.8</td>
<td>1.31±0.82</td>
<td>13.6</td>
<td>0.53±1.36</td>
<td>14.1</td>
</tr>
<tr>
<td>Max Speed (mph)</td>
<td>5.98±1.19</td>
<td>41.5</td>
<td>4.43±1.0</td>
<td>29.2</td>
<td>0.44±2.03</td>
<td>11.5</td>
</tr>
<tr>
<td>Trial 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance (miles)</td>
<td>0.02±0.01</td>
<td>3.1</td>
<td>0.02±0.04</td>
<td>5.4</td>
<td>0.04±0.04</td>
<td>5.3</td>
</tr>
<tr>
<td>Average Speed (mph)</td>
<td>0.29±0.26</td>
<td>5.0</td>
<td>0.43±0.32</td>
<td>7.4</td>
<td>-1.37±2.07</td>
<td>23.7</td>
</tr>
<tr>
<td>Max Speed (mph)</td>
<td>1.51±0.57</td>
<td>9.2</td>
<td>6.59±2.14</td>
<td>37.4</td>
<td>1.44±0.59</td>
<td>8.6</td>
</tr>
</tbody>
</table>

Conclusion
The Fitbit Surge was most accurate at measuring speed and distance for cycling followed by the S-Health app and lastly the Google-Fit app.
test), the CSBP model was stronger for the active group (≥5,000 steps/day; R²=0.97) than the inactive (R²=0.89) and stronger for the high (upper third; R²=0.95) CRF than moderate (middle third; R²=0.91) or low (lower third; R²=0.90) CRF groups. 

Conclusion: The results suggest that peripheral BP is the strongest predictor of CBP for older adults.

1279 Board #87
May 31 9:00 AM - 10:30 AM
Physical Activity Patterns Among Older Central Pennsylvania Cancer Survivors: A Comparison With BRFSS National Data
Wayne Foo, Kathryn Schmitz, FACSM. Penn State Cancer Institute, Hershey, PA. (Sponsor: Kathryn Schmitz, FACSM)

Adults can participate in a variety of physical activities to meet current federal physical activity guidelines. The differences between activity patterns of cancer survivors and the general population are not well understood. This knowledge may be useful in modifying physical activity promotion guidelines specific to cancer survivors.

PURPOSE: To compare physical activity patterns of older cancer survivors living in Central Pennsylvania (CPA) to that of a national sample of Americans using the Behavioral Risk Factor Surveillance System (BRFSS) data (≥50 years old).

METHODS: We mailed BRFSS-based questionnaires to cancer survivors living in CPA, identified using the Pennsylvania Cancer Registry. Using this data (N=541) and the 2015 BRFSS national data (N=441,456), we categorized specific types of physical activity (PA) into ten major activity types using classifications from the Compendium of Physical Activities. We fit multivariate logistic regression models to estimate the prevalence odds ratios of activity participation for each activity type. Bonferroni method was used to control for inflated error due to multiple testing (p<0.005). Effect modification by sex was analyzed for activity types that were significant in the model.

RESULTS: The most common activity in both cohorts (CPA: 58%, BRFSS: 49%), followed by garden/lawn activities (CPA: 19%; BRFSS: 14%), and then conditioning activities (CPA: 9%; BRFSS: 11%). A higher proportion of CPA cancer survivors reported at least one activity (87%) compared to the national sample of Americans (66%). Compared to the national sample, CPA cancer survivors were 1.5 times more likely to report walking (OR=1.5; 99.5% CI: 1.16-1.97), 1.4 times more likely to report garden/lawn activities (OR=1.45; 99.5% CI:1.03-1.97), 1.7 times more likely to report household activities (OR=1.67; 99.5% CI:1.06-2.61), and 3.8 times more likely to report fishing/hunting (OR=3.79; 99.5% CI: 1.38-10.46). No significant effect modification by sex was found.

CONCLUSIONS: In general, CPA cancer survivors were more likely to report participating in at least one PA. Programs aimed to increase PA among CPA cancer survivors may want to focus on walking, domestic activities such as household and garden/lawn activities, as well as outdoor activities such as fishing and hunting.

1280 Board #88
May 31 9:00 AM - 10:30 AM
Associations of Body Fatness and Cardiorespiratory Fitness on Central Blood Pressure in Older Adults
Markus H. Flynn, Nathan F. Meier, Duck-chul Lee, FACSM. Iowa State University, Ames, IA. (Sponsor: Duck-Chul Lee, FACSM)

PURPOSE: To investigate the associations of percent body fat (PBF) and cardiorespiratory fitness (CRF) on central blood pressure (BP), which is suggested as a greater predictor of cardiovascular disease (CVD) than peripheral BP and more closely related to CVD risk factors.

METHODS: This cross-sectional study included 304 older adults ≥65 years (mean age 73, range 65-95). PA and sedentary variables were assessed using a self-report survey and daily steps using an accelerometer based pedometer (Omron HJ-321). CRF was the time to complete a 400m walk in minutes, thus higher number in minutes indicates a slower walking, which is a lower level of CRF. Body composition was percentage body fat (%BF) measured by DXA and body mass index (BMI). Diagnostic variables of sarcopenia include appendicular lean mass (ALM) (kg/height in meter²) measured by DXA, handgrip strength (kg), and gait speed (m/s) from 4 meter walk test.

RESULTS: Univariate regression revealed significant relationships between ALM and CRF (p=0.012), light intensity (1.5-3.0 METs) aerobic PA (p=0.001), vigorous intensity (>6.0 METs) aerobic PA (p=0.008), age (p=0.001), male sex (p=0.001), and %BF (p=0.001). Handgrip strength was related to CRF (p=0.001), light intensity aerobic PA (p=0.002), vigorous intensity aerobic PA (p=0.002), resistance PA (p=0.051), age (p=0.003), male sex (p=0.001), and %BF (p=0.001). Gait speed was related to CRF (p=0.0001), daily steps (p=0.003), age (p=0.0001), and %BF (p=0.018). Stepwise variable selection (p=0.2 to enter the model, p<0.05 to remain in the model) was used to find significant predictors of diagnostic variables of sarcopenia. ALM was predicted by CRF (β=0.15, p=0.001), %BF (β=0.12, p=0.001), BMI (β=0.25, p=0.001), and male sex (β=0.29, p=0.001) (model R²=0.93), grip strength was predicted by CRF (β=2.50, p=0.001), gait speed (β=0.26, p=0.001), and male sex (β=1.46, p=0.001) (model R²=0.63); and gait speed was predicted by CRF (β=0.11, p<0.001) (model R²=0.24).

CONCLUSION: Cardiorespiratory fitness, measured by a simple 400m walk test, was identified as a significant predictor of all three diagnostic variables of sarcopenia in older adults.

1281 Board #89
May 31 9:00 AM - 10:30 AM
Predictors of Diagnostic Variables of Sarcopenia in Older Adults
Nathan Meier, Duck-chul Lee, FACSM. Iowa State University, Ames, IA. (Sponsor: Duck-Chul Lee, FACSM)

PURPOSE: To investigate potential predictors of diagnostic variables of sarcopenia in older adults including demographic factors (e.g., age, sex), aerobic and resistance physical activity (PA), cardiorespiratory fitness (CRF), and body composition.

METHODS: This cross-sectional study included 304 older adults ≥65 years (mean age 73, range 65-95). PA and sedentary variables were assessed using a self-report survey and daily steps using an accelerometer based pedometer (Omron HJ-321). CRF was the time to complete a 400m walk in minutes, thus higher number in minutes indicates a slower walking, which is a lower level of CRF. Body composition was percentage body fat (%BF) measured by DXA and body mass index (BMI). Diagnostic variables of sarcopenia include appendicular lean mass (ALM) (kg/height in meter²) measured by DXA, handgrip strength (kg), and gait speed (m/s) from 4 meter walk test.

RESULTS: Univariate regression revealed significant relationships between ALM and CRF (p=0.012), light intensity (1.5-3.0 METs) aerobic PA (p=0.001), vigorous intensity (>6.0 METs) aerobic PA (p=0.008), age (p=0.001), male sex (p=0.001), and %BF (p=0.001). Handgrip strength was related to CRF (p=0.001), light intensity aerobic PA (p=0.002), vigorous intensity aerobic PA (p=0.002), resistance PA (p=0.051), age (p=0.003), male sex (p=0.001), and %BF (p=0.001). Gait speed was related to CRF (p=0.0001), daily steps (p=0.003), age (p=0.0001), and %BF (p=0.018). Stepwise variable selection (p=0.2 to enter the model, p<0.05 to remain in the model) was used to find significant predictors of diagnostic variables of sarcopenia. ALM was predicted by CRF (β=0.15, p=0.001), %BF (β=0.12, p=0.001), BMI (β=0.25, p=0.001), and male sex (β=0.29, p=0.001) (model R²=0.93), grip strength was predicted by CRF (β=2.50, p=0.001), gait speed (β=0.26, p=0.001), and male sex (β=1.46, p=0.001) (model R²=0.63); and gait speed was predicted by CRF (β=0.11, p<0.001) (model R²=0.24).

CONCLUSION: Cardiorespiratory fitness, measured by a simple 400m walk test, was identified as a significant predictor of all three diagnostic variables of sarcopenia in older adults.
Board #91
May 31 9:00 AM - 10:30 AM

Associations of Cardiorespiratory Fitness and Percent Body Fat with Health-Related Quality of Life in Elderly
Heather Danzer, Nathan Meier, Duck-chul Lee, FACSM. Iowa State University, Ames, IA. (Sponsor: Duck-chul Lee, FACSM)

(No relevant relationships reported)

Purpose: To investigate the cross-sectional associations of cardiorespiratory fitness (CRF) and percent body fat (PBF) with Health-Related Quality of Life (HRQoL) in older adults.

Methods: Participants comprised 282 older adults aged ≥65 years (mean age 74) from the Physical Activity and Aging Study (PAAS). CRF was assessed by time in minutes to complete a 400-meter walk, and PBF was assessed by Dual-energy X-ray absorptiometry (DXA) and categorized into sex-specific quartiles for each CRF and PBF. HRQoL was assessed by the 36-Items Short Form Health Survey (SF-36) and categorized based on physical component scores (PCS) including physical health, physical role, bodily pain, and general health dimensions and mental component scores (MCS) including vitality, social functioning, emotional role, and emotional health dimensions. Average score below 50 (range 0-100) was used to define both low PCS and low MCS, indicating lower HRQoL, based on the population mean score of 50. However, due to having limited cases (n=20) for both low MCS and low PCS groups were combined into one overall HRQoL for analysis. Logistic regression was used to calculate odds ratios (ORs) and 95% confidence intervals (95% CIs) of having a low overall HRQoL across CRF and PBF quartiles.

Results: Compared to the lowest CRF quartile 1 (lowest 25%), ORs (95% CIs) of having a low overall HRQoL in the next higher CRF quartiles 2, 3, and 4 were 0.29 (0.08, 1.01), 0.16 (0.03, 0.85), and 0.14 (0.02, 0.85), respectively, after adjusting for age, sex, smoking, alcohol intake, physical activity, and PBF (trend p<0.01). This result indicates that two higher CRF levels (quartiles 3 & 4) are significantly associated with lower odds of having a low level of HRQoL, suggesting better overall HRQoL. However, PBF was not significantly associated with overall HRQoL after adjusting for the confounding including CRF in this study population (trend P=0.24). In the stratified analysis by PBF, although not significant due to further reduced number of cases, similar trends were observed for both low (lower 50%, lean) and high (upper 50%, fat) PBF groups.

Conclusion: This study suggests that higher CRF, independent of PBF, is associated with better HRQoL in older adults. However further exploration from prospective studies are needed.

C-38 Free Communication/Poster - Nutrition Status and Assessment
Thursday, May 31, 2018, 7:30 AM - 12:30 PM
Room: CC-Hall B

Board #92
May 31 8:00 AM - 9:30 AM

Preschool Breakfast Menus That Meet Dietary Guidelines: Comparing What Is Served And Consumed By Children
Stacie M. Kirk, Erik P. Kirk, FACSM. Southern Illinois University Edwardsville, Edwardsville, IL.

(No relevant relationships reported)

Preschool menus must meet the Dietary Guidelines for Americans. However, what is actually served and consumed by children is not restricted, potentially affecting consumption of a balanced diet. PURPOSE: Compare preschool breakfast menus meeting dietary guidelines to what is actually served and consumed by children.

METHODS: Fifty-two preschool children (mean±SD, age 3y and 10m ± 8m) from a university early childhood center participated in the 10-week study. Each day, 15 children were randomly selected for nutritional analysis of their breakfast. Prior to and immediately after consumption, a picture of the child’s tray was taken using digital photography. If a child had additional servings, additional pictures were taken. Analysis of energy and nutrient content for menus, food served, and food consumed was completed using Food Processor Nutrition Analysis by ESHA. Food color (white, brown, orange, yellow, red, green, other) was determined by observation during food intake by macronutrients (F=20.475; P<0.001), vitamins (F=12.245; P<0.001), minerals (F=20.475; P<0.001). Post hoc analyses indicated that female climbers were significantly lower in energy intake (1878.1± 542.9 vs. 2400.0 kcals; P<0.001), protein (771.± 24.0 vs. 135.0 g; P<0.001), carbohydrates (240.8 ± 79.6 vs. 330.0 g; P<0.001), vitamin D (3.8 ± 5.0 vs. 15.0 μg; P<0.001), vitamin E (5.7 ± 4.0 vs. 15.0 μg; P<0.001), magnesium (219.7 ± 116.4 vs. 310.0 mg; P<0.001), and potassium (1992.2 ± 803.1 vs. 4700.0 mg; P<0.001), but higher in sodium intake (2689.1 ± 933.9 vs. 1500.0 mg; P<0.001) than DRIs, respectively. Male climbers were significantly lower in energy intake (2124.8 ± 472.3 vs. 3000.0 kcals; P<0.001), protein (91.5 ± 23.0 vs. 169.0 g; P<0.001), carbohydrates (270.0 ± 76.5 vs. 413.0 g; P<0.001), fiber (27.6 ± 12.3 vs. 38.0 g; P<0.001), unsaturated fat (15.0 ± 20.6 vs. 69.0 g; P<0.034), saturated fat (22.4 ± 9.3 vs. 33.0 g; P<0.001), vitamin D (3.5 ± 3.8 vs. 15.0 μg; P<0.001), vitamin E (18.2 ± 64.0 vs. 15.0 μg; P<0.001), and potassium (2467.3 ± 910.7 vs. 4700.0 mg; P<0.001), but higher in vitamin C (139.2 ± 80.3 vs. 90.0 mg; P<0.001), riboflavin (1.8 ± 0.8 vs. 1.3 mg; P<0.011), mcin (20.9 ± 11.6 vs. 16.0 mg; P<0.021), iron (16.2 ± 9.1 vs. 8.0 mg; P<0.009), and sodium (2685.5 ± 684.0 vs. 1500.0 mg; P<0.001) than DRIs, respectively. CONCLUSION: Both gender differed significantly from nutritional recommendations. Given that energy and macronutrient intake are closely related to athletic performance, ensuring that optimal nutrition is achieved must be a priority.
Conclusion: Almost 75% of the dancers were at risk for the Triad [1 component (69.2%); 2 components (3.8%)]. Most dancers were at risk for LEA (69.2%), with 61.5% of dancers with LEA and ED risk combined. Menstrual dysfunction lasting greater than 6 months was present in 7.7% of the dancers, and no low BMD was present in any participants. Overall, 88.5% of dancers displayed ED Risks (risk by EDI-3 and/or EDI SC). Energy assessment included: RMR = 1155.8 ± 206.5 kcal/day; energy intake (EI) = 1473.9 ± 321.5 kcal/day; and EA = 22.3 ± 19.4 kcals/kg FFM/day. Average bone mineral density (Z-score) was 1.15 ± 0.76.

CONCLUSIONS: Almost 75% of the dancers were at risk for 1 component of the Triad. Specifically, LEA with ED risk was the most common Triad component displayed in this cross-sectional study. Participants completed demographic survey (age, academic status, etc.), Eating Disorder Inventory-3 (EDI-3), EDI-3 symptom checklist and menstrual cycle questionnaire. Each participant completed a DXA scan to examine BMD and completed a 7-day online dietary and exercise log. Ainsworth equation calculated exercise energy expenditure (EEE), and energy availability (EA) was calculated by EA = ((EI-EEE)/fat free mass). RESULTS: Overall, 73.0% of dancers were at risk for the Triad [1 component (69.2%); 2 components (3.8%)]. Most dancers were at risk for LEA (69.2%), with 61.5% of dancers with LEA and ED risk combined. Menstrual dysfunction lasting greater than 6 months was present in 7.7% of the dancers, and no low BMD was present in any participants. Overall, 88.5% of dancers displayed ED Risks (risk by EDI-3 and/or EDI SC). Energy assessment included: RMR = 1155.8 ± 206.5 kcal/day; energy intake (EI) = 1473.9 ± 321.5 kcal/day; and EA = 22.3 ± 19.4 kcals/kg FFM/day. Average bone mineral density (Z-score) was 1.15 ± 0.76. CONCLUSIONS: Almost 75% of the dancers were at risk for 1 component of the Triad. Specifically, LEA with ED risk was the most common Triad component displayed in this cross-sectional study. Participants completed demographic survey (age, academic status, etc.), Eating Disorder Inventory-3 (EDI-3), EDI-3 symptom checklist and menstrual cycle questionnaire. Each participant completed a DXA scan to examine BMD and completed a 7-day online dietary and exercise log. Ainsworth equation calculated exercise energy expenditure (EEE), and energy availability (EA) was calculated by EA = ((EI-EEE)/fat free mass). RESULTS: Overall, 73.0% of dancers were at risk for the Triad [1 component (69.2%); 2 components (3.8%)]. Most dancers were at risk for LEA (69.2%), with 61.5% of dancers with LEA and ED risk combined. Menstrual dysfunction lasting greater than 6 months was present in 7.7% of the dancers, and no low BMD was present in any participants. Overall, 88.5% of dancers displayed ED Risks (risk by EDI-3 and/or EDI SC). Energy assessment included: RMR = 1155.8 ± 206.5 kcal/day; energy intake (EI) = 1473.9 ± 321.5 kcal/day; and EA = 22.3 ± 19.4 kcals/kg FFM/day. Average bone mineral density (Z-score) was 1.15 ± 0.76. CONCLUSIONS: Almost 75% of the dancers were at risk for 1 component of the Triad. Specifically, LEA with ED risk was the most common Triad component displayed in this cross-sectional study. Participants completed demographic survey (age, academic status, etc.), Eating Disorder Inventory-3 (EDI-3), EDI-3 symptom checklist and menstrual cycle questionnaire. Each participant completed a DXA scan to examine BMD and completed a 7-day online dietary and exercise log. Ainsworth equation calculated exercise energy expenditure (EEE), and energy availability (EA) was calculated by EA = ((EI-EEE)/fat free mass). RESULTS: Overall, 73.0% of dancers were at risk for the Triad [1 component (69.2%); 2 components (3.8%)]. Most dancers were at risk for LEA (69.2%), with 61.5% of dancers with LEA and ED risk combined. Menstrual dysfunction lasting greater than 6 months was present in 7.7% of the dancers, and no low BMD was present in any participants. Overall, 88.5% of dancers displayed ED Risks (risk by EDI-3 and/or EDI SC). Energy assessment included: RMR = 1155.8 ± 206.5 kcal/day; energy intake (EI) = 1473.9 ± 321.5 kcal/day; and EA = 22.3 ± 19.4 kcals/kg FFM/day. Average bone mineral density (Z-score) was 1.15 ± 0.76. Conclusio...
PURPOSE: To describe the proportion of college combat athletes that follow some dietary and non-dietary strategies to loss body weight before a competition.

METHODS: We evaluated 80 college athletes (21.1 ±2.7 y; 51 males, 29 females) from different combat sports (wrestling 23, boxing 7, judo 21, karate 14, and taekwondo 15; 77.5% of the sample had competitions at national level and 21.3% at international level). We applied a questionnaire to account for some of the followed dietary and non-dietary strategies to achieve the desired competition weight three months before a state tournament. The questionnaire consisted of 35 items. The questions asked the subject if he/she usually perform that strategy for pre-competition weight loss. Also, the questionnaire asked the subjects about if they showed some of the most common side effects of weight loss. The results were reported as frequencies and proportions.

RESULTS: The most common dietary strategies for pre-competition weight loss were to reduce or avoid the consumption of fats and sugars (Table 1). On the other hand, the most common non-dietary strategies to pre-competition weight loss were increasing physical activity and using sauna (Table 1). The most common side effect related to pre-competition weight loss was overall fatigue (39, 48.8%), followed by low performance in trainings (30, 37.5%), susceptibility to diseases (29, 36.3%) and irritability or aggressiveness (27, 33.8%).

CONCLUSIONS: The reduction of fat consumption and the increase of physical activity were the most common strategies for pre-competition weight loss. Some extreme strategies were also reported but not as common. Some of the mechanisms of these strategies may be related to the side effects of weight loss and not just for the weight loss itself. A comparison by sex and by type of sport desirers further analysis.

Table 1. Proportion of dietary and non-dietary strategies for pre-competition weight loss

<table>
<thead>
<tr>
<th>Dietary strategies</th>
<th>(n=80)</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce the amount of food consumed</td>
<td>41</td>
<td>51.3</td>
</tr>
<tr>
<td>Reduce water and beverages consumption</td>
<td>30</td>
<td>37.5</td>
</tr>
<tr>
<td>Increase physical activity and reduce consumption of food and beverages</td>
<td>38</td>
<td>47.5</td>
</tr>
<tr>
<td>Reduce or avoid fat consumption</td>
<td>69</td>
<td>86.3</td>
</tr>
<tr>
<td>Reduce or avoid sugars and carbohydrates</td>
<td>63</td>
<td>78.8</td>
</tr>
<tr>
<td>Reduce or avoid animal source foods consumption</td>
<td>13</td>
<td>16.3</td>
</tr>
<tr>
<td>Reduce or avoid dairy consumption</td>
<td>39</td>
<td>48.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-dietary strategies</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of sauna</td>
<td>24</td>
<td>30</td>
</tr>
<tr>
<td>Use of laxatives</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Use of diuretics</td>
<td>7</td>
<td>8.8</td>
</tr>
<tr>
<td>Induce vomiting</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>Increase physical activity</td>
<td>69</td>
<td>86.3</td>
</tr>
</tbody>
</table>

THURSDAY, MAY 31, 2018

Official Journal of the American College of Sports Medicine
Vol. 49 No. 5 Supplement S253

1291 Board #99 May 31 8:00 AM - 9:30 AM

Pre-competition Weight Loss Strategies To Achieve The Desired Category Weight In Combat Sports Collegiate Athletes


(No relevant relationships reported)

PURPOSE: To compare the proportion of college combat athletes that consume protein below, inside and above the recommended amount.

METHODS: We evaluated 341 athletes (192 males and 149 females) from different combat sports. Food intake was evaluated through a 24-hour reminder for a habitual training day. Afterwards, daily protein intake was estimated and then calculated for kg/g body weight. Afterwards, subjects were categorized into one of three categories according to their daily protein intake: below (<1.4 g/kg/day); inside (1.4 to 2.0 g/kg/day), and above (>2.0 g/kg/day) the recommended amount (as suggested by the International Society of Sports Nutrition). The results were counted and expressed as percentage of subjects at each category. The 95% confidence interval (CI) was calculated for each percentage. This analysis was performed in both male and female athletes and compared by sex.

RESULTS: The general characteristics of the evaluated subjects for age, weight, height and BMI were 21.2 ± 2.1 y, 74.7 ± 14.1 kg, 176.2 ± 6.9 cm, 24.0 ± 3.8 kg/m² for males, and 20.6 ± 1.9 y, 61.5 ± 12.1 kg, 163.4 ± 6.6 cm, 23.0 ± 3.7 kg/m² for females, respectively. We observed that the number of male athletes that consumed protein below and inside the recommended amount was the same (61 subjects each; 31.8%, CI 25.2 - 38.5), and the remaining 70 subjects (36.4%, CI 29.5 - 42.3) consumed above the recommended amount of protein. Similarly, the majority of the female athletes consumed above the recommended protein amount (55 subjects; 36.9%, CI 29.1 - 44.7), followed for those who ingested below (53 subjects; 35.6%, CI 27.8 - 43.4) and inside (41 subjects; 27.5%, CI 20.2 - 34.8) the recommended amount. There were no significant differences by sex (p > 0.05).

CONCLUSIONS: The proportion of athletes consuming protein below, inside and above the recommended amount were similar regardless of sex. Most of the male and female athletes consumed more than 2.0 g/kg/day.

1293 Board #101 May 31 8:00 AM - 9:30 AM

Adequacy Of The Nutritional Intake In Volleyball Male College Athletes After Receiving Nutritional Counseling


(No relevant relationships reported)

PURPOSE: To evaluate if nutritional counseling for two different training sessions improves nutritional adequacy in male volleyball athletes.

METHODS: 13 volleyball male college athletes were enrolled. The athletes carried out a training plan which was based on training volleyball only (VO) 4 days/week and volleyball plus resistance training (VR) 2 days/week for 12 weeks. Athletes received nutritional plans according to the nutritional requirements for both VO and VR. We evaluated their food intake with a 24-h dietary recall. This evaluation was performed three times for each training day. The days evaluated were randomly selected during the study. The mean intake for each training type was calculated and compared with the indicated nutritional plan to calculate the % of adequacy. Data were reported as median, minimum - maximum, and compared between training types.

RESULTS: Only 7 athletes completed the study. It was observed that the athletes were closer to 100% of the total energy (ENG) requirement on VO (112.6%, 88.9 - 140.4) compared to VR (130.4%, 108.4 - 157.3), although there wasn’t a significant difference (p = 0.10). For carbohydrates (CHO), the days of VO were closer to 100% (99.5%, 76.1 - 123.8) while in VR they were above (110.9%, 85.3 - 183.5), but not significantly different (p = 0.29). Otherwise, the protein intake (PRO) was adequate on VR (103.6%, 63.2 - 133.8) compared to VO (81.1%, 58.4 - 108.7) which were below the indicated and different compared with VR (p = 0.01). Fat intake were well above the indicated amount for both training types, nonetheless there was a significant difference (p = 0.01) between the days of VO (200.9%, 132-293.3), which were closer to the indicated plan than the VR days (208.2%, 176-354.7) (Figure 1).

CONCLUSIONS: In this study, subjects showed better adequacy to the indicated plan for protein intake on VR days, the opposite was true for fat intake. Similar adequacy was observed for carbohydrate and energy regardless of the day.

1292 Board #100 May 31 8:00 AM - 9:30 AM

Fulfillment Of The Daily Protein Intake Recommendations In College Athletes Compared By Sex


(No relevant relationships reported)

PURPOSE: To compare by sex the proportion of college athletes that consume protein below, inside and above the recommended amount.

METHODS: We evaluated 341 athletes (192 males and 149 females) from different combat sports. Food intake was evaluated through a 24-hour reminder for a habitual training day. Afterwards, daily protein intake was estimated and then calculated for kg/g body weight. Afterwards, subjects were categorized into one of three categories according to their daily protein intake: below (<1.4 g/kg/day); inside (1.4 to 2.0 g/kg/day), and above (>2.0 g/kg/day) the recommended amount (as suggested by the International Society of Sports Nutrition). The results were counted and expressed as percentage
Purpose: To compare the concentration of several blood markers between different absolute and relative protein intake groups by sex in college athletes.

Methods: We evaluated 248 athletes (138 men [21 ± 3 y, 74 ± 14 kg, 176 ± 7 cm], 110 women [21 ± 5 y, 62 ± 12 kg, 164 ± 7 cm]) that competed at national level. We estimated the protein intake by a 24-hour reminder of a habitual training day. Subsequently the ingestion of absolute (g/day) and relative (g/kg/d) protein of each athlete was estimated. Then, the sample was divided by sex and by quartiles (Q) of protein intake (absolute and relative). In addition, blood chemistry was performed to evaluate uric acid, urea, creatinine, cholesterol, and triacylglycerides, which were measured daily in the sample of subjects who had the 24-hour reminder and their blood chemistry within a period of no more than 30 days difference.

Results: The concentrations in creatinine, uric acid, and cholesterol in males showed no significant differences between absolute protein intake Q. However, there was a trend (p = 0.10) for differences on triacylglycerides concentrations between Q2 and Q4 of absolute protein intake. No blood marker showed significant differences between Q of relative protein intake. In the case of females, no blood marker had a significant difference between Q of absolute protein intake. Similarly, there were no significant differences in the concentration of creatinine, uric acid, triacylglycerides and cholesterol among Q of relative protein intake. However, there was a significant difference (p = 0.04) in urea concentrations between Q2 and Q4 of relative protein intake. All the mean concentrations fell within the normal ranges.

Conclusions: In this study, no significant differences were found in blood markers among both male and female college athletes who consumed more protein than those consuming less. However, urea may differ with different protein intake amounts in female athletes.

Table 1. Blood markers according to different protein intake levels by sex.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Creatinine (g/l)</th>
<th>Urea (g/l)</th>
<th>Uric acid (g/l)</th>
<th>Triacylglycerides (g/l)</th>
<th>Cholesterol (mmol/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24 ±1</td>
<td>29 ±4</td>
<td>29 ±3</td>
<td>29 ±3</td>
<td>29 ±2</td>
</tr>
<tr>
<td></td>
<td>0.97 ±0.20</td>
<td>0.99 ±0.18</td>
<td>1.04 ±0.16</td>
<td>1.01 ±0.16</td>
<td>1.04 ±0.21</td>
</tr>
<tr>
<td></td>
<td>1.04 ±0.16</td>
<td>1.01 ±0.16</td>
<td>1.04 ±0.21</td>
<td>0.99 ±0.16</td>
<td>0.90 ±0.24</td>
</tr>
<tr>
<td></td>
<td>1.0 ±0.21</td>
<td>1.0 ±0.21</td>
<td>1.0 ±0.21</td>
<td>1.0 ±0.21</td>
<td>1.0 ±0.21</td>
</tr>
<tr>
<td>Females</td>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.7 ±1.1</td>
<td>4.6 ±1.1</td>
<td>4.6 ±1.1</td>
<td>4.6 ±1.1</td>
<td>4.6 ±1.1</td>
</tr>
<tr>
<td></td>
<td>1.04 ±0.18</td>
<td>1.04 ±0.16</td>
<td>1.04 ±0.21</td>
<td>1.04 ±0.21</td>
<td>1.04 ±0.21</td>
</tr>
<tr>
<td></td>
<td>1.01 ±0.16</td>
<td>1.01 ±0.16</td>
<td>1.04 ±0.21</td>
<td>0.99 ±0.16</td>
<td>1.00 ±0.21</td>
</tr>
<tr>
<td></td>
<td>1.00 ±0.21</td>
<td>1.0 ±0.21</td>
<td>1.0 ±0.21</td>
<td>1.0 ±0.21</td>
<td>1.0 ±0.21</td>
</tr>
</tbody>
</table>

Comparative Carbohydrate Intake in Mexican Soccer Players in Different Training Sessions

Purpose: To investigate if carbohydrate intake in professional soccer players is the same during moderate and high intensity training and whether intake is within the recommended range established by the American College of Sports Medicine (ACSM) (30-60 g/h).

Methods: A cross-sectional study was conducted in professional soccer players (17-37 years old) of four Mexican First Division teams (N=123) in which carbohydrate (CHO) intake was measured during training and games. We observed that Mexican professional soccer players do not consume the minimum recommended CHO intake for moderate-high intensity
American football athletes are exposed to repetitive head impacts (RHI) that, even in the absence of a clinically evident head injury, result in quantifiable neurological damage. Pre-clinical studies utilizing rodent models indicate that traumatic brain injuries (TBI) can cause a reduction in neuronal omega-3 fatty acids (n-3FAs), specifically docosahexaenoic acid (DHA). Pre-injury administration of n-3FAs, however, has shown to effectively ameliorate the pathological response to TBI. Furthermore, one study has demonstrated the potential neuroprotective effect of DHA supplementation in American football athletes evidenced by a marked reduction in blood biomarkers of axonal injury. Given that the American diet is scarce in n-3FAs DHA and eicosapentaenoic acid (EPA), the potential neuroprotective effect of n-3FAs supplementation may uniquely benefit American football athletes. **PURPOSE:** This descriptive study sought to examine the omega-3 index, an indicator of n-3FA status, in American collegiate football athletes not supplementing with n-3FAs. **METHODS:** One hundred twelve (n = 112) athletes participated in this study. Blood was obtained via finger stick and collected on blood spot cards pre-treated with an antioxidant cocktail. The dried blood samples were analyzed by gas chromatography for fatty acid (FA) levels (expressed as a % of total blood FAs). A regression formula (r = 0.98) was used to estimate the percentage of DHA and EPA in red blood cell phospholipids (omega-3 index). Ratio levels of DHA to EPA, and alpha-linolenic acid (ALA) were (mean ± SD) 2.27% ± 0.01% (range = 1.1% - 5.2%), 0.39% ± 0.00% (range = 0.2% - 1.2%) and 0.39% ± 0.00% (range = 0.1% - 1.0%), respectively. Mean omega-6 levels were 9.55 ± 1.72 (range = 4.5 - 13.9) times higher than n-3FAs levels. The mean omega-3 index was 4.35% ± 0.01% (range = 2.8% - 8.0%). Sub-optimal n-3FA levels (i.e., an index < 8.0%) were observed in 99.12% of participants. **CONCLUSION:** These data suggest that dietary intake of the n-3FAs DHA and EPA may not be adequate in American collegiate football athletes. Though the current evidence relates n-3FA deficiency to an increased risk for cardiovascular risk, American football athletes may derive neuroprotective benefit from n-3FA supplementation with little to no risk.

**Conflict of Interest:** No relevant relationships reported.

**Support:** Supported by a Grant-in-Aid for Scientific Research (C), National Natural Science Foundation of China (No. 31571226), and the Program for Professors of Special Appointment (Eastern Scholar) at Shanghai Institutions of Higher Learning (No. TP2014057) to ZBC.

The paper concludes with a discussion of the implications of the findings, particularly in the context of football, and highlights the potential benefits of supplementation with omega-3 fatty acids for athletes. It also touches on the broader implications for public health and dietary guidelines.

The authors acknowledge the need for further research to fully understand the impact of omega-3 fatty acid supplementation on the health outcomes of football players and other athletes.
As the global burden of cardiovascular disease (CVD) rises, public health-related interventions aimed at prevention have gained increased attention. Physicians and health authorities may be unaware that CVD or cardiac events are related to more than half of the lifetime of deaths in firefighters (FF). Diet is one of the main modifiable CVD risk factors, yet poor diet and the risk factors it contributes to, including obesity, continue to be an issue as the prevalence of obesity is high in FF. Dietary patterns can also influence other risk factors like blood pressure, lipid levels, body composition and glucose metabolism. However, healthy diets are not always accessible for FF, due to the fast-paced unpredictable nature of work, and FF often rely on quick meals that may not be nutritionally optimal. Limited research has examined FF dietary intake and preferences. PURPOSE: To examine the dietary habits of local volunteer FF and compare these to adult non-FF in the area. METHODS: 76 adults (36 FF, 37.0 ±11 years, BMI 30.4 ±5.7 kg/m2; 40 non-FF, 30.6 ±11 years, BMI 28.3 ±5.7 kg/m2) were studied. All participants completed a 3-day dietary recall, and both height and weight measured. Three-day diet recalls were obtained from volunteer FF who attended dietary workshops in their firehouse and from non-FF adults in the area who were interested in finding out their dietary habits. Data was analyzed using Diet Analysis Plus. RESULTS: Macronutrient composition of the diets were similar. The FF average diet was 2037.9 ±597.3 calories; including 34.8% fat, 46.0% carbohydrates, and 17.8% protein. The average diet for non-FF adults was 2185.7 ±405.9 calories; including 34.1% fat, 48.6% carbohydrates, and 17.8% protein. FF had significantly lower levels of vitamin B-6 (1.7 ±0.9 vs 2.3 ±1.2 mg), folate (498.3 ±253 vs 685.7 ±375 µg), and vitamin C (50.8 ±48 vs 111.9 ±87.8 mg) intake compared to non-FF, respectively, p<0.05. FF diets were lacking in several key micronutrients, including calcium (961.8 ± 410 mg), magnesium (227.7 ±138 mg), potassium (2177.7 ±1059 mg), and vitamin D (4.2 ±4.6 µg). For these, >90% of the FF diets did not meet recommended levels. CONCLUSION: These data suggest that volunteer FF exhibit deficiencies in several micronutrients and may benefit from diets that encourage increased consumption of fruits and vegetables.

Athletes often overlook the psychological and physiological importance of recovery nutrition in athletic performance. Little research has investigated the role of recovery nutrition on perceived exertion in collegiate athletes. PURPOSE: To examine the perceived and physiological effects of regular, whole food, recovery nutrition on session rating of perceived exertion (RPE) and body composition in collegiate athletes. METHODS: Female tennis players (n=8, age 20.1 ±1.4 years; weight 66.8 ±6.9 kg) volunteered for the 8-week study during their competitive season. Air displacement plethysmography was used to estimate fat mass (FM) and fat-free mass (FFM) at baseline, 4-week, and end of the 8-week intervention. Seven training sessions (60 min), consisting of high intensity strength and power exercises, were performed during each 4-week phase of the study. Athletes continued their normal pattern during the first 4-weeks (T1) and were provided with standardized recovery nutrition at the conclusion of each training session for the second 4-weeks (T2). RPE on a scale of 0-10 was reported immediately after each training session. Recovery nutrition consisted of a 1° red apple, 7° banana, 1.05 oz. peanut butter spread, and an 85 bagel or 99g gluten-free bagel. Nutritional composition for a standard snack bag was 680kcal, 106g carbohydrate, 17.8g protein, 24.7g fat, while a gluten-free snack bag totaled 740kcal, 107g carbohydrate, 18.8g protein, 31.7g fat. Participants were instructed to consume all foods with training. Repeated measures ANOVA was used to examine changes in session RPE and body composition over time. RESULTS: There was a main effect of recovery nutrition on session RPE (p<0.001) with a lower RPE reported in T2 (3.53 ±1.24) than T1 (4.50 ±1.44). FM and FFM decreased 0.05g and 0.28kcal respectively, however, changes were not significant (p=0.05). Athletes reported an increased quality of training with recovery nutrition. CONCLUSIONS: Four weeks of recovery nutrition resulted in a ~10% decrease in session RPE in female tennis players. Further, athletes perceived they trained harder during the sessions with recovery nutrition. Future research would be beneficial to determine the direct effects of recovery nutrition on performance.

Support was provided by the Ewu’s Start Something Big Grant - T1F6.
Continuous data collection on fueling and food strategies of ultramarathoners during competition is scarce. Existing publications mostly report nutrient intake without much detail of fluid balance and foods consumed.

PURPOSE: To provide an overview of the consumption of carbohydrates and fluids, fluid balance and types of foods during a race comprising 10-14 hours of continuous exercise.

METHODS: Pre-race height, cm (Cescorf stadiometer) and pre- and post-race body weight, kg (Seca scale S760 mechanically) were measured. All food products were labeled and weighed (g) pre- and post-race (Cresta, CK750). Continuous observation of food and beverage intake was performed as all runners were accompanied by a research team member on a bicycle using pre-defined lists and action cams (SJCAM, SJ4000) to record all items consumed. Fluid excretion collection was done using urine bags (Roadbag®). Results are expressed as mean±SD and range (min-max) or as percentage (%).

RESULTS: The average temperature was 7.0°C with a humidity of 67%. Five runners performed the 120 km run with an average duration of 12:19±1:29 hours (9:50-13:49). They reported 38±10 (25-48) food and beverage consumption events over the race which consisted of 4-7 different preferred food items per person. This resulted in an average carbohydrate intake of 44±19 g and fluid intake of 421±127 mL. Runners lost 2.5±1.6 kg (0.2-3.8) of total weight during the race. The average urine specific excretion was 0.8±0.5 kg (0.3-1.4). This resulted in an estimated fluid loss of 6.6±2.3 kg (4.6-10.1) and four out of five runners reported a lower post-race body weight of 4% (0.6). During the first 60 km of the race the preferred foods and beverages were energy gels, water and sports drinks. After this, food preferences suggested a more mixed pattern including the use of cola, chocolate milk and fruit.

CONCLUSIONS: Runners consume, on average, fewer carbohydrates and fluids than recommended due to a high variability in intake. As urine excretion was relatively low, mostly a high sweat rate contributed to a lower post-race weight. Although non-specific sport nutrition foods and beverages were used, runners preferred the use of commercial sports nutrition products the most. Supported by regional grant Eat2Move of the province of Gelderland, The Netherlands.

C-39 Free Communication/Poster - Correlates and Behavioral Aspects of Physical Activity
Thursday, May 31, 2018, 7:30 AM - 12:30 PM
Room: CC-Hall B

In adolescents sleep behavior differs markedly between weekdays and weekend days. The implications of this disparity for the associations among sleep, physical activity and sedentary behavior are unclear. PURPOSE: To determine if there are significant differences in physical activity and sedentary behavior between students who experience adequate vs. inadequate sleep, analyzing weekday and weekend data separately. METHODS: The School Sleep Habits Survey was used to measure total sleep time on weekdays and weekends. Sleeping ≥8 hours per night was considered adequate sleep (AS), while sleeping <8 hours was considered inadequate sleep (IS). Accelerometry was used to measure sedentary behavior (SB) and total physical activity (PA) on weekdays and weekends. SB was determined by the total minutes/day below 100 counts/minute, while PA was determined by the total minutes/day at, or above 100 counts/minute. A majority were African American (52%). Average weekday PA was compared between the AS group and the IS group using weekday sleep data. The same was done using weekday SB. T-tests were used to determine significant differences between groups. RESULTS: There were more students in the AS group (n = 156) than the IS group (n = 96) on weekends, and more students in the IS group (n = 169) than the AS group (n = 92) on weekdays. There were no statistically significant differences between PA and SB levels by sleep group, on weekends and weekdays. CONCLUSION: Students who experience adequate levels of sleep did not differ in their levels of PA from those who experienced inadequate sleep. This was the case on weekends and weekdays. Similarly, students who experienced adequate levels of sleep did not differ in their levels of SB from those who experienced inadequate sleep. This was also the case for weekends and weekdays. Analysis of variance testing was performed using the Multilevel modeling approach. This project was made possible in part by Grant Number T32-GM081740 from NIH-NIGMS. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the NIGMS or NIH.
Flexible Nonlinear Periodization (FNLP) was developed to preserve training quality in athletes by matching workload demand to pre-exercise mental and physical states. The degree of “readiness to train” is purportedly determined via a six-part checklist: coach-athlete interactions, injury status, hydration, fatigue ratings, vertical jump power, and initial performances. Prior to adapting FNLP for untrained populations, it is important to examine if similar factors predict exercise behavior in a free-living context. PURPOSE: Use ecological momentary assessment to determine time-lagged and concurrent effects of factors suggestive of readiness on exercise behavior. METHODS: Participants (N=29, 24.6±6.55 years of age, 76% female, 70% white) received text message prompts to their personal smartphones at 9:30am, 1:30pm, 5:30pm, and 9:30pm over 14 consecutive days. Each prompt contained a link to a survey (Qualtrics) that assessed perceptions of core affect, fatigue, bodily discomfort (e.g., pain, stiffness), and hydration, as well as self-efficacy to exercise in the subsequent four-hour block. Exercise type and duration were also collected in each survey and used to calculate total volumes expressed at MET-minutes. On average, participants were active, accumulating 1116±596 MET-minutes of structured exercise per week (SD=150, max=2074). Lagged and concurrent prediction analyses were conducted using three-level (time of day, day of week, individual) linear mixed models in SAS. RESULTS: Self-efficacy was the only variable predictive of MET-minutes in a subsequent four-hour block (r = .48, p = .001, R² = .43). Fatigue was the only variable concurrently related to self-efficacy (r = -.38, p = .0017, R² = .18). Concurrent correlates of fatigue (R²=0.60) included core affect (r=.85, p <.0001) and discontinuit (r=.86, p <.0001) with a trend for perceived hydration (r = 1.72, p = .09). CONCLUSIONS: These findings continue to support self-efficacy as a strong predictor of future exercise behavior. While measures of fatigue, affect, discomfort, and hydration did not directly predict exercise behavior, the observed inter-relationships provide some support for the key assumption of FNLP. Replication of these results in relevant target populations is necessary prior to implementing FNLP-based interventions.

1330 Board #117 May 31 9:00 AM - 10:30 AM
Using Ecological Momentary Assessment to Explore Proposed Indices of Exercise Readiness and Subsequent Exercise Behavior

1330 Board #118 May 31 9:00 AM - 10:30 AM
Affect, Eating Attitudes, and Exercise Dependence Of Personal Trainers With Different Years Of Experience
David A. Tobar, Brett C. Holcomb, Bonnie G. Berger. Bowling Green State University, Bowling Green, OH.

Purpose. The purpose of the study was to explore factors that are associated with exercise behavior among the older Chinese adults in the rural area.

Method. The data of 2586 older Chinese adults (males=1320, females=1259, age M=69.65, SD=8.0) in the rural area were analyzed from the National Health Service survey in Fujian, China. The t-test and z2-test were carried out to compare the differences between older Chinese adults living in the rural area who did not exercise and who exercised at least once a week, on age, family income, education level, whether having partner, whether having chronic disease or pain, as well as the physical function levels. All data were collected in 2013.

Results. The results showed that there were significant differences between individuals who did not exercise and who exercised at least once a week on the following variables: age (M=69.8, SD=8.1, M=68.6, SD=7.1, respectively, p<0.01), family income (M=32178, SD=34430, M=38017, SD=30991, respectively, p<0.05), education level (with elementary education or above, 49.5% vs. 68.3% respectively, p<0.01), having a partner (72.9% vs. 88.0%, respectively, p<0.05), having difficulties on movement (16.0% vs. 8.4%, respectively, p<0.05), having difficulties on self-care (10.7% vs. 5.8%, respectively, p<0.05), and having difficulties on daily activity (14.6% vs. 7.2%, respectively, p<0.05). There were no significant differences between individuals who did not exercise and who exercised at least once a week, on the following variables: having at least one chronic disease (44.7% vs. 45.3%, respectively) and suffering from pain (28.1% vs. 22.7%, respectively), both P>0.05.

Conclusion. The older Chinese adults in the rural areas were more likely to exercise if they were younger, had higher income and education level, had a partner, and had no difficulties on physical functions.
Flexible Non-Linear Periodization (FNLP) was designed by Kraemer & Fleck to optimize athletic performance and prevent burnout by basing athletes’ daily training regimens on their personal “readiness to train” (physical/mental states pre-exercise). FNLP-based prescriptions may be an effective approach in improving exercise behavior of inactive adults. However, it is necessary to operationally define readiness in specific populations, particularly between genders. PURPOSE: Identify and compare the underlying themes relating to readiness to complete low-demand (LDB) and high-demand (HDB) aerobic bouts between men and women who do not engage in regular aerobic activity. METHODS: Via Qualtrics, 1,039 respondents completed the online survey. After quality control, 166 respondents (49±13y, 61.4% female) met the criteria of reporting <90 min/week of moderate aerobic activity (25±7, 26±3 min/week). Respondents described mental/physical states necessary to complete a LDB (10-min slow stroll) and a HBD (60-min jog). Data were analyzed using content and thematic analysis. RESULTS: To complete the LDB and HDB, themes among men and women included body integrity (free from pain/illness) and positive affect. A unique theme emerged for the LDB, in that many men and women indicated it could be completed under normal or worse circumstances. A primary difference between genders is, to complete the LDB, women needed to feel rested, which was not reported by men. While a theme relating to motivation emerged for both bouts, it appears motivation to complete the LDB is rooted in a need for change (change of scenery, clear head), whereas motivation for the HDB related more to completing the bout itself (focused, determination, committed). For the HDB bout only, men and women indicated a need to feel fueled (enough food, hydrated), adequately conditioned, and energized. CONCLUSIONS: Little difference was noted between inactive men and women regarding indices of readiness. Three uncovered themes (body integrity, fueled, energized) parallel factors from Kraemer & Fleck’s proposed six-item readiness checklist: injury status, hydration level, and fatigue ratings. These factors represent the more personal, non-performance aspects of the checklist, providing initial support for adapting FNLP for inactive populations.

Perceptions that pregnant women have towards physical activity (PA) appear to affect levels of participation. Qualitative findings indicate that past adverse prenatal experiences may elevate pregnant women’s PA concerns regarding the health of the baby. PURPOSE: We investigated whether behavioral and cognitive differences among pregnant women with past miscarriage or infertlity experiences compared to pregnant women without. Additionally, we examined whether moderate-to-vigorous PA (MVPA) and PA discussion with a healthcare provider (HCP) differed between these two groups. METHODS: Pregnant women (N=497) completed an online survey and answered multiple questions about past pregnancy experiences, and current PA perceptions and behavior specific to various PA modalities. These included: walking, light and intense jogging, cycling, and swimming, prenatal yoga, aerobic dance, and resistance training exercises. PA outcome expectancy for each modality was assessed on an 11-point Likert scale. Participation in each was defined as PA > 10 min/wk. MVPA was dichotomized as meeting the guideline (MVPA ≥150 min/wk) or not. Participants were also asked questions regarding PA discussion with a current HCP. Mann-Whitney U-tests were performed to examine outcome expectancy differences between women with past adverse prenatal experience and those without. Chi-square analyses were conducted to examine differences in meeting the MVPA guideline, HCP discussion, and PA modality participation. RESULTS: A total of 170 women (30.5%) reported past miscarriage or infertility experiences. PA outcome expectancy for these women did not significantly differ from women without past adverse prenatal experience for any specific modality of activity. However, women with past miscarriage or infertility were less likely to meet the current MVPA guideline [χ² (1) = 4.32, p = .04]. Participation in specific PA modalities was not significantly greater for women without past adverse prenatal experience, nor was the occurrence of PA discussion with a HCP. CONCLUSIONS: Pregnant women with past miscarriage or infertility did not perceive PA differently but did perform less MVPA than women without past adverse experiences. Longitudinal examinations of PA perception and behavior are needed among this subpopulation.
The benefits of physical activity extend across the lifespan, but the psychological processes supporting active aging are not often addressed for older adults. This research explores older adults’ narratives of health and physical activity experiences and applies a Self-Determination Theory (SDT) framework for understanding how basic needs are accommodated in physical activity contexts. 

**METHODS:** Narrative interviews were conducted with 51 older adults (65-95 yrs) to elicit life-history narratives regarding 1) experiences in physical activity and sport; 2) current perceptions of health, and 3) identity as a healthy or unhealthy person. The semi-structured interviews ranged from 1-3 hours and fostered in-depth accounts of individual’s life histories. Interviews were transcribed verbatim and data was subjected to thematic narrative analysis.

**RESULTS:** Data supported a SDT approach (Ryan & Deci, 2001; Ryan, Huta, & Deci, 2006) to understanding the connection between goal pursuits, achievement, and well-being. Contexts and activities that supported participants’ perception of autonomy (e.g., “I have choices about the activities that are available”), competence (e.g., “I can successfully participate”), and sense of belonging (e.g., “The people are very supportive and I feel welcome”) were related to participants’ articulation of healthy activity as a first-order, intrinsic goal (e.g., “I golf because I love movement, not for any other reason”). Participants demonstrated an age-related shift in understanding physical activity and health. Older participants (88.5 yrs) more often narrated physical activity as a first-order, intrinsic goal (e.g., movement for movement’s sake), whereas younger participants (70.5 yrs) more often narrated physical activity as a lower-order, extrinsic goal (e.g., “I am physically active because my doctor told me I needed exercise and/or I want to be healthier”). **CONCLUSIONS:** This research supports the SDT contention that intrinsic goals related to greater well-being and highlights the importance of fostering perceptions of autonomy support, competence, and relatedness for physical activity among older adults.

**The Role of Gratitude in Intrinsic and Extrinsic Exercise Motivation**

Allison Hicks, Savannah Neace, Marci DeCaro, Paul Salmon. University of Louisville, Louisville, KY.

**PURPOSE:** To determine the role of positive psychology in the prediction of exercise motivation. Specifically, we examine the construct of gratitude in association with intrinsic and extrinsic exercise motivation.

**METHODS:** One hundred predominantly female (84%) undergraduate participants (age: M=19.78, SD=2.43) responded to online survey questionnaires including demographics, subjective health, gratitude (GRAT-R) and Exercise Motivation (EMI-2).

**RESULTS:** Hierarchical regressions including theoretically derived control variables (age, sex, minority status and subjective health) explored the role of gratitude in the prediction of intrinsic and extrinsic exercise motivation. Gratitude was significantly positively associated with intrinsic motivation (β= .397, p<.001), but not extrinsic motivation (β=.225, p=.07). In analyzing gratitude subcales, Sense of Abundance was positively associated with intrinsic motivation (β=.296, p<.01), and Social Appreciation was positively associated with both intrinsic (β=.497, p<.001) and extrinsic motivation (β=.401, p<.001). In further examining subscales of the EMI-2, total gratitude scores were significantly positively correlated with Stress Management (r=.411, p<.001), Revitalization (r=.386, p<.001), Enjoyment (r=.411, p<.001), Challenge (r=.390, p<.001), Affiliation (r=.254, p<.01), Ill-Health Avoidance (r=.250, p<.05), Positive Health (r=.356, p<.001), Weight Management (r=.201, p<.05) and Strength/Endurance (r=.310, p<.01).

**CONCLUSIONS:** Gratitude positively predicted exercise motivation, particularly intrinsic motivators of exercise. These findings suggest that positive psychological practices are associated with attitudes that encourage health behavior change.
Mindfulness and Intrinsic Exercise Motivation—The Mediating Role of Exercise Self-Efficacy

Savannah M. Neace, Allison Hicks, Paul Salmon, Marci DeCaro. University of Louisville, Louisville, KY.

(No relevant relationships reported)

TITLE: Mindfulness and Intrinsic Exercise Motivation: The Mediating Role of Exercise Self-Efficacy

AUTHORS: Savannah Neace, Allie Hicks, Marci DeCaro, Paul Salmon University of Louisville, Louisville, KY

PURPOSE: We examined the role of mindfulness in predicting exercise motivation. Mindfulness is associated with health, but its influence on exercise motivation is largely unexamined. We tested the relationship between mindfulness and exercise motivation, using self-efficacy as a possible mediator of this relationship.

METHODS: Undergraduates (N = 100; 84% Female, 80% Caucasian) completed online questionnaires assessing demographics, Mindfulness (MAAS), exercise self-efficacy (SEE), and exercise motivation (EMI-2).

RESULTS: Hierarchical regressions controlling for age, sex, and minority status examined relationships among mindfulness, exercise self-efficacy, and exercise motivation. Mindfulness was positively associated with intrinsic motivation (β = .210, p < .05), but not extrinsic motivation (β = .086, p = .438). Mindfulness was also positively associated with exercise self-efficacy (β = .244, p < .05). Exercise self-efficacy was positively associated with both intrinsic motivation (β = .484, p < .000) and extrinsic motivation (β = .218, p < .05). Mediation analysis revealed that exercise self-efficacy fully mediated the relationship between mindfulness and exercise motivation (β = .210, p < .05; β = .186, p = .285). Exploratory analyses examined correlations between facets of the EMI-2 and mindfulness and exercise self-efficacy. Mindfulness was significantly correlated with two intrinsic facets [Revitalization (r = .220, p < .028), Enjoyment (r = .254, p = .011)]. Exercise self-efficacy was significantly correlated with five intrinsic facets [Revitalization (r = .500, p < .000), Enjoyment (r = .499, p < .000), Challenge (r = .509, p < .000), Affiliation (r = .216, p < .05), Positive Health (r = .284, p < .01)] and one extrinsic facet [Competition (r = .344, p < .000)].

CONCLUSIONS: Mindfulness is moderately predictive of intrinsic exercise motivation, however, exercise self-efficacy largely mediates this relationship.

The Mediating Effect of Perceived Health on the Relationship Between Physical Activity and Subjective Well-being

Zhanja Zhang,1 Bo Chen,2 Qiang Li,3 Weiyun Chen1. 1University of Michigan, Ann Arbor, MI. 2 Beijing University of Chemical Technology, Beijing, China. 3 Nanjing Sport University, Nanjing, China.

(No relevant relationships reported)

Subjective well-being (SWB) is a critical indicator of positive youth development. Physical activity (PA) has been identified as a potential correlate of SWB. But the underlying mechanism for the association between PA and SWB has remained largely unexplored.

PURPOSE: To examine the association between the PA and SWB in college students, and to determine if the perceived health mediated the association between them.

METHODS: 1209 college students (631 male and 578 female, mean age = 19.63 years) voluntarily completed a questionnaire consisting of four parts: Subjective Happiness Scale with four 5-point Likert items assessing Happiness, Satisfaction with Life Scale with five 7-point Likert items measuring life satisfaction, two questions adapted from the National Health and Nutrition Examination Survey (NHANES) asking the time (in minutes) spent on PA per week, and one 5-point Likert item adapted from NHANES measuring the perceived health. According to a widely used procedure to test mediation, three multiple regression models were performed. First, the perceived health (mediator) was regressed on the PA (independent variable). Second, happiness and life satisfaction (dependent variables) were respectively regressed on the PA (independent variable). Finally, happiness and life satisfaction (dependent variables) were respectively regressed on both the PA (independent variable) and perceived health (mediator). Age, gender, and weight status were obtained by self-report and added to all models as covariates.

RESULTS: The first model revealed that PA was a significant predictor of perceived health (r = .530, p < .001). In the second model, PA significantly contributed to the happiness (r = .433, p < .001) and life satisfaction (r = .362, p < .001), respectively. However, after including the perceived health to the second model, the coefficient of PA was no longer significant for both happiness and life satisfaction (p > .05). Our results showed that perceived health had no effect when the mediator was controlled, suggesting a mediating effect of the perceived health on the relationship between PA and SWB.

CONCLUSIONS: The increased time spent on PA is associated with a higher level of SWB among college students. Moreover, this positive association is mediated by the individual level of perceived health.

Testing The Effects Of Message Framing On Physical Activity Motivation: Does Stage Of Change Matter?

Derek J. Hevel, Anthony J. Amorose, Kristen M. Lagally, FACSM, Anna Rinaldi-Miles, Scott Pierce. Illinois State University, Normal, IL.

(No relevant relationships reported)

PURPOSE: Understanding how to best “sell” physical activity (PA) is a critical goal. This study investigated the effects of message framing on motivation to participate in a PA program, and tested whether the effectiveness of messages framed to promote either affective benefits, physical health benefits, or a combination benefits varied based on one’s current PA status. METHODS: Adult participants (N=188) from a Midwestern university, who were recruited via email, completed an online survey assessing demographic information and current stage of change. They then viewed one of four randomly assigned promotional flyers for a PA program offered on campus. The flyers mentioned either the: (a) affective benefits of program participation (e.g., improved mood), (b) physical health benefits (e.g., improved fitness), (c) a combination of affective and physical health benefits, or (d) a control message noting some generic aspects of the program (e.g., clean facilities). After viewing the flyer, participants responded to a series of questions about the content of the flyers (manipulation checks) and their perceived behavioral control for participating in the program, followed by their interest in the program, intention to participate, the likelihood of participating (β = .44; p = .004) and extrinsic motivation (β = .218; p < .05). ANOVAs found that, after accounting for perceived control, the effectiveness of the different promotional messages on intention and likelihood of participating varied based on the respondents’ PA status. The major finding was the message promoting affective benefits were significantly greater in intention and likelihood of participation than the other messages for those who were active, but the opposite occurred for non-active participants. No group or message differences were found with regard to interest in the program. Further, a chi-square analysis found no differences in participants’ yes or no response to wanting to schedule a session in the program at that time.

CONCLUSIONS: Using message framing to sell PA may help increase intention to participate. However, the type of message that effectively promotes PA appears to vary depending on the message receiver’s current physical activity.

Race and Types of Motivation in Indoor Group Cycling

Alvin L. Morton, Derrick T. Yates, Miguel Aranda, Lyndsey Hornbuckle. University of Tennessee, Knoxville, TN.

(No relevant relationships reported)

As racial health disparities persist in the U.S., for conditions that can be mitigated by regular exercise (e.g., cardiovascular disease, type II diabetes), identifying the types of motivation that drive various racial groups to participate in exercise may be a strategy to help inform intervention efforts and reduce these health disparities. PURPOSE: To identify racial differences in the types of motivation (autonomous, controlled, or amotivation) that influence regular participation in indoor group cycling classes. METHODS: Twenty-one indoor group cyclists currently participating in classes ≥ 1 day/week for ≥ 3 consecutive months (non-Hispanic Whites (NHW) = 14, non-Hispanic Black (NHB) = 4, mixed-race = 3; age: 43.6 ± 14.5 yrs.; body mass index: 26 ± 3.8 kg/m²) were recruited for this study. Participants completed the Treatment Self-Regulation Questionnaire (TSRQ) using a 7-point Likert scale to indicate why they continue to utilize indoor group cycling classes as an exercise modality. Average TSRQ scores of autonomous and controlled motivation, and amotivation were examined by race. One-way ANOVA was used to examine between-group differences. Significance was accepted at p < 0.05. RESULTS: There were no racial differences in autonomous (p = 0.44) or controlled motivation (p = 0.84) by race, but there was a significant difference in amotivation (p = 0.02). Tukey post hoc analyses showed that NHB had higher amotivation (3.5 ± 1.0) compared to NHW (2.0 ± 1.1) and mixed-race (1.3 ± 0.4) participants. CONCLUSION: Compared to the other race groups in this sample, NHB had higher amotivation despite continued participation in indoor group cycling. This suggests that other factors (e.g. group dynamics, environment) may be driving NHB to continue participation. Further research using racially diverse samples is needed to identify possible factors related to motivation in NHB and other race groups, as they may be valuable in the development of culturally relevant exercise programs.
**Purpose:** The primary purpose of this study was to test if an acute bout of cycling exercise in a sample of young adults with epilepsy would improve feelings of energy and enhance executive function. Secondary aims included evaluating cardiorespiratory fitness and physical activity level. **Methods:** A within-participants crossover design was used to compare seated rest to 20 minutes of moderate-intensity cycling. Ten people diagnosed with epilepsy completed the Profile of Mood States (POMS) and the Wisconsin Card Sorting Task (WCST) before and twice after the treatments. Cardiorespiratory fitness was assessed with a standardized, graded maximal cycling exercise test. Physical activity level was assessed with a hip-worn accelerometer (ActiGraph GT3X+) and a self-reported past-year physical activity questionnaire (CARDIA Physical Activity History). **Results:** Within-participants repeated measures ANCOVAs controlling for initial values and order of treatments showed a significant interaction for POMS vigor, $F(2,32)=4.21, p=.024$. Immediately after exercise, vigor scores were higher than after seated rest. WCST performance was not influenced by acute exercise. Independent t-tests revealed that this sample of people with epilepsy was similarly fit and similarly active compared to reference groups of young adults without epilepsy. **Conclusion:** Acute cycling transiently increases feelings of energy without altering executive functioning in normally active and fit people with epilepsy.

**Results:**

- Physical activity and exercise levels have been shown to decline throughout childhood and adolescence with a noticeable decrease occurring during the transition to college. The Exercise Motivation Inventory-2 (EMI-2) has been used to identify factors that potentially affect exercise levels in adults. There is little known research regarding the motivation to exercise in college students at a rural, commuter-based, two-year University campus of this study. The purpose of the study was to determine whether differences existed in enjoyment, appearance, and weight maintenance-related motivations and MVPA based on body fat percentage levels in male college students.

**Methods:** Thirty-nine, traditional-age (18–25 y), full-time (~12 credit hours) male college students were recruited for this study. The participants completed the EMI-2 instrument and then anthropometric measures (height, weight, and BF%) dual energy x-ray absorptiometry (DXA) were collected. All participants were divided into two groups, a healthy body fat group, (HBF; ≥ 22 BF%, n = 16) and an overweight group (OB; > 22 BF%, n = 23). A one-way MANOVA was used to determine differences in exercise motivations and physical activity levels based on body fat percentage. **Results:** A significant main effect was determined for body fat category, Wilks’ lambda=.533, $F(4, 34) = 7.439, p <0.001, \eta^2_p = .467$. Pairwise comparisons of EMI-2 scores determined that OB men had greater motivation scores based on appearance ($F(4, 35) = 2.703, p = .062$) and weight management ($F(3, 33) = 1.781, p < .001$) compared to their healthy-fat counterparts. There were no significant differences in enjoyment scores ($F(3, 53) = 2.039$, $p = .045$) or time spent in MVPA (OBF, 289 min/week vs. HBF, 371 min/week, $p = .064$). **Conclusion:** Body fat percentage can influence the motivations to exercise in college age men. OB men reported stronger motivations to exercise based on appearance or weight management compared to the HBF. Despite these stronger motivations, this did not translate into greater time spent in MVPA compared to their HBF counterparts. More research is necessary to determine motivation and barriers to exercise in this population, while considering the impact of body composition.

**Results:**

- Previous research has shown a positive relationship between academic success and recreational sports participation. Few studies have investigated the relationships between recreational sports participation and psychosocial/physical health indicators. **Purpose:** To investigate the impact of recreational sports on psychosocial and physical health indicators in college freshmen, and determine differences in impact between high and low users. **Methods:** Participants included freshmen students who participated in an online survey and consented to recreational sports usage tracking. Usage was collected via ID card swipe each time the student utilized the University fitness centers, group fitness classes, and participated in intramural sports games. Users were categorized as high or low (median split) based on total usage during their 1st year. The survey was administered during the 2nd semester of participants’ 1st year. Participants reported the impact (1=very negatively to 5=very positively) of their usage on psychosocial and physical health variables. Responses were categorized into negative/no impact (1-3) and positive impact (4,5). Frequencies were calculated for variables of interest. Logistic regression was utilized to investigate the impact of recreational sports use on psychosocial and physical health indicators. **Results:** The sample (N=131) was 51.1 percent male and primarily Caucasian (82.4%). On average, high users had 48.1±39.2 ID card swipes per week; low users had 6.1±3.3. Most participants reported that recreational sports participation had a positive impact on psychosocial and physical health: overall well-being (86.3%); sense of belonging (83.2%); stress management (77.9%); self-confidence (77.9%); time

**Results:**

- Previous research has shown a positive relationship between academic success and recreational sports participation. Few studies have investigated the relationships between recreational sports participation and psychosocial/physical health indicators. **Purpose:** To investigate the impact of recreational sports on psychosocial and physical health indicators in college freshmen, and determine differences in impact between high and low users. **Methods:** Participants included freshmen students who participated in an online survey and consented to recreational sports usage tracking. Usage was collected via ID card swipe each time the student utilized the University fitness centers, group fitness classes, and participated in intramural sports games. Users were categorized as high or low (median split) based on total usage during their 1st year. The survey was administered during the 2nd semester of participants’ 1st year. Participants reported the impact (1=very negatively to 5=very positively) of their usage on psychosocial and physical health variables. Responses were categorized into negative/no impact (1-3) and positive impact (4,5). Frequencies were calculated for variables of interest. Logistic regression was utilized to investigate the impact of recreational sports use on psychosocial and physical health indicators. **Results:** The sample (N=131) was 51.1 percent male and primarily Caucasian (82.4%). On average, high users had 48.1±39.2 ID card swipes per week; low users had 6.1±3.3. Most participants reported that recreational sports participation had a positive impact on psychosocial and physical health: overall well-being (86.3%); sense of belonging (83.2%); stress management (77.9%); self-confidence (77.9%); time
management (68.7%); overall health (90.8%); fitness level (89.3%); weight control (64.9%); balance and coordination (74.8%); and sleep (61.8%). High users were more likely than low users to report positive impacts on overall well-being (OR: 3.2; 95%CI: 1.1 - 9.5), fitness level (OR: 4.4; 95%CI: 1.2 - 16.7), and self-confidence (OR: 3.0; 95%CI: 1.2 - 7.7).

CONCLUSIONS: Recreational sports participation had a positive impact on self-reported psychosocial and physical health in college freshmen, and frequency of participation played a role in some of these relationships.

College students often see a decline in their physical activity, in pair with an increase in psychological stress. Many universities aim to increase physical activity and spark new interest by offering a wide variety of health and physical activity classes for all students.

PURPOSE: To explore demographic differences among students in the physical activity classes and to examine how stress relates to how students self-select into different types of physical activity classes.

METHODS: Potential participants were students who self-enrolled in physical activity classes at the University. Participants (n=155) completed consent forms, a demographics questionnaire, and a stress survey through Qualtrics during the first, ninth, and fifteenth week of the semester. The surveys assessed psychological stress, both academically related (Academic Stress Scale) and non-academically related (Perceived Stress PSS-10). Between group differences were analyzed using One-Way ANOVA’s to find using SPSS.

RESULTS: Results of the One-Way ANOVA of the Academic Stress showed female students (mean = 9.61) to have statistically significant higher academic stress levels compared to male students (mean = 7.82) (p < .001). While not significant, the students on the spectrum of gender identity reported higher academic stress levels than both male and female students (mean = 9.82). Females also reported higher overall (non-academic) stress (mean = 17.53) than males (mean = 15.42) (p < .030). Female students reported more academic stress (mean = 9.67) than males (mean = 7.63). Students in the College of Education reporting the highest overall stress (mean = 20.33) on the Perceived Stress Scale. Time point three will be analyzed to assess changes in stress through the semester.

CONCLUSIONS: This study explored the descriptive statistics of students self-enroll in physical activity classes and examine differences in their stress levels through the semester. The results of this study can be used to reach students who’s major may not require physical activity classes. Results can also be used to try to get more students involved in physical activity classes, or which courses certain colleges should consider requiring students to take.

Board #137
May 31 9:00 AM - 10:30 AM
Academic and Non-Academic Stress of College Students Enrolled in Physical Activity Classes
Lauren Kizlik, Kristin Nassen, Dr. Jessica Albers. Minnesota State University, Mankato, Mankato, MN.

(no relevant relationships reported)

The term “active couch potato” was developed to describe individuals who participate in regular, planned physical activity yet are also highly sedentary. These individuals are of interest as participation in excessive amounts of sedentary behavior, even in individuals which are regularly physically active, increases the risk for cardio-metabolic disease. Our group has demonstrated that cellular telephone (cell phone) use is positively associated with sedentary behavior, but not related to physical activity. Therefore, it is possible that individuals who use their cell phone heavily may participate in large amounts of sedentary behavior while also regularly participating in physical activity. This cell phone use may predict the likelihood of being an “active couch potato.”

METHODS: A sample of 228 college students completed validated survey items to assess their daily cell phone use, physical activity, and sedentary behavior. Tertile splits were performed and participants were categorized into low, moderate, or high groups for each of these three variables. Participants were then categorized as “active couch potatoes” if they were a) in the high physical activity group and also in a high or moderate sitting group, or b) in the moderate physical activity group and also in the high sitting group. Mann-Whitney U tests compared the number of “active couch potatoes” across the three cell phone use groups and binary logistic regression was used to test if cell phone use group predicted being an “active couch potato.”

RESULTS: There were a greater (Z ≥ 1.9, p ≤ 0.05) number of “active couch potatoes” in the moderate (n = 21) and high (n = 28) cell phone user groups versus the low (n = 11) user group. The likelihood of being an “active couch potato” was significantly (Z = 11.0, p = 0.01) associated with cell phone use. Specifically, individuals in the moderate and high cell phone use groups were 2.3 and 3.5 times more likely (Wald ≥ 3.9, p < 0.05), respectively, to be an active couch potato than low users.

CONCLUSION: Among a sample of college students, moderate and high cell phone users were significantly more likely to be categorized as “active couch potatoes” than their low use peers.

Board #139
May 31 9:00 AM - 10:30 AM
Cellular Telephone Use Predicts the Likelihood of Being an “Active Couch Potato” in College Students
Hannah Altzma, Andrew Lepp, Jacob E. Burkley. Kent State University, Kent, OH. (Sponsor: Ellen Glickman, FACSM)

(no relevant relationships reported)
among multiracial white respondents (beta=.51, odds=1.67) vs. non-white respondents, and 15% higher among respondents who had not used exercise equipment in the residence halls (beta=.58, odds=1.79). CONCLUSIONS: Colleges may be able to enhance participation in PA by providing well-distributed resources throughout campuses. Colleges should be aware that social and ecological factors may also influence PA and associated health benefits.

Eating and exercise behaviors among college students remains an area of interest as habits formed during these years may affect future behavior. Additionally, individuals who engage in extreme eating and exercise behaviors may be at risk for compromised health and well-being. PURPOSE: To investigate the relationship between obligatory exercise, eating attitudes, and perceived body image among collegiate males and females.

METHODS: 222 females aged 20.1 ± 1.9 yrs, and 136 males aged 20.1 ± 2.2 yrs voluntarily completed a demographic questionnaire, the Obligatory Exercise Questionnaire (OEQ), Compulsive Exercise Test (CET), Social Physique Anxiety Scale (SPAS), and the Eating Attitudes Test (EAT). Variables were analyzed with one-way ANOVA and Pearson product coefficient correlations. RESULTS: Overall 15% of women and 6% of men scored higher than 20 on the EAT indicating a high level of concern about dieting, body weight or eating behaviors where counseling is recommended. One-way ANOVA revealed that men were more obligated to exercise than women (47.7 ± 8.4 vs. 44.7 ± 9.3, p = 0.004), men had lower SPAS scores compared to women (28.7 ± 10.9 vs. 36.5 ± 11.3, p < 0.001), and men had lower scores on the EAT (7.2 ± 6.3 vs. 10.5 ± 9.3, p < 0.001). Correlations by sex revealed that men had a significant correlation for OEQ and CET (r = 0.618, p < 0.001), CET and EAT (r = 0.313, p < 0.001), and SPAS and EAT (r = 0.234, p < 0.007). Women had a significant correlation for OEQ and CET (r = 0.685, p < 0.001), OEQ and EAT (r = 0.261, p < 0.001), SPAS and CET (r = 0.328, p < 0.001) and SPAS and EAT (r = 0.490, p < 0.001), and CET and EAT (r = 0.446, p < 0.001). CONCLUSION: While it may appear that a low percentage of participants had concerning scores on the EAT, this sample indicated that approximately 1 in 10 college students may need proper counseling in this area. Although women were more likely to have higher scores on the EAT, it may appear that a low percentage of participants had concerning scores on the EAT, 0.490, p < 0.001), and CET and EAT (r = 0.446, p < 0.001).

C-41 Free Communication/Poster - Correlates and Behavioral Aspects of Physical Activity in Youth and Teens

THURSDAY, MAY 31, 2018

Research indicated that maintaining adequate physical fitness may benefit cognitive health among adolescents. It was noticed that psychosocial process may be the underlying mechanism to understand cognitive health (Lubans et al., 2016). Current literature has no sufficient evidence to conclude the responsible mechanism to cognitive health. PURPOSE: Guided by expectancy-value theory (Eccles et al., 1983), this study was to explore how psychosocial process (i.e., expectancy-value beliefs) interact with fitness components (i.e., cardiovascular fitness, muscular fitness, flexibility, and body mass index [BMI]) to affect cognitive health (i.e., executive function) among adolescents. The direct and indirect effects of expectancy-value beliefs on executive function through fitness were tested.

METHODS: Participants were adolescents (N = 424; 58% female; M_age = 12.7, SD = .93) recruited from Southwest region of the U.S. to complete this cross-sectional study.

FITNESSGRAM® test battery was utilized to measure fitness components. Participants self-reported their expectancy-value beliefs (Xiang et al., 2003). The Behavior Rating Inventory of Executive Function Self-Report Form (BRIEF-SR®, Guy et al., 2004) was used to assess executive function. Higher scores of BRIEF-SR® indicate lower executive function.

RESULTS: Correlation analysis demonstrated that expectancy-value beliefs were significantly related to each component of physical fitness. Cardiovascular fitness and muscular fitness were negatively associated with BMI and positively associated with EAT, while BMI was positively correlated with executive function. The structural equation modelling (AMOS 22.0) supported the significant indirect effect of expectancy-value beliefs on executive function (β̂ = -.11) through physical fitness (γ̂/df = .284.16/113, p < .001; NFI = .85; IFI = .90; CFI = .90; RMSEA = .06; 90% CI (.05, .07)). The variance explained by the model was 12% for physical fitness and 9% for executive function.

CONCLUSION: The findings support the psychosocial mechanism towards adolescents’ cognitive function proposed by Lubans et al.’s conceptual model (2016). School-based interventions focused on building perceived confidence and values may directly augment physical fitness and may serve to enhance executive function during adolescence.

Physical activity self-efficacy (PASE) and the school’s physical environment (SPE) can influence children’s moderate-to-vigorous physical activity (MVPA) participation. However, no association between PASE and the SPE has not been established in this population. PURPOSE: To evaluate the relationship between PASE and SPE among elementary school children in Puerto Rico. METHODS: Sixty-eight girls and 63 boys (age 7.8 ± 0.7 years) completed a questionnaire to assess PASE by interview. SPE was evaluated taking into consideration the physical education class, recess time, and use of facilities that promoted PA. Time in physical education and recess was provided by the school’s administration. To determine the use of facilities, a score was generated based on self-reported activities and time spent in each. Children wore a GTX4® accelerometer during 5 consecutive school days to determine MVPA and sedentary time (ST) during school time. MVPA and ST data was included if participants were accelerometer ≥ 3 school days for ≥ 3 hr/day. Correlation analysis was conducted to test the relationship between the use of facilities and PASE. Mann Whitney U-test was conducted to test the difference in PASE by recess time and Kruskal-Wallis test was used to evaluate difference in PASE by physical education time. Secondary correlation analyses were conducted to test the relationship between 1) PASE and MVPA (min/wk), and 2) PASE and ST (hr/wk). RESULTS: Participants accumulated 110.9 ± 21.8 min/wk in MVPA, and 34.8 ± 48.9 hr/wk in ST. No significant correlations were observed between: 1) use of facilities and PASE (r = .122, p = .22); 2) PASE and MVPA (r = .010, p = .91); and 3) PASE and ST (r = .086, p = .45). No significant differences were found in PASE by recess time (U = 1815.00, p = .86) and by physical education time (H(2) = .830, p = .66). CONCLUSIONS: Satisfy time was allowed for participants to comply with one of the PA recommendation (60 min/day = 420 min/wk). Lack of relationship between SPE and PASE could be explained by an overall high PA self-efficacy score, which requires further investigation. Funded by University of PR - FIPIT Institutional Grant.

PURPOSE: The transition from childhood to adolescence is marked by a dramatic decrease in physical activity (PA). While many mediating factors have been suggested to explain this drop, one of the most influential may be the experiences children derive from physical education (PE). Scholars have been voicing concerns about the potential long-term implications of early PE experiences for nearly 100 years. However, there has been surprisingly little empirical investigation into this subject. Using a retrospective survey, we examined whether memories of enjoyment or non-enjoyment of PE significantly related to each component of physical fitness. Cardiovascular fitness and muscular fitness were negatively associated with PA and executive function, while BMI was positively correlated with executive function. The structural equation modelling (AMOS 22.0) supported the significant indirect effect of expectancy-value beliefs on executive function (β̂ = -.11) through physical fitness (γ̂/df = .284.16/113, p < .001; NFI = .85; IFI = .90; CFI = .90; RMSEA = .06; 90% CI (.05, .07)). The variance explained by the model was 12% for physical fitness and 9% for executive function.

CONCLUSION: The findings support the psychosocial mechanism towards adolescents’ cognitive function proposed by Lubans et al.’s conceptual model (2016). School-based interventions focused on building perceived confidence and values may directly augment physical fitness and may serve to enhance executive function during adolescence.
Adolescents report low efficacy in healthy behavior engagement, and are disproportionately affected by obesity. Short-term interventions, such as behavior change summer camps, may positively influence psychological correlates of healthy behavior, particularly Exercise Identity (EI) and Healthy Eater Identity (HEI). However, previous studies lack family involvement, and do not take into consideration potential disparities in EI and HEI based upon weight status (healthy vs. obese).

**PURPOSE:** To determine if the combination of a 1-week intervention and an 8-week family-oriented eHealth program will increase EI, HEI, and subsequent healthy behaviors in adolescent girls. Additionally, we sought to determine if EI and HEI scores differ between normal-weight and obese groups.

**METHODS:** Twenty-one participants (age=11.3±1.0 years, BMI=20.2±6.4 kg/m²) were recruited from a prevention camp (no BMI inclusion criteria), and twenty participants (age=12.4±1.5 years, BMI=31.6±6.6 kg/m²) were from a treatment camp (elevated BMI inclusion criteria). Both camps lasted 1-week in duration, and had similar intervention components. Participants self-reported EI, HEI, physical activity, screen-time, and dietary behavior at baseline and post-intervention. All families were given access to an 8-week eHealth program, and measures were repeated three months following camp.

**RESULTS:** EI and HEI role-identities significantly differed between the prevention and treatment groups at baseline (ΔEI=4.0, p=0.007; ΔHEI=4.5, p=0.001). Positive trends in increasing EI and HEI scores were seen in both groups following the 1-week intervention; however, mean role-identity disparities remained between groups. Participation in the eHealth program was low-moderate. At follow-up, the treatment group had increased EI and HEI role-identities in such that the groups no longer significantly differed (ΔEI=3.2, p=0.161; ΔHEI=3.5, p=0.464). Minimal changes in health behaviors were experienced in each group.

**CONCLUSION:** Findings indicate that EI and HEI role-identities may differ in adolescent girls based upon weight status; 1-week interventions may positively influence EI and HEI, mitigating these differences. Further investigation is warranted to address eHealth compliance, and subsequent changes in health behavior.
Compared to boys, adolescent girls have a higher prevalence of obesity, are more sedentary, and suffer more from psychosocial distress. It has been theorized that girls imitate their mothers’ body image concerns and physical activity habits. PURPOSE: The aim of this study was to explore the relationship between adolescent girls’ and mothers’ perceived physical and emotional health. METHODS: Adolescent girls (N = 44) and their mothers (N = 19) participated in seven and four focus groups, respectively. Each focus group lasted 30-45 minutes and included an average of six and five participants for girls and mothers, respectively. Questions focused on physical activity behaviors of mothers and daughters as well as their perceptions of body image and self-esteem. The focus groups were analyzed using “Framework Analysis”. Intercoder reliability was addressed through an iterative coding process (initial coding, code modification, recording) whereby three of the authors developed and agreed upon the codes and subsequent collapsed themes. RESULTS: The thematic analysis resulted in four major themes and five subthemes: 1) Health related conversations are complex and result in a) daughters feeling frustrated and b) mothers feeling confused, 2) Social expectations influence body image through a) social networks and b) women’s changing bodies, 3) Social comparison is common in women and girls in a) their comparison of one another which influences the daughter’s perception of herself, and 4) Mothers’ health behaviors are noticed by daughters who report very little physical activity participation with mothers. CONCLUSION: Results from this study highlight the type of health communication that mothers and daughters perceive as most challenging; daughters struggled with indirect conversations with their moms about health, whereas their mothers struggled with direct communication about health. Potential implications of this research include the support for targeting mothers, in addition to adolescent girls, in interventions aimed at improving mother-daughter communication as well as adolescent girls’ health. Other possible implications include targeting psychosocial health (e.g., body image) and including a mothers’ educational component for programs aimed at improving adolescent girls’ health.

Young children should be provided with physical activity (PA) opportunities that promote both skill and cognitive development. Unstructured free play, both indoors and outdoors, allows young children to accumulate PA while engaging in diverse types of play behaviors, which include social and cognitive components. Cognitive play behaviors focus on the purpose of the children’s activity and are classified as constructively exploratory, functional, and game play. The aim of this study was to explore the effects of environment (indoors vs. outdoors) and PA type, environment and context, and the interaction between these variables. METHODS: Twenty-five toddlers (2.9±0.6y; 12 male) were video-recorded during four 20-minute free play segments (2 indoor and 2 outdoor). Each free play assessment was coded for type of PA, play context, and group composition using the Noldus Observer XT system and the percentage of time spent in each variable was averaged for indoor and outdoor segments. The Observational System for Recording Physical Activity in Children – Preschool (OSRAC-P) was used to classify the type of PA and play context. The three most common PA types (sit/squat, stand, and walk), indoor (transition, manipulatives, and sociodramatic), and outdoor (open space, portable equipment, and fixed equipment) contexts were included in the analyses. Group composition (solitary, parallel, or group) was assessed using the Play Observation Scale. Multiple repeated measures ANOVAs with post hoc analysis (LSD) were used to determine the effects of environment (indoors vs. outdoors) and PA type, environment and context, and environment and group composition as well as any interactions among these variables. RESULTS: The children spent 5.6% more time walking outdoors and 15.5% more time sitting/squatting outdoors (p<0.05). They spent more time on fixed equipment and in sociodramatic play compared to using manipulatives/portable equipment (13.7%) and transitioning or being in an open space (9.9%; p<0.05). Finally, the participants engaged in 13.5% more parallel and 11.1% more group play compared to solitary play (p<0.05). CONCLUSION: The type of PA varied by environment and consisted primarily of sitting/squatting, standing, and walking. The contexts were similar despite differing environments. The children spent most of their time transitioning and in open spaces and playing with manipulatives or portable equipment and playing with or in close proximity to other children. These results provide insight into children’s play and PA choices during indoor and outdoor free time.

Youth sport coaches set the stage for athletes’ and parents’ future sport involvement, experiences, and perceptions as well as attitudes toward playing safely. If youth level coaches do not see safety as a priority, athletes and parents may not either. PURPOSE: To determine youth sport coaches’ safety perceptions and prioritization. METHODS: Youth sport coaches (males: n=28; females: n=2; age=46.2±12.1yrs; yrs coached=12.1±10.6) from 10 sports completed a validated survey and participated in a qualitative focus group (FG) examining prioritization, challenges, and barriers related to implementing safety policies. Coaches reported their agreement level (1 strongly disagree to 5 strongly agree) to 30 statements related to implementing safety policies. Descriptive statistics described each factor’s agreement. Coaches were asked to elaborate on their thoughts and comments and data was analyzed thematically. RESULTS: 97% of youth sport coaches agreed/strongly agreed that sport safety is important (n=29, 4.3±0.5), although only 77% actually make safety a priority within their sport (n=23, 3.9±0.6). Less mean agreement existed in league mandates including: coach safety education (3.8±0.9), emergency action plans (EAP) (3.2±1.1), coaches’ EAP awareness (2.7±1.0, range=1-5), concussion management policies (CMP) (3.4±1.0), coaches’ CMP awareness (3.1±1.0), and being encouraged to share safety information (3.8±0.9). Challenges associated with implementing sport safety include: parental involvement, education, sport culture and tradition, win-at-all-costs mentality, athlete physical development, lacking medical personnel, and time. These findings are reinforced qualitatively by three main FG themes affecting youth sport safety and culture including education and athlete development, others’ influence and expectations, and sport safety overall. CONCLUSION: These data suggest a gap among youth sport coaches who think sport safety is important at the youth level versus those who actually make it a priority. Some challenges they experience with implementation may provide future targets for sport safety initiatives at the youth level. By targeting these challenges, we can minimize the gap between importance and prioritization. Supported in part by a UNC-Chapel Hill Junior Faculty Development Award.

THURSDAY, MAY 31, 2018

ACSM May 29 – June 2, 2018
Minneapolis, Minnesota
PURPOSE: This study evaluated whether young children perceive their body weight correctly, and to investigate relationships among weight perception, exercise behavior and physical fitness in elementary school children.

METHODS: We recruited 200 boys (9±1 yrs, 138±6 cm, 19±4 kg, 19±3 cm/kg) and 197 girls (9±1 yrs, 138±6 cm, 36±9 kg, 19±3 cm/kg). Their physical fitness such as endurance shuttle run (63±26 vs. 51±20 laps), sit-and-reach (5.8±6.5 vs. 8.8±5.6 cm), grip strength (15±3 vs. 14±3 kg), and standing long jump (137±21 vs. 123±21 cm for boys vs. girls) were measured. They responded to a questionnaire reporting weight perception, exercise participation, physical activity time, physical activity preference. Their relative weight status (BMI percentile) was categorized as: underweight (<5th), UW, normal weight (5-85%), NW, and overweight/obese (>85<), OW. Data analyses were performed using Chi-square test, Fisher’s exact test, Independent t-test and One-way ANOVA.

RESULTS: More than one third (36.8%) of children misperceived their body weight compared with the actual weight. In particular, body weight misperception rate was higher in NW than UW and OW. Girls considered themselves more to be overweight while boys did more to be underweight. Physical activity time and physical activity preference were not related to weight perception. Exercise participation showed differences according to gender. Physical fitness level was related to time spent in exercise behaviors. Physical fitness was higher for children who liked to exercise or were being active than those who were not. Endurance run and standing long jump were more strongly associated with physical activity preference than physical activity time, and a dose-response relationship was observed.

CONCLUSIONS: Overall, weight perception of the children was not quite accurate when compared with their actual body weight. However, there was no difference in exercise behaviors according to weight perception. Physical fitness level was associated with exercise behaviors. Endurance run and standing long jump were more strongly associated with physical activity preference than physical activity time, and a dose-response relationship was observed.

Given the fact that adolescence is a critical period for establishing independent healthy lifestyle, the prevalence of physical inactivity and mental health problems should be addressed (Cai et al., 2017). Research has indicated that health-related behaviors can be promoted by satisfying individuals’ basic psychological needs if we create a need-supportive social environment (Ryan & Deci, 2017). Thus, it is essential to investigate the relationships among need support, need satisfaction, physical activity, and health outcomes among adolescents. PURPOSE: Guided by self-determination health behavior model (Ryan et al., 2008), the aim of this study was to examine the relationships between perceived need support, need satisfaction, and health-related outcomes (i.e., physical activity and well-being) among middle school adolescents in China. METHODS: Participants were adolescents (N = 300; 50.3 ± 14.8 years old) recruited from five middle schools in Shanghai, China. In this cross-sectional study, participants completed previously validated questionnaires assessing their perceived need support from PE teachers (i.e., autonomy support, competence support, and relatedness support), need satisfaction (i.e., autonomy, competence, and relatedness), physical activity, and well-being. RESULTS: Correlation analysis revealed significant positive associations among need support, need satisfaction, physical activity, and well-being (r ranged from .15 to .82). The structural equation modelling (AMOS 22.0) supported the hypothesized model with a good fit to the data (χ²/df = 5.80/18.8, p < .001, NFI = .97, IIF = .97, RMSEA = .09, SRMR = .09, CF = .86, CI [06, 11]). The need support had a large influence on need satisfaction (β = .80), and need satisfaction also had an significant contribution on health-related outcomes including physical activity and well-being (β = .89). CONCLUSION: The findings highlighted the importance of need-supportive environments, and supported the theoretical tenets of self-determination theory in health and social settings, they also could promote adolescents’ health-related outcomes among adolescents. To maintain adolescents’ healthy lifestyle, school teachers and health professionals need to create a need-supportive environment to enhance adolescents’ need satisfaction and health-related outcomes during adolescence.
The utility of physical activity, fitness to improve cognition and academic achievement is important to make pleasant learning disturbs and difficulties. PURPOSE: To verify the effects of three months of interdisciplinary physical education program on academic achievement and selective attention in children. METHODS: 60 boys and girls from 4th grade of public elementary brazilian school, underwent a Education by Movement group (EduMove) (n=39; 9.7±5yr; 31.6 ± 6.2 kg; 1.4 ± 0.1 m; 17.9 ± 7.2 % body fat) with math, written and reading classes through physical education activities during a school journey (172.8±16.31bmp) (60min each class, twice a week), and a control group (Con) (n=21; 9.9±0.8yr; 30.0 ± 5.1 kg; 1.4 ± 0.1 m; 17.1 ± 8.6 % body fat) which participated at traditional classes (92.4±9.8bmp). Children performed an academic achievement standardized test (reading, writing and math), selective attention test (Stroop Go/NoGo) and anthropometric measures before and after three months. RESULTS: ANOVA revealed tricipital skinfold reduction for EduMove in comparison with Con at post test (11.8 ± 5.6 vs 12 ± 7.3; p = 0.008), it was observed higher physical activity level for EduMove vs Con (Δ 23.3 vs 2.9 METs; p=0.09). Children showed better results at reading capacity for EduMove vs Con (65.3 ± 4.9 vs 64.7 ± 3.0; p=0.038). Regarding selective attention EduMove was faster and committed less mistakes in comparison with pre test (236.1 ± 39.9 vs 327.9 ± 45.88 ms/m; Δ -90ms e -2% of mistakes p=0.09). CONCLUSIONS: A short term interdisciplinary physical education program can improve reading capacity, and selective attention in children. These results may suggest that activity breaks during a school journey could contributing to learning.

Previous research has showed the majority of high school adolescents are not physically active and fit (CDX, 2010). The literature indicates that individuals’ goal orientations would influence their healthy behavior (Elliot et al., 1999). The 3 × 2 Achievement Goal Model aims to understand individuals’ six goal orientations (i.e., task-approach, task-avoidance, self-approach, self-avoidance, other-approach, and other-avoidance; Elliot et al., 2011), Therefore, it is important to identify high school adolescents’ goal orientations toward their physical activity and fitness. PURPOSE: Guided by 3 × 2 Achievement Goal Model attempts to examine the relationships between six goal orientations, physical activity, and physical fitness among high school adolescents. METHODS: Participants were 792 Chinese adolescents (432 females; 360 males; Mages = 16.9yr) recruited from four high schools in Shanghai, China. They completed previously validated survey to measure their 3 × 2 goal orientations (Elliot et al., 2011), physical activity (Kowalski et al., 1997), and physical fitness (i.e. 50-meter run and standing long jump). RESULTS: Correlation analysis demonstrated that task-, self-, and other-approach goals were significantly correlated to physical activity and fitness (rs ranged from -.10 to .27). While task-, self-, and other-avoidance goals were positively related to physical activity (rs ranged from .10 to .13), they were not significantly associated with physical fitness. The results of three multiple regressions revealed that other-approach goal (β = -.19), self-approach goal (β = .18), and task-avoidance goal (β = .09) were significant predictors of physical activity (R² = 9.0%). Other-approach goal (β = -.19) and self-avoidance goal (β = -.10) significantly contributed to 50-meter run (R² = 2.5%). Only self-approach goal (β = .14) significantly predicted standing long jump (R² = 1.9%). CONCLUSION: The findings supported the 3 × 2 Achievement Goal Model can be used to understand adolescent physical activity and fitness among high school adolescents. Specifically, creating a self- and other-approach oriented environment and designing developmentally appropriate class contents based on adolescents’ level could be effective strategies to augment high school adolescents’ physical activity and fitness.
Deception is a psychological approach to manipulate the exercise expectation (EE) before or during self-paced exercise (SIE).

**PURPOSE:** Verify how negative expectations would alter pacing strategy, performance and psychophysiological responses to an all-out sprint interval exercise (SIE)

**METHODS:** Participated of the study, eleven cyclists (34 ± 6 years old, 173 ± 4.8 cm, 73 ± 5.8 kg, 52.90 ± 8.1 ml/kg/min, 298.4 ± 29.9 Wpeak). After characterize the cyclists and according to the MDEE and MPO, 34 riders were classified as control and 21 as experimental group for the EE condition. Two counterbalanced groups were made upon the information of the cyclists about to rest for 50s between sprints, and their actual rest time was used to analyze the EE effect. The MDEE experimental group was informed that the next sprint was the last, which could be performed at their best. 

**RESULTS:** Main effect of EE was not found on performance, however the MDEE session show a higher PPO in the last sprint (p=0.019). EE main effect was also detected for FS (p < 0.001) but not for SIE (p = 0.26). 

**CONCLUSIONS:** The manipulation of pre-EE, it seems to influence psychophysiological but not physiological responses, in two all-out SIE with the same exercise configuration.

Flow state (FL) and motivation (M) are among the most studied psychological conditions that may affect athletes’ performance. Highly intrinsically motivated players who are fully synchronized and absorbed into their game have greater chances to perform well, to deal positively with stress and pressure associated with competitions, and to maintain a mental balance that allows them to be successful in their personal life as well. Among the strategies that athletes, or their coaches, adopt to prompt a positive mental condition before and after trainings and competition, listening to music has become a widespread trend.

**PURPOSE:** To determine motivational and flow profiles of athletes based on their use of music before and after trainings and competitions.

**METHODS:** A sample of 263 athletes participating in the 2017 University Olympics of Mexico filled a questionnaire on music habits and preferences, the Sports Motivation Scale and the Flow State Scale. The structural equation model analysis was performed to examine athletes’ music-related profiles. RESULTS: The analysis highlighted the presence of two main groups: Music Enthusiasts (ME), athletes who listen to music often in

Mindfulness includes the ability to be attentive and aware of present events and experiences without making judgments based off prior beliefs. There is evidence that mindfulness is related to grit and academic performance but has not been well studied in the collegiate athletic population. **PURPOSE:** The purpose of this study was to determine if grit, academic confidence and demographic factors were predictive of mindfulness in collegiate student-athletes. **METHODS:** 149 (19.6±4.0, 1.23; 191 male, 158 female) varsity student-athletes completed the Mindfulness Attention Awareness Scale, Academic Confidence Scale, and short grit scale as part of the baseline concussion testing protocol. 177 were classified as contact and 75 as non-contact student-athletes (Football, Lacrosse, Soccer), 75 as contact student-athletes (Football, Lacrosse, Soccer), and 263 as non-contact student-athletes (Cross Country, Track and Field, Tennis, Golf, Volleyball). These classifications are used by the NCAA and may influence levels of mindfulness. A stepwise multiple regression was conducted to determine if grit, academic confidence and demographic factors were predictive of mindfulness in collegiate student-athletes. **RESULTS:** Demographic information including age, gender and sport classification do not significantly predict the variance of mindfulness (r = 0.91, P < 0.001; r = -0.90, P < 0.001) than for the MDEE (r = 0.69, P = 0.026; r = -0.79, P = 0.006), respectively. Additionally, by means of circumplex model, the CON affects pre-exercise and sprint 1 values, were in the calmness quadrant, contrary to what is observed in MDEE. Main effect of exercise expectation was also found in HR (p = 0.002) but not for VO2 (p = 0.067) and BLC (p = 0.38).

**CONCLUSIONS:** The manipulation of pre-EE, it seems to influence psychophysiological but not physiological responses, in two all-out SIE with the same exercise configuration.

Quality of instruction significantly influences skill acquisition and performance in sport related tasks, such as golf putting. Instruction for novice individuals should promote external focus, and constantly emphasize the relationship between motor action and task outcome. **PURPOSE:** To analyze the influence of an anchoring bias, while also examining the learning benefits of integrating action-perception external focus. **METHODS:** The putting protocol consisted of three trials: pre-test, acquisition, and post-test. Each trial was performed from a distance of eight feet on artificial turf. The subjects (6 males, 6 females) did not receive instructions or cues for any of the ten putts during the pre- or post-tests. Two counter balanced groups were made upon the completion of the pre-test. Immediately before the start of the acquisition trial subjects were provided with an anchor number and asked to estimate whether their average putt would stop closer or further than the number. Group one (High) was given an anchor of 12 inches and group two (Low) was given an anchor of 3 inches. Differences between groups were not found to be statistically significant (p = 0.262).

**CONCLUSION:** The high anchor group responded with an average of 5.55 inches (3.1, 1.96; 3.75; 1.78; p < 0.05) more than the low anchor group. This difference was found to be significant, demonstrating that anchor values may have an influence on estimation. Error was reduced in both the High (50.1±18.07 to 40.8±9.71, p < 0.05) and Low (58.72; 18.59 to 35.71; 7.99, p < 0.05) groups from pre-test to post-test. Differences between groups were not found to be statistically significant (p = 0.262).

**CONCLUSION:** Individuals used the provided anchor values to adjust their estimate of predicted performance. Significant differences in putt performance from pre to post test showed improvement in both groups. Improvement between groups were not significant.
training and match situations, are characterized by high intrinsic (20.2), low extrinsic motivation (9.3), and null amotivation (7.5); also, they have high levels of flow state (FS = 18); and Music HOt (MH), athletes who listen to music seldom or never, have low intrinsic (5.1), high extrinsic motivation (20.4), as well as high amotivation (19.3); although MH’s flow profile is similar as ME’s in many dimensions, the formers show moderate balance between personal skills and task challenges (12.2), moderate focus on their tasks (13.1), and tend to have low self-awareness (9.9).

CONCLUSIONS: Listening to music seems to trigger an optimal mental state before trainings and competitions, as well as it allows athletes to maintain a psychological balance after their performance.

For an athlete whose identity is contingent upon their participation in sport, an injury that forces them to cease participation can represent a significant loss. As a result, grief models are often applied to the context of sport injury. However, most models may be outdated, and little empirical research has been done to test their applicability to sport injury. PURPOSE: The effectiveness of grief-response models in describing emotional responses to injury was evaluated in collegiate student-athletes. Additionally, the role of social support in determining emotional response was investigated. METHODS: 14 collegiate student-athletes (9 female, 5 male) across five Division I sports participated in this study by completing a semi-structured interview regarding the individual’s injury experience. RESULTS: Athletes most frequently reported feeling upset during the injury diagnosis stage. For those athletes whose injury required surgical intervention, their top reported emotional response during that time was anxiety or fear. Frustration was the most commonly expressed emotion during the rehabilitation stage. Finally, in returning to play, the top emotional response reported among participants was nervousness/anxiety. Regarding social support, participants reported one or both of their parents as their greatest source of social support, while coaches were the primary source that the student-athletes wished they had received more support.

CONCLUSION: Preliminary findings suggest that grief models should redirect focus from shock and depression and be reworked to account for the prevalence of anxiety and frustration in multiple stages of recovery. Additionally, results identified a need for increased availability of social support resources on campus, as well as, training for coaching staff on how to better meet the expectations and needs of injured athletes.

Table 1. Proportion of burnout indicators by sport type and sex.

<table>
<thead>
<tr>
<th>By sport type</th>
<th>Team sports (n = 124)</th>
<th>Individual sports (n = 112)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EE</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>EE</td>
<td>D</td>
</tr>
<tr>
<td>Low risk</td>
<td>53.2% (n = 66)</td>
<td>43.6% (n = 54)</td>
</tr>
<tr>
<td>Moderate risk</td>
<td>13.9% (n = 42)</td>
<td>34.7% (n = 43)</td>
</tr>
<tr>
<td>High risk</td>
<td>11.3% (n = 14)</td>
<td>13.7% (n = 17)</td>
</tr>
<tr>
<td>With burnout</td>
<td>1.6% (n = 5)</td>
<td>8.1% (n = 10)</td>
</tr>
<tr>
<td>By sex</td>
<td>Females (n = 76)</td>
<td>Males (n = 160)</td>
</tr>
<tr>
<td>Low risk</td>
<td>36.8% (n = 28)</td>
<td>48.7% (n = 37)</td>
</tr>
<tr>
<td>Moderate risk</td>
<td>44.7% (n = 34)</td>
<td>32.9% (n = 25)</td>
</tr>
<tr>
<td>High risk</td>
<td>11.9% (n = 19)</td>
<td>6.6% (n = 5)</td>
</tr>
<tr>
<td>With burnout</td>
<td>6.9% (n = 6)</td>
<td>11.8% (n = 9)</td>
</tr>
</tbody>
</table>
| * Significant differences by sport type (p < 0.05).
| ^ Significant differences by sex (p < 0.05).

Few studies have examined motivation types in collegiate athletes over time using the Self-Determination Theory (SDT) continuum. PURPOSE: To investigate differences in motivation types in NCAA Division II student-athletes (SAs) over three time points. METHODS: Overall, 530 SAs (n = 355, men = 175) with an age range of 18 to 23 (M = 19.40, SD = 1.33) from 21 teams voluntarily completed a demographic questionnaire and the 18-item Sport Motivation Scale II used to measure six motivation types: intrinsic (IN), integrated (INT), identified (ID), introjected (INTR), external (EXTR), and amotivation (AMR). Variation, six, one-way, repeated measures ANOVA’s of Variance with Bonferroni post hoc tests were used to analyze SA motivation types over the pre-season (PS), in-season (IS), and off-season (OS). An alpha level of p < .05 was set for statistical significance. RESULTS: Analyses revealed statistically significant differences in IN, INTR, ID, and AMR types over time. For IR, a difference was seen, F(2, 710) = 3.66, p = .026, between the PS and IS (p = .028) with lower scores in the IS (M = 16.11, SD = 4.21) versus the PS (M = 16.67, SD = 4.13). For INTR, differences were seen, F(1,95, 691.39) = 15.75, p < .001, between both the PS and IS (p < .001) and between the PS and OS (p < .001) with lower scores in the IS (M = 16.69, SD = 3.69) and OS (M = 16.53, SD = 4.05) versus in the PS (M = 17.58, SD = 3.29). For ID, a difference was seen, F(1,92, 680.470) = 5.89, p = .003, between the PS and IS (p = .004) with higher scores in the IS (M = 16.43, SD = 4.09) versus in the PS (M = 17.12, SD = 3.62). For AMR, differences were seen over time, F(1,97, 699.89) = 8.21, p < .001, between both the PS and IS (p < .001) and between the PS and OS (p < .001) with higher scores in the IS (M = 7.82, SD = 4.31) and OS (M = 7.78, SD = 4.73) versus lower scores in the PS (M = 6.93, SD = 4.11). CONCLUSIONS: Findings demonstrated that more self-determined motivation (IR, INTR, ID) was highest in the PS while increasing AMR scores predominated over time extending into the IS and OS. This is consistent with the athlete burnout/SDT literature where motivation extremely low in internalization (i.e., AMR) is positively associated with burnout and motivation extremely high in internalization (i.e., IR) is negatively associated with burnout (Cresswell, 2009; Cresswell & Ekland, 2005a, 2005b).

**Table 1. Proportion of burnout indicators by sport type and sex.**
The National Collegiate Athletic Association has over 250,000 students competing in Division I (DI) and Division III (DIII) programs. DI colleges comprise 32% of the association while DIII accounts for 40%. Previous studies of individuals within the same collegiate level have uncovered a positive correlation between the hours of deliberate play and athletic skill level. To date, there have been no studies on comparing the two aforementioned divisions. PURPOSE: To investigate the quantity of deliberate play that contributes to achieving the DI and DIII statuses. METHODS: Using an online interview as proposed by Côté, Ericsson, and Law (2005), all student-athletes from both Rice University (DI) and State University of New York (SUNY) in Plattsburgh (DIII), were recruited via email. Sixty-three participated from DI (track and field, basketball, and football) and 90 from DIII (track and field, basketball, hockey, soccer, softball, and tennis). The response rate was 17% and 29%, respectively. Descriptive statistics and parametric tests were used in the analysis. RESULTS: Differences with statistical significance (p<0.05) were found in: (a) height (when younger, 100% DI vs 78% DIII were average or taller than peers), (b) participation in early activities of art (17 to 37%), organized games with rules (72 to 86%), and other sport-related activities (48 to 74%), (c) parents being top athletes (24 to 48%), and (d) the current activities of sleeping (25 to 52 hours per week), socializing (9 to 21 h.), school/college (8 to 21 h.), and studying (9 to 15 h.). CONCLUSIONS: In both divisions, we further attest to the suggestions of Côté et al. (2003) about participation of youth in multifarious activities. Our results also align with past work from Landers et al. (2011), which has underscored the competitive advantage of athletes with longer lever ages over their peers. The comparison of current activities indicate that a DII school may be promoting a more wellness lifestyle (including all its dimensions, such as social, physical, occupational, and mental). Possible limitations of this study are the use of convenience and unequal samples, self-reported data, and of retrospective methods. Future research, comparing more cases of different-division schools, is recommended.

A female volleyball athlete’s ability to cope within the competitive environment oftentimes determines the outcome of a match. Therefore, possessing a strong coping skill set necessary at this level of competition is essential for optimal performance potential. PURPOSE: To quantify the athletic coping skills of Division I female volleyball players. METHODS: Following a self-reported consultation, 28 female volleyball players (mean age 19.7 ± 1.5) completed the Athletic Coping Skills Inventory (ACSI; Smith et al., 1995): coping with adversity (COPE), peaking under pressure (PEAK), goal setting/mental preparation (GOAL), concentration (CONC), freedom from worry (FREE), confidence and achievement motivation (CONF), coachability (COAC), and personal coping resources (PCR). Data were grouped by athletic rank (top, bottom), present injury status (yes, no), and by academic level (upper class, lower class). RESULTS: MANOVAs (Wills’ criterion) indicated significant main effects for athletic coping by athletic rank (F 1,15 = 5.046; P = 0.002), but no significant main effects across present injury status (F 1,19 = 1.711; P = 0.161) or academic level (F 1,19 = 0.76; P = 0.391). Post hoc analyses (T scores; T = 50, SD = 10) indicated that top-ranked athletes responded significantly higher in COPE (55 vs 42; p < 0.001), PEAK (53 vs 44; p = 0.001), GOAL (54 vs 44; p = 0.006), and CONC (53 vs 48; p = 0.025), CONF (54 vs 46; p = 0.001), COAC (52, 39; p = 0.001), and PCR (56 vs 41; p = 0.001) than bottom-ranked peers, respectively. There was also a trend for athletes experiencing trauma to respond more positively in COPE, PEAK, GOAL, CONF, COAC, FREE, and PCR than non-injured peers. Of concern, athletic coping skills among this group were below average when compared to normative values across other athletic populations. CONCLUSION: Although findings were influenced by limited sample size, results still support the recommendation that volleyball athletes incorporate psychological skills training into their workout routines that specifically target athletic coping skills. Further research is warranted to assess coping skills within a larger volleyball population, to assess coping skills in athletes recovering from injuries, as well as to quantify the efficacy of coping skills interventions on volleyball performance. Internal self-talk has been shown to improve performance and reduce effort, but less is known about how short-term mental strength (MS) and mindfulness (MD) training affect performance and underlying physiological variables. PURPOSE: To determine how MS (grit, resilience) or MD training affect cycling time trial performance and to determine the physiological mechanisms underlying these changes. METHODS: 35 college-aged participants visited the lab on 4 separate days. A VO2max with ventilatory threshold (VT) was performed on day 1. The subsequent visits consisted of time trials to exhaustion (TTE) performed at 10% above VT. Between visit 3 and 4, MS (13 participants) and MD (10 participants) groups watched a video or listened to an audio recording for 15 minutes each day for one week. Also, the control group (C) did not train. Heart rate (HR), rate of perceived exertion (RPE), VAS scores for pain and fatigue, and EMG were recorded during the time trials. CD-Risc, GRIT-S, and the 5-factor mindfulness surveys were also completed before study days 3 and 4. A RM-ANOVA was done to compare group and time differences.

RESULTS: TTE was significantly increased in MS (8.6±13.6%, p<0.05) and MD (4.3±5.8%, p<0.05) compared to C (4.9±11.6%). There were no changes between MS or MD and C for differences between trial 1 and trial 2 for maximum HR, average HR, maximum RPE, average RPE, or VAS scores for pain or fatigue (p>0.05). One week of MS or MD training also did not change the GRIT-S, CD-Risc, or 5-factor mindfulness survey (p>0.05). There was a significant decrease in EMG for MS as compared to both MD (p<0.05) and C (p=0.01), but MD EMG did not change as compared to C (p>0.05).

Conclusions: One week of mental training, whether MS which included grit and resilience training or for MD, has the ability to improve TTE performance. However, current psychological surveys are not sensitive enough to detect changes in mental performance, perhaps because they are not sport/exercise specific. Further, MS may improve performance by reducing EMG input and shifting to a more external focus, allowing a decreased activation of muscle and subsequent reduced fatigue rate.
1363 Board #171 May 31 9:00 AM - 10:30 AM

Muscle Dysmorphic Disorders, Body Dissatisfaction and Eating Disorder in Male Bodybuilders

Ashi Devrim1, Pelin Bilgic1, Nobuko Hongu1, 1Hacettepe University, Ankara, Turkey; 2University of Arizona, Tucson, AZ

(No relevant relationships reported)

Muscle dysmorphic disorders (MDD) have been described as a body image disorder, characterized by a perceived lack of muscularity, and largely affect males. PURPOSE: The study aimed to determine the rates and relationships among MDD, body image disturbance and eating disorders in both competitive/professional and non-competitive/recreational male bodybuilders. METHODS: The participants consist of 120 bodybuilders (competitive, n=62; mean age 25.63 ± 6.67 yr) recruited from four bodybuilding gym centers in Ankara, Turkey. Weight, height and body fat percentage were measured with BIA (Tanita, TBF-300). To assess symptoms of eating disorders, muscle dysmphia, and body dissatisfaction, the participants were asked to answer four questionnaires, including Eating Attitude Test (EAT)-40, Muscle Dysphoria Disorder Inventory (MDDI), and Bodybuilder Image Grid (BIG)-Original (BIG-O) and Scale (BIG-S). The instruments to measure the perceptual body image disturbance and perceived attractiveness. A multiple linear regression model was used to identify independent factors associating eating disorders. RESULTS: 81 bodybuilders (67.5%) had EAT-40 scores above its cut off point, indicating having eating disorders, and there was no significant difference between competitive and non-competitive bodybuilders (p>0.05). The average scores of BIG-O and BIG-S showed statistically significant differences (p<0.01) in current and ideal body fat and muscle mass scores, indicating the most bodybuilders desire to be leaner (less fat) and muscular than their current body sizes. According to MDDI, 70 bodybuilders (58.3%) had a risk of having MDD. Furthermore, there was a significant positive relationship between EAT-40 and MDDI total scores (r= 0.614, Φ= 0.713, p<0.001) in both competitive and non-competitive bodybuilders. A linear regression analysis predicts that the eating disorder was a relative risk factor for MDDI and muscle-related body dissatisfaction in male bodybuilders. CONCLUSIONS: Eating disorder psychopathology is positively related with body dissatisfaction and body dysmorphic disorders. The screening tools, EAT-40, MDDI, and BIG-O and BIG-S may provide early detections of body dissatisfaction and eating disorders in male bodybuilders.

1364 Board #172 May 31 9:00 AM - 10:30 AM

Training Mental Toughness In Sport: A Review And Meta-analysis

Andreas Stamat1, Peter W. Grandjean, FACSM2, Grant B. Morgan2, SUNY Plattsburgh, Plattsburgh, NY; 1Baylor University, Waco, TX. (Sponsor: Dr. Peter Grandjean, FACSM)

(No relevant relationships reported)

In January 2017, after a week of strenuous, military-style, and anecdotally-based workouts designed to test the level of mental toughness (MT), three Pac-12 football players were diagnosed with rhabdomyolysis. In sporting environments, are there any mental toughness (MT) levels.

1365 Board #173 May 31 9:00 AM - 10:30 AM

Relationships among Perceived Recovery, Vertical Jump And Change In Repeated Sprint Performance

Justin Kraft, FACSM1, Matt Lauren2, Stephanie Douglas3, Danilo Tolusso4, Adam Fullenkamp5, James M. Green, FACSM1, Missouri Western State University, St. Joseph, MO; 2Tarleton State University, Stephenville, TX; 3Bowling Green State University, Bowling Green, OH; 4University of Alabama, Tuscaloosa, AL; 5University of North Alabama, Florence, AL

(No relevant relationships reported)

Recovery may be determined by using a counter movement vertical jump (CMJ). While a CMJ has been shown effective to evaluate recovery, there may be more efficient, less physically taxing alternatives such as the Perceived Recovery Status (PRS) Scale. The PRS is a non-invasive, and accurate psychophysiological tool designed to measure recovery and its correlation to performance. PURPOSE: To determine the efficacy of CMJ and PRS as methods for monitoring recovery between repeated sprint efforts. METHODS: Eight college-aged individuals (age=23±0.9 years; height=1.65±0.11 meters; weight=67.1±9.3 kg; percent body fat=17.5±8.4%) performed repeated sprints. The protocol consisted of three sets of eight 30 meter sprints on a non-motorized treadmill with 45 seconds of rest between each sprint. The sets were separated by 5 minutes of passive rest. Mean power output (MP) was measured during each sprint. RPE (overall) was recorded immediately following each sprint. Immediately before the next set of sprints PRS was recorded and a CMJ was performed on a force plate with a maximal height of H (m). RESULTS: A 1-way repeated measures ANOVA showed a significant main effect of sprint set on RPE (p<0.04) and PRS (p<0.01). Subsequent pairwise comparisons revealed significant differences for RPE between sprint sets 1 and 2 (p<0.05), and in PRS between sprint sets 1 and 2 (p<0.001), and sprint sets 1 and 3 (p=0.02). Correlations showed the relationship between PRS and delta MP to be moderate, and significant at (R=0.32) while the relationship between CMJ and MP was weak (R=0.14). CONCLUSION: Current results suggest PRS may demonstrate a stronger relationship with change in repeated sprint performance within a session than CMJ. However, neither index of recovery was robust, and may indicate that these measures may be more appropriate for between day-to-day training sessions (as previous research established) and not necessarily to gauge recovery as in the current paradigm.

1366 Board #174 May 31 9:00 AM - 10:30 AM

Cross-cultural Invariance Of The Mental Toughness Inventory Among American And Greek Athletes

Grant B. Morgan1, Andreas Stamat2, Zacharias Papadakis3, Vassilis Mougos4, Gregory Bogdanis3, Alexandra Spiniou1, Baylor University, Waco, TX; SONY Plattsburgh, Plattsburgh, NY; 1Rice University, Houston, TX; 2Aristotelian University of Thessaloniki, Thessaloniki, Greece; 3National and Kapodistrian University of Athens, Athens, Greece; 4University of Thrace, Komotini, Greece. (Sponsor: Peter Grandjean, FACSM)

(No relevant relationships reported)

The popularity of the term mental toughness (MT) in sporting environments, at least in the U.S., has been established. However, its worldwide cultural relevance remains to be fully uncovered. Recently, Gucciardi et al. (2016), using the Mental Toughness Index (MTI), reported intra-cultural invariance of MT in Australia. To date, there has been no effort to uncover the extent of the universality of the term between Europe and USA via MTI. PURPOSE: To examine the invariance of MT across two different cultural groups of athletes and to further validate MTI. Method: The MTI was completed by 99 Greek and 173 US athletes via Qualtrics. The MTI consisted of eight items with a seven-point response scale. Both samples consisted of roughly half male and half female athletes from a number of sports, including American football, basketball, baseball, softball, volleyball, golf, tennis, soccer, track and field, swimming. Judo was only reflected in Greek sample. Invariance testing was conducted using multiple group confirmatory factor analysis with increasingly restrictive models. We first fitted a unidimensional model within each sample to ensure good model-data fit. Then we estimated configurual (equal number of dimensions), metric (configural + equal loadings), and scalar invariance models (metric +equal intercepts). Scalar invariance is the minimum type of invariance to infer cross-cultural equality. To test the configural invariance we used the Comparative fit index (CFI), root mean square error of approximation (RMSEA), and the differences between these indices for increasingly restrictive models. Results: The model-data fit in both samples was very good (CFI Greek = .995, RMSEA Greek = .046; CFI US = .998, RMSEA US = .032). The scalar invariance model was selected as the best fitting (CFI scalar = .950, RMSEA scalar = .078) but with a slightly different item intercept for one item (Item 4: <.5).
Conclusions: The results of this analysis provide evidence for the partial scalar invariance of the MTI across cultural samples. This implies that the meaning of the MT construct and the levels of the underlying items are equal in both cultures. As a result, the two cultures can be directly compared on their scores in the latent variable.

Perceived Behavioral Control is Key for Activity Tracker Usage

Mary M. Yoke, FACSM, Susan E. Reddick, Paul W. Seibel, Nathaniel C. Worsley, Kim A. Kohn, and Michael D. Smith. Indiana University, Bloomington, IN.

Purpose: The Reasoned Action Approach (RAA) has not been previously used to examine activity tracker (AT) beliefs. The purpose of this study was to use the RAA to explore which global constructs (attitude toward the act (AA), perceived norm (PN), and perceived behavioral control (PBC)) would best predict trained-users' intentions to use their activity trackers for the next month. This descriptive study addresses a gap in the literature by examining the AT beliefs of 165 university faculty and staff.

Methods: A convenience sample was recruited from participants who previously took part in an on-campus physical activity program during 2014-2016. The participants were "trained-users", having been guided for 8 weeks by student coaches and provided with ATs during the program. An online survey was utilized to measure AT beliefs. The purpose of this study was to use the RAA to explore which global constructs (attitude toward the act (AA), perceived norm (PN), and perceived behavioral control (PBC)) would best predict trained-users' intentions to use their activity trackers for the next month. This descriptive study addresses a gap in the literature by examining the AT beliefs of 165 university faculty and staff.

Results: A standard regression analysis showed that 69.1% of the variance in the intention to use an AT was explained by attitude toward the act (Beta = .31), perceived norm (Beta = .153), and perceived behavioral control (Beta = .488). R (r = .831, F (3, 159) = 116.37, p < .0001). PBC was found to be the strongest contributor towards the intention to use an AT.

Conclusion: This is the first study to examine AT usage using the RAA model. Results of this theory-based research suggest that focusing on perceived behavioral control (the perceived ease or difficulty of AT usage and a person's self-efficacy) may be the most efficacious route to helping individuals become long-term AT users.
PURPOSE: To investigate the effect that watching professional baseball at a ballpark has on the elderly’s health-related outcome indicators.

Methods: Participants included 17 Division III collegiate soccer players (19 ± 1.1 years, 65% female, 35% male) who completed an experimental protocol involving exposure to both live and broadcast baseball games. Subjects (n = 34) were randomly assigned to two groups: a spectator group (n = 17) and a control group (n = 17). The intervention period was approximately 2 months. During the intervention period, 21 professional baseball games were held. The spectator group was requested to watch professional baseball games at the ballpark freely, whereas the control group underwent a 2-month waiting-list phase. The intervention period involved watching (5-10 min) of a professional baseball game at a ballpark followed by a 15 min post-exposure quiz. The control group watched the same video material for the same time and then answered the same post-exposure quiz.

Conclusion: The results of the study are promising for the potential use of baseball as a light physical activity for older adults.

(No relevant relationships reported)

Competitive soccer players are required to perform various physiological movements including short passing under the stressful conditions of a match. Individual self-confidence and ability to perform under pressure may impact on a successful match outcome. Purpose: The purpose of this cross-sectional study was to examine the relationship between short-passing ability and anxiety and self-confidence among collegiate male and female soccer players. Methods: Participants included 17 Division III collegiate soccer players (19 ± 1.1 years, 65% female, 35% male) who completed the following questionnaires on a computer to assess competitive anxiety and self-confidence: The Illinois Competitive State Anxiety Inventory-2 (CSAI-2R), Sport Confidence Inventory (TSCI), and Trait Sport-Confidence Inventory (CSAT). The soccer-specific physical and technical performance were assessed. Results: The median number of days that the spectator group watched baseball games was 6 (interquartile range (IQR): 4-10 days, range: 1-21 days). Although there were no significant differences, the reverse-Stroup interference rate showed greater improvement in the spectator group (median: IQR: 17.0% (9.2-22.8) to 13.3% (3.1-24.9)) than in the waiting-list group (19.1% (7.4-30.1) to 18.0% (9.2-33.3)) (P = 0.063). The CES-D showed significantly greater improvement in the spectator group (5 (4-12) to 3 (2-7)) than in the waiting-list group (4 (1-8) to 5 (1-8)) (P = 0.016). There were no significant differences between the two groups regarding the other health-related outcome indicators.

Conclusion: These results suggest that regularly watching professional baseball at a ballpark may positively influence elderly adults’ depression symptoms.

(No relevant relationships reported)
self-paced TT under 4 environmental conditions at random: SLTN, SL hot (SLH); 250 m, 35°C, 30% RH), altitude thermoneutral (ATN; 3,000 m, 20°C, 30-50% RH) and altitude hot (AH; 3,000 m, 35°C, 30% RH). Performance was assessed by the total amount of work (kilojoules, kJ) completed during each TT. Heart rate (HR) and rate of perceived exertion (RPE) were recorded during the TTs. RESULTS: The CV was 2.6% for familiarization trials. Differences existed in total work completed during the 15 min TT between SLTN vs ATN (167 ± 32 vs 148 ± 28 kJ, P < 0.05) and SLTN vs AH (167 ± 32 vs 149.6 ± 29 kJ, P < 0.05). No differences existed in mean HR during the TT, or in RPE at the end of exercise (P > 0.05) for both of any condition. The pacing at 3 min increments was not different between environments (P > 0.05). CONCLUSION: Self-paced TT performance was negatively impacted by exposure to altitude, but not heat. The combination of heat and altitude did not lead to a further decrement in exercise performance than could be attributed by either of the two environmental conditions alone. Disclaimer: The opinions or assertions contained herein are the private views of the author(s) and are not to be construed as official or reflecting the views of the Army or the Department of Defense.

Objective and subjective measures of the stress response have been shown to increase in response to exercise in sea-level thermoneutral (SLTN), hot, or altitude environments. However, responses to a combination of these stressors remain unclear. PURPOSE: To determine if the responses of objective (serum cortisol [CORT] and subjective (perceived strain index [PeSI]) stress indices are further increased in a combined environment of heat and altitude. METHODS: Six participants (1 F, 5 M) completed 30 min of steady state (SS) exercise on a cycle ergometer at 50% of SL VO2max in four separate environmental conditions: 1) SLTN (250 m, 20°C, 30-50% RH); 2) Sea-level hot (250 m, 35°C, 30% RH); 3) Altitude thermoneutral (3,000 m, 20°C, 30-50% RH); and 4) Altitude hot (3,000 m, 35°C, 30% RH) randomized in order, separated by 1 week. Blood samples were drawn via an indwelling venous catheter: upon arrival to the laboratory (baseline, BL); 1 hr upon reaching target environmental condition but before SS (PRE); and immediately following SS exercise (POST). A seated posture was maintained for at least 20 min prior to each draw. PeSI, a product of rating of perceived exertion (RPE) and perceived thermal stress (TS), [5*(TS)16] + [5*(RPE-6)/14], was calculated PRE and POST SS exercise. RESULTS: CORT (ng/ml, mean ± SD) response to SS exercise did not differ among any of the four environmental conditions at any time point (P > 0.05), however, there was a main effect of time for CORT levels as shown by an increase noted following both BL and POST (110 ± 64 vs. 120.32 ± 72 P < 0.05) and PRE and POST (113 ± 66 vs 120 ± 72, P > 0.05). Similarly, no differences in PeSI (mean ± SD) were observed among any of the four environmental conditions (P > 0.05), yet there was a main effect of time on PeSI (P < 0.05) as demonstrated by an increase from PRE (1.36 ± 0.40) to POST (4.68 ± 1.65) SS exercise. CONCLUSION: During SS exercise, the combination of heat and altitude resulted in similar objective and subjective stress responses compared to any singular environmental stressor, suggesting that exercise, and not environmental condition, is responsible for any observed differences.

Introduction: During ascent to high altitude, inadequate pulmonary acclimatization may lead to high altitude pulmonary edema. One potential mechanism for acclimatization is pulmonary endothelial release of nitric oxide (NO) to reduce pulmonary pressures. PURPOSE: To characterize: 1) the change in exhaled nitric oxide (eNO) levels during acclimatization to high altitude; 2peak. John H. Sellers, Michelle A. King, Roy M. Salgado, Karleigh E. Embry, Charles S. Fulco, Robert W. Kenefick, FACSM. USARIEM, Natick, MA. (No relevant relationships reported)

THURSDAY, MAY 31, 2018

Official Journal of the American College of Sports Medicine

Vol. 49 No. 5 Supplement S275

Abstracts were prepared by the authors and printed as submitted.
The cerebral blood flow velocity (CBFV) response to acute hypoxia has been known to increase. But, how CBFV might respond to exercise in hypoxic condition and be associated with EEG remains unclear. PURPOSE: To evaluate the effects of exercise in hypoxic condition corresponding to the altitudes of 4000m on cerebral blood flow velocity and EEG. METHODS: In a randomized, double-blind, balanced crossover study, ten healthy volunteers (19.8±6.4yrs) were asked to perform the incremental bicycle ergometer exercise twice in hypoxic and control(sea level) condition with a week interval, respectively. Exercise intensity was set initially at 50W and increased by 25W every 2 minutes to 125W. Acute normobaric hypoxic condition was maintained for 45 minutes using low oxygen gas mixture. CBFV in middle cerebral artery (MCA) and EEG were measured at rest 5 minutes, immediately after exercise, and 15 minutes recovery using transcranial-Doppler sonography and EEG signal was recorded from 6 scalp sites (frontal, temporal and occipital lobe of the international 10-20 system) leading to analysis of theta (4-7Hz), alpha (8-13Hz), beta (13-30Hz), and gamma(30-50Hz) relative activities. All data were analyzed using two-way ANOVA with repeated measures and Pearson’s correlation. RESULTS: CBFV in MCA in hypoxic condition was significantly higher than in control group immediately after exercise (0.28±0.07 vs. 0.20±0.07 µV, p<0.05). Gamma wave activity of frontal lobe in hypoxic group was significantly higher than in control group immediately after exercise (0.25±0.12 vs. 0.12±0.08 µV, p<0.05). CONCLUSION: These results suggest that hypoxia might amplify the changes of CBFV observed during exercise. But, the changes of CBFV might have no association with the changes of EEG activities in hypoxia.
Exposure to high altitude could increase sweating responses as a result of widening the air-to-skin water vapor pressure gradient. Previous laboratory studies have reported both lower and higher sweat losses at altitude. PURPOSE: To determine if exposure to altitude in a thermo-neutral environment, and exposure to altitude in the heat will alter the onset time of sweating (OTS) and sweat rate (SR) during 30 minutes of steady state (SS) exercise. METHODS: Seven healthy volunteers (2F, 5M, age: 27 ± 5 yrs, height: 175 ± 10 cm, weight: 79.7 ± 18.5 kg, sea level (SL) VO	extsubscript{2peak}: 41.8 ± 4.6 ml·kg	extsuperscript{-1}·min	extsuperscript{-1}) completed 30 minutes of SS cycling exercise (50% SL VO	extsubscript{2peak}) in four randomly assigned conditions: SL thermo-neutral (SLTN; 250m, 20°C, vapor pressure (VP): 5·3.8-8.8 mmHg), SL hot (SLH; 250m, 35°C, VP: 12.7 mmHg), altitude-thermo-neutral (ATN; 3,000m, 20°C, VP: 5·3.8-8.8 mmHg), altitude hot (AH; 3,000m, 35°C, VP: 12.7 mmHg). Prior to exercise, a ventilated sweat cap (surface area: 15.9 cm	extsuperscript{2}, air flow: 2 standard liters/min) was applied to the suprazines of the volunteer. Ambient temperature (°C) and relative humidity of the capsule interior were recorded throughout SS exercise. The time at which OTS occurred (minute) and SR (mg·cm	extsuperscript{-2}·min	extsuperscript{-1}) were calculated. RESULTS: OTS and SR were not different (P > 0.05) between SLTN vs. ATN conditions (7.58 ± 2.90 vs. 7.45 ± 2.90 min; 0.70 ± 0.32 vs. 0.78 ± 0.33 mg·cm	extsuperscript{-2}·min	extsuperscript{-1}, respectively). Furthermore, in the heat OTS and SR were not different (P > 0.05) between SLH vs. AH conditions (1.28 ± 1.64 vs. 0.83 ± 1.31 min; 1.55 ± 0.25 vs. 1.51 ± 0.20 mg·cm	extsuperscript{-2}·min	extsuperscript{-1}, respectively). CONCLUSION: Both exposure to altitude in a thermo-neutral environment and exposure to altitude in the heat did not alter either OTS or SR. This suggests the water vapor pressure gradient at 3,000m was not great enough to have a marked effect on sweating responses. Disclaimer: The opinions or assertions contained herein are the private views of the author(s) and are not to be construed as official or reflecting the views of the Army or the Department of Defense.

PURPOSE: To determine if heart rate variability, body composition and hypoxia exposure affects neuromuscular activity agonist muscle during exercise. METHODS: Previous studies indicated that there was a difference between hypoxia and normoxia for amplitude parameters of surface electromyography (EMG). However, there are few reports on frequency parameters of EMG because of limitations of traditional analytical methods. PURPOSE: The purpose of this study was to investigate the differences of surface electromyography during incremental cycling exercise in hypoxia and normoxia using wavelet transform analysis. METHODS: Subjects were sixteen active and healthy men. (mean±SD; age: 21.08 ± 1.50 years; height: 1.69 ± 0.06 m; weight: 60.16 ± 7.77 kg; maximal oxygen consumption: 51.11 ± 9.54 ml·min	extsuperscript{-1}·kg	extsuperscript{-1}). The subjects performed incremental cycling exercise test to exhaustion in hypoxia (F	extsubscript{O2}; 13.4%) and normoxia conditions (F	extsubscript{O2}; 20.9%). EMG activities of vastus lateralis (VL), vastus medialis (VM), rectus femoris (RF) and biceps femoris (BF) were recorded during cycling exercise test at a sampling rate of 2000 Hz. Integrated electromyogram (iEMG) and mean power frequency (MPF) for each exercise intensity were calculated from the EMG data. Contentious wavelet analysis was used to calculate MPF, and mother wavelet was set at morlet wavelet. The differences between exercise intensities and F	extsubscript{O2} conditions were compared using a two-way analysis of variance. The significance level was set at p<0.05. RESULTS: iEMG of each muscle significantly increased with increasing exercise intensities (all: p < 0.01). However, there were no significant differences between F	extsubscript{O2} conditions for each muscle (VL: p = 0.37; VM: p = 0.49; RF: p = 0.37; BF: p = 0.64). MPF of VL significantly decreased with increasing exercise intensities (p < 0.01), and MPF in hypoxia was higher than that in normoxia (p < 0.01). MPF of VM significantly decreased with increasing exercise intensities (p < 0.01), but there were no significant differences between F	extsubscript{O2} conditions (p = 0.37). In addition, there were no significant differences between exercise intensities (RF: p = 0.49; BF: p = 0.57) and F	extsubscript{O2} conditions (RF: p = 0.49; BF: p = 0.19) for RF and BF. CONCLUSION: The current results demonstrated that the change in MPF was different for each muscle, and MPF of VL in hypoxia was only higher than that in normoxia, and suggested hypoxia exposure affects neuromuscular activity agonist muscle during exercise.

Training in hypoxia has been widely utilized to improve endurance capacity. On the other hand, the influence of the endurance training in hypoxia on hepcidin (a liver-derived, iron regulating hormone) response remains unclear. This information would be a great help for preventing iron deficiency in endurance athletes. PURPOSE: The purpose of the present study was to determine the influence of endurance exercise under hypoxic condition on post-exercise hepcidin levels in endurance athletes. METHODS: Nine trained endurance athletes (19.7 ± 0.3 years, 169.8 ± 2.2 cm, 57.1 ± 1.3 kg, VO	extsubscript{2max} 62.8 ± 6.1 ml·kg	extsuperscript{-1}·min	extsuperscript{-1}) completed two different trials on different days, consisting of exercise in under moderate hypoxic (H, FiO	extsubscript{2}; 14.5%) and normoxic (N, FiO	extsubscript{2};20.9%) conditions. They performed interval type of endurance exercise (10·3 min running at 95% of VO	extsubscript{2max} with 60% of active rest at 60% of VO	extsubscript{2max}) followed by 5·3 min of continuous running at 85% of VO	extsubscript{2max} under hypoxic or normoxic conditions. Venous blood samples were collected before the exercise and during 120·min of post-exercise period. RESULTS: Running velocities during interval and continuous exercise were significantly lower in the H trial than in the N trial (P < 0.0001). Exercise-induced blood lactate elevation was significantly greater in the H trial (3.1 ± 0.5mmol/L) than the N trial (3.2 ± 0.7mmol/L; P < 0.05). There were significant increases in plasma iron, 6-iron, serum, and blood glucose levels after exercise, but these responses were not significantly different between the two trials. Serum hepcidin levels increased significantly at 120·min after completing exercise (H: from 10.7 ± 9.4 ng/ml to 15.8 ± 11.2 ng/ml; N: from 7.9 ± 4.7 ng/ml to 13.2 ± 7.9 ng/ml; P < 0.05). However, there was no significant difference between the two trials.

Conclusions: Endurance exercise under moderate hypoxic conditions resulted in similar exercise-induced serum hepcidin response compared with equivalent exercise under normoxic condition in endurance athletes.
**Purpose:** Hypoxia and hypoxia exert independent effects on exercise-induced oxidative stress in blood, while the hypoxia and hypoxic influences are not well defined. The current study was undertaken to quantify exercise-induced oxidative stress recovery during lab-simulated hypoxic and hypobaric conditions following a common bout of exercise.

**Methods:** At a base elevation of 975m, physically active participants (n=16), ages 18-40, provided informed consent prior to performing 60 minutes of cycle ergometry at 70% watts max. Using a randomized counter-balanced crossover design participants recoded for 4 hours in 3 lab-simulated conditions; 1008m normobaric normoxia (NN, 675mHg, 18.8%FiO2), 4400m normobaric hypoxia (NH, 675mHg, 12%FiO2), or 4400m hypobaric hypoxia (HH, 440mHg, 12%FiO2). O2 saturation was confirmed via pulse oximetry throughout the 3 exercise-recovery trials. Blood samples were collected in heparinized vacuum tubes at time points Pre, Post, 2 Hours Post, and 4 Hours Post exercise. Blood plasma was analyzed for the quantification of oxidative stress to proteins (protein carbonyls, PC; 3-nitrotyrosines, 3NT), lipid hydroperoxides, LOOH, nitrosothiols, 8-ISO, and antioxidative capacity (ferric reducing ability of plasma, FRAP, trolox equivalent antioxidant capacity, TEAC).

**Results:** Plasma TEAC, FRAP, 8-ISO and PC were unaltered by exercise and recovery environments (p>0.05). Exercise-induced increases in LOOH and 8-ISO were significantly different among conditions (p<0.05). Levels of 8-ISO in NH and HH were significantly lower than PC in NN, HH and NH, respectively. There was a significant main effect of condition for PC (F = 4.076; p = .016), with a significantly higher PC in NH compared to HH and NN. A significant main effect of condition was observed for LOOH (F = 3.024; p = .023). Specifically, LOOH was significantly lower in NH compared to 8-10min (8.01 ± 1.17%) and 18-20min (7.50 ± 1.24%).

**Conclusions:** These data indicate that exercise recovery in simulated conditions of NH and HH do not impact a common panel of blood oxidative stress measures.

---

**C-44**

**Free Communication/Poster - Cold/Dive/Space Physiology**

**Board #197**

**May 31 8:00 AM - 9:30 AM**

**Precooling With An Ice Vest: Effect On Core Temperature And Heart Rate While Swimming**

Brent Alumbaugh, Shelbi Peters, Leah Hendrick, Michael Reeder, Colorado Mesa University, Grand Junction, CO.

(No relevant relationships reported)

Precooling has been shown to improve athletic performance by decreasing core body temperature prior to exercise, thus delaying the onset of core heating and decreasing heart rate at given intensities during training and competition. Previous research has studied the effect of precooling on cyclists and runners, but very little research has observed core temperature (CT) and heart rate (HR) response to precooling in collegiate female swimmers. **Purpose:** To observe the effect of precooling on core temperature and heart rate prior to swimming 1600 yards. **Methods:** Eleven female collegiate swimmers participated in randomized, crossover swimming trials with and without precooling. Trials were separated by one week with each subsequent trial performed at the same time of day. Precooling trials started 45 minutes prior to non-precooling trials and subjects precooled wearing an ice vest with a wet t-shirt prior to the exercise trial. All trials had a 15 minute warm up consisting of a 400yd swim, 200yd kick, and four sets of 50yd drill, followed by a 200yd cool down. Core temperature monitoring was performed during a main set of 1600 yards, swam at 75% of fastest mile pace, broken into eight, 200yd intervals. CT, heart rate (HR), and rating of perceived exertion (RPE) were measured before and after warm-up and at 200yd intervals for the remainder of the trial. **Results:** Group precooling CTs were significantly lower. Group precooling HRs were not significantly different (p=0.20), however seven of the subjects did present significantly lower (p<0.05) lower HRs during the precooling trial. **Conclusion:** Precooling, using an ice vest 45 minutes prior to exercise, was shown to significantly reduce core temperature during swimming compared to non-precooling. Individual response in HR between subjects was observed, with the majority of subjects (7/11) responding with a significant decrease in HR in the precooling condition.

**Keywords:** Core Temperature, Precooling, Ice Vest, Core Temperature PIII, Swimming
cycling exercise at 60% VO<sub>max</sub>. Furthermore, MPT significantly increased from the beginning of exercise, suggesting an increase in action potential conduction velocity.

### 1391
**Board #199 May 31 8:00 AM - 9:30 AM**

**Habitation to the Cold Pressor Test**

Alyssa Leger, David Bellar. University of Louisiana at Lafayette, Lafayette, LA.

(No relevant relationships reported)

During acute cold exposure, a stress response is induced. **PURPOSE:** The purpose of this study was to see if daily, cold water exposure to the dominant hand causes habituation to the stress responses that occur due to cold exposure. **METHODS:** Fourteen seemingly healthy men (age=22±2; 2 years, height=70±3; cm, body fat %17.5±2; 12.9%) participated in the study. Subjects performed the cold pressor test (CPT) a total of 20 times for 4 weeks (5 times per week). Data was collected during the first and final day of the 20-day habitation period. Blood glucose levels were measured before and immediately after the CPT. Subjects were asked to respond to both pain and thermal sensation scale every 30 seconds during the CPT testing. **RESULTS:** A repeated measures ANOVA showed a significant main effect for time for glucose, day 1 versus the final day (F=5.16; p<0.05). A paired t-test also revealed a significant difference between the changes in glucose levels (pre-CPT-post-CPT), day 1 versus the final day (mean difference=11.79; t=2.27; p<0.05). The mean change pre to post CPT in glucose on day one was 12±13 mmol/L, and the mean change in glucose on the final day was 5±8 mmol/L. Repeated measures ANOVA showed a significant main effect for time for pain scale, but there was no significant main effect for time for thermal sensations (pain scale: F=27.39; p<0.01) (thermal sensation: F=68; p<0.72). Pain scale responses decreased significantly while thermal sensations remained unaltered. The average pain score on day one was 35.45, and on the final day 13.1.

**CONCLUSION:** This study found a significantly decreased glucose response after 20 days of cold water exposure to the hand. This demonstrates habituation to the stress response. The perception of pain decreased significantly, but not thermal discomfort. More studies are needed to further the investigation on the physiological processes that habituated due to repeated cold exposure.

### 1392
**Board #200 May 31 8:00 AM - 9:30 AM**

**Afterdrop Effect during Recovery after Aerobic Exercise in a Cold vs Moderate Temperature Environment**

Jeremiah A. Vaughan, Brittany N. Followay, Savannah R. Hall, Joseph A. Laudato, Elliott Arroyo, Cody S. Dulaney, Adam R. Jajtner, Ellen L. Glickman, FASCM. Kent State University, Kent, OH. (Sponsor: Ellen L. Glickman, FASCM)

(No relevant relationships reported)

**PURPOSE:** To examine the effect of after drop following a bout of aerobic exercise and exposure to a cold compared to moderate temperature during recovery. **METHODS:** Fourteen seemingly healthy men (age=22±2; 2 years, height=70±3; cm, body fat %17.5±2; 12.9%) participated in the study. Subjects performed the cold pressor test (CPT) a total of 20 times for 4 weeks (5 times per week). Data was collected during the first and final day of the 20-day habitation period. Blood glucose levels were measured before and immediately after the CPT. Subjects were asked to respond to both pain and thermal sensation scale every 30 seconds during the CPT testing. **RESULTS:** A repeated measures ANOVA showed a significant main effect for time for glucose, day 1 versus the final day (F=5.16; p<0.05). A paired t-test also revealed a significant difference between the changes in glucose levels (pre-CPT-post-CPT), day 1 versus the final day (mean difference=11.79; t=2.27; p<0.05). The mean change pre to post CPT in glucose on day one was 12±13 mmol/L, and the mean change in glucose on the final day was 5±8 mmol/L. Repeated measures ANOVA showed a significant main effect for time for pain scale, but there was no significant main effect for time for thermal sensations (pain scale: F=27.39; p<0.01) (thermal sensation: F=68; p<0.72). Pain scale responses decreased significantly while thermal sensations remained unaltered. The average pain score on day one was 35.45, and on the final day 13.1.

**CONCLUSION:** This study found a significantly decreased glucose response after 20 days of cold water exposure to the hand. This demonstrates habituation to the stress response. The perception of pain decreased significantly, but not thermal discomfort. More studies are needed to further the investigation on the physiological processes that habituated due to repeated cold exposure.

### 1393
**Board #201 May 31 8:00 AM - 9:30 AM**

**Thermal Responses Associated with Prolonged Cycling in Cold Temperature**

Cody S. Dulaney, Adam R. Jajtner, Jeremiah A. Vaughan, Brittany N. Followay, Elliott Arroyo, Savannah R. Hall, Joseph A. Laudato, Ellen L. Glickman FASCM Exercise Physiology Department, Kent State University, Kent, OH
cody dulaney. Kent state university; Kent, OH. (Sponsor: Ellen G Glickman, FASCM)

(No relevant relationships reported)

**PURPOSE:** To assess thermal responses to exercise in cold versus moderate temperature. **METHODS:** Recreationally active men (n=5; 23.4±2.2 years; 183.1±6.1 cm; 86.9±11.9 kg; 4.44±0.75 L·min<sup>-1</sup>) completed a cycling protocol in 5°C (LT) and 22°C (MOD). The protocol consisted of 60-min cycling at 60% VO<sub>max</sub> (C<sub>L</sub>D), 15-min rest, and a time to exhaustion at 90% VO<sub>max</sub> (TTE). Mean skin (T<sub>S</sub>) and core temperature (T<sub>C</sub>) were evaluated before CT (BL) and at 3, 20, 40, and 60 min. Metabolic heat production (M) was assessed at BL, 3, 15, 30, and 60 min. Tissue insulation (I) was measured at 30, and 60 min T<sub>g</sub>-T<sub>S</sub> and I were measured before (PRE) and after (POST) TTE. M was measured at PRE, at the mid-point (MID), and POST TTE. Changes were analyzed using within-subjects repeated measures ANOVA.

**RESULTS:** An interaction was observed for T<sub>s</sub>-T<sub>c</sub> during C<sub>L</sub>D (F = 64.06 p < 0.001), T<sub>s</sub>-T<sub>c</sub> was lower in LT versus MT (p < 0.001) at 3 min (25.5±0.7°C, 30.7±0.6°C, respectively), 20 min (23.0±0.7°C, 30.4±0.8°C, respectively), 40 min (22.4±0.6°C, 30.4±0.8°C, respectively) and 60 min (21.9±1.0°C, 29.9±1.3°C, respectively). No interaction (F = 5.97; p < 0.01) T<sub>s</sub>-T<sub>c</sub> was observed for T<sub>c</sub>. A time effect was observed for M during the C<sub>L</sub>D (F = 25.8, p < 0.001, η<sup>2</sup> = 0.866). M increased from 3 min (348.2±36.9 W m<sup>-2</sup>) at 15 min (375.8±35.6 W m<sup>-2</sup>; p = 0.006), 30 min (383.6±37.6 W m<sup>-2</sup>; p < 0.001), 45 min (384.6±35.2 W m<sup>-2</sup>; p = 0.001) and 60 min (391.2±34.0 W m<sup>-2</sup>; p = 0.004). An interaction was observed for M during TTE (F = 29.08 p < 0.001, η<sup>2</sup> = 0.879), with M lower during LT versus MT at PRE (113.9±28.7 W m<sup>-2</sup>; 309.2±103.2 W m<sup>-2</sup>; respectively; p = 0.016), MID (154.3±54.3; 529.8±6.53 W m<sup>-2</sup>; respectively; p < 0.001), and POST (176.3±26.6; 577.6±59.6 W m<sup>-2</sup>; respectively; p < 0.001).

**CONCLUSION:** As expected, I increased in 5°C compared to 23°C, while M increase during submaximal exercise. However, M decreased during excessive exercise perhaps due to fatigue.

Long duration spaceflights have been associated with profound dysregulation of the immune system, which could jeopardize crew safety and mission success. Recent studies have examined the impact of long-duration spaceflight on specific markers of adaptive and innate immunity, but no study to date has characterized humoral immunity and serological markers of B-cell function. **PURPOSE:** The aim of this study was to characterize acute and chronic changes in polyclonal Free Light Chains (FLC) and in Immunoglobulin class switching, indicative of overall B-cell function, by retrospectively analyzing archived plasma samples collected during long-duration spaceflight studies. **METHODS:** Plasma samples were collected before flight, during (“Early Flight”, “Mid-flight” and “Late flight”), immediately upon return and during a recovery period (R18, R33 and R66) from 23 astronauts and 6 age/gender-matched healthy ground-based controls. Plasma kappa and Lambda Free Light Chains were measured using commercially available ELISA kits (Abingdon Health, Oxford, UK), and changes in renal function were identified by calculating Cystatin C-derived estimates of Glomerular Filtration Rate (eGFR). Finally, Immunoglobulin isotype switching was assessed by measuring changes in total plasma IgA, IgG and IgM through ELISA kits (Biolegend, San Diego, CA, USA). Maximum likelihood linear mixed models (LMM) were used to determine main effects of time on the concentration of serum FLC, Immunoglobulins and Cystatin C.

**RESULTS:** There was no difference in serum kappa and Lambda FLC between pre-flight samples and either in-flight or recovery samples (p>0.05). Furthermore, serum levels of IgA, IgG and IgM remained unchanged during and after spaceflight, when compared to pre-flight values (p>0.05). Finally, there was no difference in eGFR (p>0.05) between, before and during flight, suggesting that kidney function was not affected by spaceflight. **CONCLUSION:** These preliminary findings indicate that free light chains...
Power But Not Fatigue Is Influenced By Hot And Cold Immersion Prior To Vigorous Cycling

Donald L. Hoover, Samuel K. Knott, Christopher A. Bidwell, Carrie A. Revlett, Sarah E. Parks, Daren T. Webb, Lawrence W. Judge, Elizabeth Norris, Scott W. Arnett. Western Michigan University, Kalamazoo, MI. Western Kentucky University, Bowling Green, KY. Western Kentucky University, Bowling Green, IN. Ball State University, Muncie, IN. (No relevant relationships reported)

PURPOSE: The impact of hot and cold immersion upon vigorous physical activity is not fully understood. Increased body temperature has been linked to improved performance during vigorous activities, whereas lower body temperature has been noted as detrimental during maximal exercise. A deeper understanding of the effect of heat and cold immersion on fatigue characteristics during the Wingate Anaerobic Test (WAnT) may better understand how to best construct training and rehabilitation programs. The purpose of this study was to explore the effects of hot and cold immersion on measures of power and fatigue while completing a maximal bout of anaerobic cycling.

METHODS: Thirty apparently healthy and physically active women (23.02±2.67 yr, 165.77±5.95 cm, 61.97±10.56 kg) completed this study. Participants visited the laboratory on three occasions. Using a counterbalanced design, each completed the WAnT following three immersion protocols: HOT, COLD, and no immersion (CON). Each then rode an electronically-braked cycle ergometer at maximal intensity for 30 seconds. Conditions were controlled and measured by computer. Indices of peak power (PP), mean power (MP), and fatigue index (FI) were calculated using 5-second time periods. Repeated measures ANOVA were used for statistical analysis. Statistical significance was set at the p ≤ 0.05 level.

RESULTS: Significant differences were found between conditions for PP [F(2,28)=3.918, p≤ 0.032) and MP [F(2,28)=101.71, p< 0.001)], respectively. Pairwise comparisons using the Bonferroni correction indicated that PP (p≤ 0.024) was significantly different between HOT and COLD conditions, and MP (p< 0.001) was significantly different between HOT, COLD, and CON conditions. Non-significant differences were found between the warm-up conditions for PP [F(2,28)=0.32, p= 0.968]).

CONCLUSIONS: The measures for PP and MP were improved following heat immersion. These findings suggest heat immersion had a stimulatory effect upon performance in this study. Conversely, no differences were found between conditions regarding FI. This element suggests that the types of immersion therapy used in this study were essentially neutral in affecting power output during maximal cycling.

Central Chemosensitivity is Augmented during Thermoneutral Head Out Water Immersion in Healthy Adults

James R. Sackett, Zachary J. Schlader, Christopher L. Chapman, Blair D. Johnson. University at Buffalo, Buffalo, NY. (Sponsor: Dave Hostler, FACSM) (No relevant relationships reported)

Carbon dioxide (CO2) retention occurs during water immersion and increases the risk of CO2 toxicity. The central chemoreceptors primarily mediate the rise in ventilation during hypocapnia. However, it is unknown if central chemosensitivity is altered throughout two hours of head out water immersion (HOWI) in healthy adults.

Purpose: We tested the hypothesis that central chemosensitivity is blunted throughout two hours of HOWI in healthy adults. Methods: We assessed central chemosensitivity in 17 subjects (age 22±1 y, BMI: 25±2 kg/m², 7 women) during a thermoneutral (35°C/0°C) HOWI trial and a time-control dry trial at baseline, 10 min, 60 min, 90 min, 120 min, and post. The partial pressure of end tidal CO2 (PETCO2; capnometer) and minute ventilation (pneumotachometer) were recorded continuously. Central chemosensitivity was evaluated via a rebreathing test. Subjects rebreathed 7% CO2 from a 10 L bag for 3.5 min. Central chemosensitivity was calculated as the slope of the linear regression line of minute ventilation vs. PETCO2, every 30 s throughout the data. The data were plotted as a change from baseline (mean ± SD). Results: PETCO2 increased from baseline during HOWI at 10 min (+1.12±0.66 mmHg), 60 min (+2.12±1.18 mmHg), 90 min (+2.12±1.18 mmHg), and 120 min (+2.12±2.11 mmHg) (all p<0.01). The change in PETCO2 was greater during HOWI vs. control at 10 min, 60 min, 90 min, and 120 min (all p<0.01). The change in minute ventilation did not differ over time (p=0.50) or between conditions (p=0.09). Central chemosensitivity increased from baseline during HOWI at 10 min (+0.68±0.51 L/min/mmHg), 60 min (+0.70±0.69 L/min/mmHg), 90 min (+0.73±0.92 L/min/mmHg), 120 min (+0.85±1.09 L/min/mmHg), and post (+0.39±0.72 L/min/mmHg) (all p<0.01). Central chemosensitivity also increased from baseline during control at 120 min (+0.36±0.52 L/min/mmHg, p<0.04). The change in central chemosensitivity was greater during HOWI vs. control at 10 min, 60 min, 90 min, and 120 min (all p<0.01). Conclusion: These findings indicate that central chemosensitivity is augmented during two hours of thermoneutral HOWI. Thus, it is unlikely that changes in central chemosensitivity contribute to CO2 retention during water immersion.
The results of this study suggest a need for additional analyses to help develop "personalized" exercise countermeasures for those undergoing significant periods of unloading (e.g., people in bed rest or Astronauts)."—EndFragment—

Reliability of the Portable Metabolic Gas Analysis System used on the International Space Station

Alan D. Moore, FACSM1, Meghan E. Downs2, Shannon L. Jordan1, Alan H. Feiveson3, Jamie R. Guined4, Stuart MC Lee1
1Lamar University, Beaumont, TX; 2KBWyle, Houston, TX.
3NASA-Johnson Space Center, Houston, TX; 4University of Houston, Houston, TX.

(No relevant relationships reported)

Metabolic gas analysis is utilized for both research and medical operations purposes on the International Space Station (ISS). Data regarding reliability of metabolic gas analysis system used on board the ISS, the Portable Pulmonary Function System (PPFS—Danish Aerospace Corporation, Odense, DK), has not been reported. PURPOSE: To determine the reliability and intra-subject repeatability of metabolic gas analysis data collected by the PPFS. METHODS: Subjects (n=9, 5M, 3F) performed 3 peak cycle tests, consisting of 5 min stages designed to elicit 25%, 50%, and 75% peak oxygen consumption (VO2peak) followed by stepwise increases of 25 W/min until reaching volitional exhaustion. Metabolic gas analysis was performed using the PPFS during these tests. Intraclass correlation coefficients (ICC), within-subject standard deviations (WS SD), and coefficients of variation (CV %) were calculated. RESULTS: The ICC, WS SD and CV % for peak exercise are contained in the table below. Across all exercise stages, the ICC values for oxygen consumption (VO2), carbon dioxide production (VCO2), and ventilation (VVE) ranged from 0.79 to 0.99; however, the ICC for respiratory exchange ratio (RER) indicated poorer agreement between trials (ICC=0.11 to 0.51). The CV values for all dependent variables ranged from 2.6% to 31.9%, which are consistent with reported values obtained using other metabolic gas analysis devices.

<table>
<thead>
<tr>
<th>Variable</th>
<th>ICC</th>
<th>WS SD</th>
<th>CV (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VO2peak (L/min)</td>
<td>0.98</td>
<td>0.11</td>
<td>3.6</td>
</tr>
<tr>
<td>VCO2peak (ml/kg/min)</td>
<td>0.92</td>
<td>1.91</td>
<td>4.6</td>
</tr>
<tr>
<td>RER</td>
<td>0.94</td>
<td>0.18</td>
<td>5.4</td>
</tr>
<tr>
<td>VVE (L/min)</td>
<td>0.94</td>
<td>6.34</td>
<td>5.6</td>
</tr>
<tr>
<td>Peak Watts</td>
<td>0.96</td>
<td>10.32</td>
<td>3.7</td>
</tr>
</tbody>
</table>

CONCLUSIONS: The PPFS appears to yield reliable metabolic gas analysis data. Lower reliability of RER measurements are reported in the literature using other devices as is not likely a function of the PPFS. The PPFS appears to yield precise and reliable data for research and monitoring of human adaptation to spaceflight.

Thermoregulatory Responses To Moderate-intensity And High-intensity Cycling In The Heat

Eliott Arroyo, Brittany N. Followay, Jeremiah A.baugh, Cody S. Dulaneay, Joseph A. Laudato, Savannah R. Hall, Ellen L. Glickman, FACSM, Adam R. Jajtner
1Kent State University, Kent, OH. (No relevant relationships reported)

PURPOSE: To examine the thermoregulatory responses to moderate- and high-intensity cycling in the heat. METHODS: Recreationally active Caucasian men (n=5, 24±2.9 yrs; 183.6±6.2 kg; 117.7±2.8%BF; 48.9±6.2 ml·kg⁻¹·min⁻¹) completed an exercise protocol under two conditions: high temperature (HT, 35ºC) and moderate temperature (MT, 22ºC). The protocol consisted of 60 minutes of cycling at 60% VO2max (CTmax), 15-minute rest period, and a time to exhaustion trial at 90% VO2max (TTE). Mean skin temperature (Tsk; °C), core temperature (Tmc, °C), and thermal sensation (TS) were evaluated before CTmax (BL) and at minutes 3, 20, 40, and 60. Metabolic heat production (M, W·m⁻²) was evaluated at BL and at minutes 3, 15, 30, 45, and 60. Tissue insulation (I, m²·W⁻¹) and physiological strain index (PSI) were evaluated at minutes 3, 15, 30, and 60 of CTmax. Tsk, Tmc, TS, PSI, and M were measured before (PREmax) and after (POSTmax) TTE. M was measured at PREmax during TTE (MIDmax), and POSTmax. Changes were analyzed using a two factor (time x trial) within-subjects repeated measures ANOVA.

RESULTS: For MT, Tsk was lower at all timepoints relative to BL (p<0.014–0.028). For HT, Tsk was higher at all timepoints relative to BL (p<0.003–0.005). Tmc was significantly higher in HT compared to MT at minutes 3, 20, 40, and 60 (p<0.001–0.033). Tsk was significantly higher in HT compared to MT (p<0.001). Tsk was higher at all timepoints relative to BL (p<0.001–0.004) during CTmax and was significantly higher during HT compared to MT (p<0.003). In HT, Tsk decreased from PREmax to POSTmax (p<0.002). Tsk was significantly higher in HT compared to MT (p<0.009) and POSTmax (p<0.003). M was higher at minutes 15, 30, 45, and 60 relative to 3 min (p<0.001–0.047) and increased at MIDmax, and POSTmax (p<0.001) relative to PREmax, was significantly lower during HT compared to MT at minutes 3, 20, 40, and 60 (p<0.001–0.001), was lower at POSTmax relative to PREmax, and was significantly higher in HT compared to MT at times 20, 40, and 60 (p<0.0001–0.009). PSI was significantly higher in HT compared to MT at PREmax (p<0.047). CONCLUSION: As expected, tissue insulation is decreased, and physiological strain index is increased during exercise in the heat.

Effects Of Wrist Cooling On Balance And Cognitive Performance In The Heat

Rachel K. Katch, Ryan Curtis, Anders Almeraya, Rebecca L. Stearns, Douglas J. Casa, FACSM. University of Connecticut, Storrs, CT. (Sponsor: Dr. Douglas J. Casa, FACSM)

(No relevant relationships reported)

Many cooling modalities exist in the literature claiming to improve performance in the heat; however, there’s a paucity of literature regarding wrist cooling’s effects on balance and cognitive performance after a bout of exercise in the heat. PURPOSE: To examine the effects of wrist cooling influences on balance and cognitive performance after a bout of exercise in the heat. METHODS: Twenty male participants, age (22±4 years; height, 182±7 cm; body mass, 75.4±8.7 kg; body fat %, 10.7±3.4%) were analyzed. In an environmental heat chamber (39.5±0.9 °C, 38.6±5.2% RH) participants underwent three randomized 135-minute cycling trials, which included: one wrist cooling device (W1), two wrist cooling devices (W2), and no wrist cooling device (W0) during exercise. Cognitive measures (Balance Error Scoring System [BESS], Letter Digit Substitution Test [LDST], Trail Making Test [TM]) were conducted immediately post-exercise, and delta scores were calculated from a baseline familiarization session. Rectal temperature (Trec) was taken every 15 minutes during exercise. A group x time interaction was observed for metabolic or EMG analyses. A time effect (F=145.23, p<0.001, η²=0.973) was observed for VO2max, VO2 was lower (p<0.001) at PRE (1.78 ± 0.52 L·min⁻¹) than MID (2.97 ± 0.48 L·min⁻¹) and POST (3.15 ± 0.53 L·min⁻¹). A time effect (F=222.182, p<0.001, η²=0.982) was observed for VCO2. VCO2 was lower (p<0.001) at PRE (1.401 ± 0.371 L·min⁻¹) than MID (2.97 ± 0.72 L·min⁻¹) and POST (3.49 ± 0.48 L·min⁻¹), while MID was lower than POST. A time effect on V̇E (F=87.523, p<0.001, η²=0.956) indicated increases (p<0.005) from PRE (37.4±6.95 L·min⁻¹) to MID (67.7±21.72 L·min⁻¹) to POST (86.4±17.95 L·min⁻¹). A time effect (F=45.382, p<0.002, η²=0.002) for HR indicated increases (p<0.005) from PRE (150.80 ± 29.0 bpm) to POST (183.8 ± 15.8 bpm). A time effect (F=4.720, p<0.004, η²=0.541) of MPP indicated no differences across time points. Conclusions: LT had no effects on TTE endurance. Endurance in MT may be better compared to HT, though metabolic and EMG variables are likely not responsible for this difference.
repeated measures ANOVA was conducted to determine group differences, and paired samples t-tests were used to determine mean differences. RESULTS: No statistical difference between Tc before and after the TTE and W2 occurred (W2: 39.1 ± 0.4°C; W1: 39.0 ± 0.4°C). No statistically significant difference was observed in Tdp between W0 and W2. Significant differences were noted in BESS delta scores between W0 and W2, specifically for the single leg and the tandem, in which performance improved (vs. W1) as follows: W1: 2±1.1; W2: 1±0.8. CONCLUSION: Wrist cooling during the exercise in the heat did not have an effect on Tdp, LDST, and TM scores; however, it did significantly improve single leg foam stance of the BESS testing post-exercise. Further research is warranted to investigate the potential link of body cooling and performance balance, as well as the effectiveness of wrist cooling on cognitive measures after exercising in the heat.

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

**S282 Vol. 49 No. 5 Supplement**

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

**1403 Board #211 May 31 8:00 AM - 9:30 AM**

**Game-to-Game Increases in Core TemperatureDuring Rugby 7’s World Series Tournaments**

Lee Taylor, FACSM1, Heidi Thornton2, Nick Lumley1, Christopher Stevens1. 1Aspetar – Orthopaedic and Sports Medicine Hospital, Doha, Qatar. 2Newcastle Knights Rugby League Club, Newcastle, Australia. 3Scottish Rugby Union, Edinburgh, United Kingdom. 4Southern Cross University, Coffs Harbour, Australia. (No relevant relationships reported)

**PURPOSE:** Characterize player core temperature (Tc) across two separate World Rugby 7’s Series (WRSS) tournaments in temperate and warm environments.

**METHODS:** Continuous Tc (ingestible e-Celsius™ capsule) was collected in seventeen separate playing members of one team’s sex (Singapore: n = 12, London: n = 11, with n = 6 competing in both tournaments) competing at the Singapore (warm) and London (temperate) WRSS tournaments. Symptoms of exertional heat illnesses (EHI), cooling strategy use, playing minutes and wet bulb globe temperature (WBGT) were collected. Linear mixed models were used and a magnitude-based inference network was used to describe differences in delta Tc between all periods (baseline, pre-warm-up, warm-up, pre-game, game and post-game) within and between tournaments. **RESULTS:** There were substantial game-to-game Tc increases relative to baseline, particularly within second and third games, on all match-days. Despite high peak Tc values (Singapore 39.9°C; London 39.6°C); (1) no signs and symptoms of EHI were reported by players; (2) voluntary post-game CWI usage was low; and (3) other pre- and during- and post-game cooling maneuvers were not implemented. Magnitude of Tc response was associated with playing minutes [excluding London Day 2 (Effect size; ES = 0.87–1.46) and WBGT [excluding Singapore Day 1 (ES = 0.54–0.60)].

**CONCLUSION:** Tc demonstrated game-to-game increase with peak temperatures approaching thresholds associated with EHI (>40°C) and exceeding those demonstrated to decrement repeated sprint performance (>39°C), despite the short game duration. Practitioners may consider the use of acclimation/acclimatization programs (preferentially) and practice compatible cooling strategies to minimize Tc increases and maximize recovery and preparedness for games within and between match-days. Supported by Aspire Zone Foundation (AZF; Doha, Qatar) funding.

**1404 Board #212 May 31 8:00 AM - 9:30 AM**

**Effect of Thermal Stress on Cycling and Plasma Volume Shifts, Body Weight and Water Intake**

Joseph A. Laudato, Eileen L. Glickman, FACSM, Brittany N. Followay, Jeremiah A. Vaughan, Elliott Arroyo, Cody S. Dulaney, Savannah R. Hall, Adam R. Jajtner, Kent State University, Kent, Ohio. (Sponsor: Eileen Glickman, FACSM) (No relevant relationships reported)

**PURPOSE:** To examine the effects of environmental stress while cycling, and its influence on hydration status. **METHODS:** Recreationally active men (n=5, 24.2 ± 2.6 years; 183.6 ± 5.6 cm; 80.0 ± 4.0 kg; 11.7 ± 2.5 %BF; 3.9 ± 0.3 L·min−1) completed 4 trials, with the first consisting of a VO2 max test, and the remaining 3 trials involving cycling at 5°C (LT), 23°C (MT), and 34°C (HT) in a counterbalanced manner. Each trial consisted of 60 min of cycling at 60% VO2 max, 15-min rest, and a time to exhaustion (TTE) at 90% of VO2 max. Blood was drawn prior to (PRE), immediately following (60), after TTE and 1-h post-trial (REC). An automated hematology analyzer measured hematocrit (Hct) which was used to calculate plasma volume shifts (PVS) which were calculated using the formula established by Dill & Costill (1974). Body weight (BW) and water intake (WATER) was assessed at each time point, while urine specific gravity (USG) was assessed at PRE and REC. All data were analyzed using within-subjects repeated measures ANOVA. **RESULTS:** A trial x time interaction was observed for PVS (F= 5.51; p=0.041; η2= 0.655). Post Hoc analysis indicated that at REC, PVS were greatest in LT (14.72 ± 2.33%) compared to HT (9.33 ± 1.77%; p=0.032), but not a main effect of time (F=0.655; p=0.595; η2= 0.141), or trial (F=0.515; p=0.616; η2= 0.114) in BW. A main effect of trial was observed in WATER (F= 29.156; p=0.001; η2= 0.879). WATER was lower in LT (399.2 ± 186.9 ml) than MT (903.9 ± 302.6 ml; p=0.001) and HT (1386.0 ± 216.8 ml; p=0.021), and greater in HT than MT (p=0.033). There was no trial x time interaction nor main effect of time or trial in USG. **CONCLUSIONS:** Cycling resulted in a greater PVS at REC for LT, compared to HT and MT. For MT and HT, PVS were reduced at REC when compared to 60 and TTE, revealing a resolution of plasma volume post-trial. As expected, water intake increased as trial temperature increased.

**1405 Board #213 May 31 8:00 AM - 9:30 AM**

**World Championship Heat Stress Preparation: A Comparison Of IAAF And UCI Athletes**

Julien Piéard1, David Nichols2, Sebastien Racinais3. 1University of Canberra, Canberra, Australia. 2Aspetar Sports Medicine Hospital, Doha, Qatar. 3Aspetar – Orthopaedic and Sports Medicine Hospital, Doha, Qatar. (Sponsor: David Pyne, FACSM) (No relevant relationships reported)

**PURPOSE:** To compare exertional heat illness (EHI) history and preparedness to compete in the heat at the Beijing, China 2015 IAAF (athletics) and Doha, Qatar 2016 UCI (road cycling) World Championships. **METHODS:** Responses to a pre-competition questionnaire evaluating EHI history, heat countermeasure strategies and recovery approaches were compared in 307 IAAF and 69 UCI respondents (32% and 7% participation rate, respectively). The IAAF event was held in ~29°C and ~58% RH conditions, and the UCI event in ~37°C and ~25% RH. A Chi-square test of independence was employed to compare sports. **RESULTS:** Both the IAAF (48%) and UCI (57%) athletes had experienced EHI symptoms, with 29% of IAAF athletes and 17% having been diagnosed with EHI, respectively (P<0.001). Only 15% of IAAF athletes trained in the heat (5-30 days) before the championships, in contrast to 32% of the cyclists (P<0.001). Half of the IAAF athletes (52%) had a precouling strategy compared with 96% of the cyclists (P<0.001). Ice slurry ingestion was the most prevalent strategy in athletics and wearing an ice-vest during the warm-up was most common for cyclists. Almost all IAAF (96%) and all UCI athletes (100%) had a fluid consumption strategy (P=0.001), which differed based on event category (field, sprints and distance events; time trials and road race). The volume of fluids planned on being consumed also differed between event categories within each sport, although water was the fluid most commonly consumed. Most IAAF athletes (89%) planned on using at least one recovery strategy with the most frequently employed being massage, active recovery, stretching and cold-water immersion. The majority of cyclists (92%) planned on using one or more recovery strategies with massage, stretching and active recovery the most prevalent. **CONCLUSION:** Athletes competing at the 2015 IAAF and 2016 UCI World Championships reported a similar history of heat illness. Along with most athletes competing throughout the northern hemisphere summer months, 15% of IAAF athletes surveyed prepared specifically for the event by training in the heat, whereas 32% of the cyclists reported undertaking some form of heat training. Approximately half of the IAAF athletes and almost all the UCI athletes had a precouling strategy. Most athletes in each sport had a fluid consumption and recovery strategy.

**Continuous measurement of rectal temperature (RT) using a wired rectal probe (WRP) comes with obvious technical difficulties and practical limitations. Measurement of RT using a telemetric pill (TP) inserted as a suppository to act as a rectal probe would circumvent some of those problems. **PURPOSE:** Validate the use of a commercially available gastrointestinal TP (H2O Inc.) for the continuous measurement of RT during slow and rapid increase and decrease in core temperature induced by periods of passive cooling, heat stress, active cooling, heating, active and passive cooling. **METHODS:** 30 healthy volunteers (30 ± 9 yrs; 175 ± 7 cm; 75 ± 9 kg) underwent a research protocol where they completed, while wearing a WRP (YSI 401) linked to a TP: 1) a 30 min sitting period (23°C) followed by 2) a 45 min sitting period inside a head-out environmental chamber (40-42 °C); 3) a 45 min sitting period (23°C) while ingesting, over the first 30 min, 7.5 g of shaved ice (1°C 100% energy intake;) in a running exercise period (38 °C, 20-30 °C RH) at 68% VO2max until a WRP temperature of 39.5°C and; 5) a cold-water (10°C) immersion period until a WRP decrease in temperature of 1°C. The WRP and each TP were calibrated before experiments. A
bias ± random error contained within ± 0.35°C (daily variation in RT of ± 0.25°C + sensors measurement error of ± 0.1°C) around the zero line was deemed acceptable between sensors. Furthermore, the rate of change was different during phases 1, 2, 3, 4 and 5 was respectively of -0.008 ± 0.007°C/min and -0.006 ± 0.004°C/min, 0.003 ± 0.005°C/min and 0.002 ± 0.004°C/min, -0.011 ± 0.002°C/min, 0.057 ± 0.010°C/min and 0.054 ± 0.008°C/min and -0.141 ± 0.124°C/min and -0.091 ± 0.065°C/min. Mean biases (WRP - TP) and random errors during phases 1, 2, 3, 4 and 5 were of 0.12°C ± 0.33°C, 0.15°C ± 0.22°C, 0.12°C ± 0.26°C, 0.21°C ± 0.34°C and 0.24°C ± 0.66°C, respectively CONCLUSION: The use of TPs (HQ Inc.) as suppositories tracked slow and rapid increases in RT and slow decreases in RT as measured by WRP, but did not detect the rapid decrease in RT. In all instances, however, the absolute difference between WRP and TP exceeded +/- 0.35°C. Therefore, we conclude that a TP inserted as a suppository to act as a rectal probe does not provide acceptable absolute measure of RT.

Measurement of core temperature at the gastrointestinal level with an ingestible telemetric pill (ITP) is increasingly used in research. But, unlike core temperature measured at the rectum via a rectal probe (RP), data contamination due to water or food ingestion remains a limitation of ITP. Rapid creation of a heat sink at the stomach and upper-intestinal level (duodenum to ileum), as can be obtained, for example, following shaved-ice ingestion, could potentially differently impact ITP and RP temperature measurements. In fact, the closer proximity of ITP to the heat sink than RP could result in a more important and faster rate of energy loss for ITP than RP. PURPOSE: To examine the impact of shaved-ice ingestion following exercise-induced increase in core body temperature on the degree of agreement between ITP and RP temperature measurements. METHODS: 8 healthy young men (33 ± 8 yrs, 75 ± 6 kg, 176 ± 5 cm) underwent a passive sitting period of 20 min at 20°C, after which they completed 2 exercise periods (cycling or running) at 75% of estimated maximal heart rate in a hot dry environment (31 ± 1.1°C, 32% RH) with the goal of increasing rectal core temperature by 1°C over baseline level. Following each exercise period, subjects passively seated in a 20°C ambient temperature for 45 min while ingesting, over the first 30 min, either 7.5 g of water provided at rectal temperature/kg body mass (after the first exercise) or 7.5 g of shaved-ice provided at -1°C/kg body mass (after the second exercise). Rectal (YSI 401) and gastrointestinal temperatures (HQ Inc.) were measured continuously during the experiments. ITPs were ingested 10 h prior to arrival time at the laboratory. RESULTS: The rate of decrease in RP and ITP temperatures during water ingestion was respectively of 0.017 ± 0.006°C/min and 0.018 ± 0.008°C/min, compared to 0.025 ± 0.006°C/min and 0.026 ± 0.006°C/min for shaved-ice ingestion. Mean biases (RP - ITP) and 95% limits of agreement during the passive sitting period, first exercise period, water ingestion period, second exercise period and shaved-ice ingestion period were respectively of 0.10°C ± 0.35°C, 0.09°C/± 0.31°C, 0.17°C/± 0.66°C, 0.12°C/± 0.38°C and 0.16°C/± 0.64°C. CONCLUSION: The present results indicate that the creation of a heat sink at the stomach and upper-intestinal level does not alter the degree of agreement between RP and ITP.

Environmental temperatures perceived as comfortable in the summer season are often perceived as uncomfortable and even extreme during the winter, and vice versa. During rest, behavioral thermoregulation is driven by thermal discomfort, which is largely mediated by changes in skin temperature. Thus, it is likely that seasonal acclimatization shifts the skin temperature thresholds that elicit behavioral thermoregulation. However, this is unknown.

METHODS: Test the hypothesis that skin temperatures upon the decision to behaviorally thermoregulate differ between the winter and summer.

Results: The time prior to moving from C-to-W (S: 9.4 ± 3.4 min, W: 10.5 ± 3.9 min, P=0.46) and W-to-C (S: 15.1 ± 4.5 min, W: 14.1 ± 4.2 min, P=0.51) did not differ between seasons. Intestinal temperature at C-to-W (S: 36.8 ± 0.2°C, W: 37.1 ± 0.2°C, P=0.01) and W-to-C (S: 36.7 ± 0.2°C, W: 36.8 ± 0.3°C, P=0.05) was higher in the winter. However, mean shaving-ice temperature at C-to-W (S: 33.2 ± 4°C, W: 31.9 ± 0.8°C, P<0.01) and W-to-C (S: 35.9 ± 0.5°C, W: 34.4 ± 0.6°C, P<0.01) was lower in the winter. Thermal sensation at C-to-W (S: 2.5 ± 0.4, W: 2.7 ± 0.3, P=0.02) and W-to-C (S: 5.5 ± 0.6, W: 5.3 ± 0.4, P=0.49) did not differ between seasons. Thermal discomfort at C-to-W (S: 1.9 ± 0.4, W: 2.0 ± 0.1, P=0.58) and W-to-C (S: 1.9 ± 0.6, W: 2.0 ± 0.2, P=0.50) also did not differ between seasons.

Conclusion: Compared to the summer, skin temperatures upon the initiation of thermoregulatory behavior were shifted to lower temperatures in the winter.

Heat stress may be an extra concern to obese and unfit adolescents while exercising. Besides the higher rate of body temperature (Tb(max)) increase, it is believed that heat stress aggravates perceived exertion (RPE), irritability and thermal sensations. However, no study has compared thermoregulatory and perceptual responses of obese and unfit girls in relation to their lean and fit peers under similar heat stress and metabolic heat production. PURPOSE: To verify thermoregulatory and perceptual responses of obese and lean girls, either fit or unfit, exercising in the heat at a similar metabolic heat production per unit of body mass (Hp). METHODS: 34 pubescent (Tanner 2 to 4) girls divided in four groups participated in the study. 21 were obese (fit and unfit) and 9 lean (fit and unfit) with similar metabolic heat production (5.0 ± 0.5 meters kg(meters squared)·hr⁻¹·min⁻¹). They cycled 2×25 min bouts, with a 10-min rest, at ~5.4 W·kg⁻¹ and 57±10 W kg⁻¹-to lose heat and gain heat in the (36°C and 40°C) RH. Rectal (Ta) and skin (Tskin) temperatures and heart rate (HR) were measured every 5 min. Additionally, RPE, irritability, thermal sensation and thermal comfort were collected throughout the exercise. Sweat losses were replenished with spring water during rest period.

RESULTS: Initial Ta and Hb were similar between obese and lean girls (37.5±0.3 and 37.2±0.3°C and 101±16.6 and 98.8±11.9°C). No difference was observed among the 4 groups (obese fit obese, lean fit and lean unfit) throughout the exercise for Ta (37.6±0.2, 37.5±0.3, 37.5±0.3 and 37.4±0.3°C, Tc 34.8±0.8, 35.1±1.0, 34.4±0.9 and 35.2±0.9°C, T0 37.0±0.2, 37.0±0.4, 36.8±0.3°C, HR 128±18, 118±12, 130±16 and 119±16 bpm. Also, no differences were observed in the perceptual responses (RPE11:2, RPE12, RPE11 and RPE11, irritability: 3±0.5, 3±0.3, 3±0.8 and 2±0.3, thermal sensation: 7±0.4, 7±0.5, 7±0.7, 6±0.7 and thermal comfort: 3±0.4, 3±0.5, 3±0.7 and 3±0.5). CONCLUSION: Regardless of the adiposity or aerobic fitness level, pubescent girls had similar thermoregulatory and perceptual responses while cycling under heat stress during a mild (~5.4 W·kg⁻¹) intensity level.
Clinical medicine defines dehydration using blood markers which confirm hypertonicity (serum sodium concentration [Na+] > 145 mmol/L) and intracellular dehydration. Sports medicine equates dehydration with a concentrated urine as defined by any urine osmolality (UOsm) ≥ 700 mosmol/kgH2O or urine specific gravity (USG) ≥ 1.020. **PURPOSE:** To compare blood versus urine indices of dehydration in a cohort of athletes undergoing routine screenings. **METHODS:** 318 collegiate athletes (193 female) provided blood and urine samples and asked to rate how thirsty they were on a 10-point visual analogue scale. Serum was analyzed for serum [Na⁺] while urine osmolality was measured using an osmometer. USG was measured using a Chemstrip. Data were categorized into Dehydrated versus Hydrated groupings based upon the above-mentioned USG and UOsm thresholds. **RESULTS:** Athletes from seven sports teams were represented (combined: height 1.75±0.1 m; weight 71.9±13.5 kg; body mass index 23.2±2.5 kg/m²). Overall, female athletes had lower USG vs. male athletes (1.014±0.006 vs. 1.015±0.006; p=0.03). Using the UOsm ≥700 mosmol/kgH2O threshold to define dehydration, 55% of athletes were classified as dehydrated. Using any USG ≥1.020 to define dehydration, 27% of these same athletes were classified as dehydrated. No athlete met the clinical definition for dehydration (hypertonicity; serum [Na+] >145 mmol/L) and normonatremia (serum [Na⁺] between 135-145 mmol/L) was maintained in 99.7% of athletes (mean serum [Na⁺] 139±9.2 mmol/L; range 134-145 mmol/L). A significant correlation was confirmed between serum [Na⁺] vs. urine osmol (r=0.18; P=0.001). However, urine concentration at the extreme ranges of dehydration did not reflect clinical abnormalities in serum markers or thirst rating (mean rating 4.4±1.8; range 0-10). **CONCLUSION:** Urine concentration thresholds (commonly used by sports medicine) classified 27.5%-55% of collegiate athletes as dehydrated, while no athlete was dehydrated according to serum [Na⁺] measurement. Practitioners should caution against using urine indices, as isolated measurements, to diagnose or monitor dehydration because urinary output is largely a response rather than a reflection of physiologically regulated blood tonicity.

Mild dehydration is associated with increased core temperature and reduced performance during endurance events in adult athletes. Little is known about hydration practices, hyperthermia, and the effects of insufficient fluid replacement on performance in young athletes during real-life competitions. **PURPOSE:** Examine voluntary fluid intake, the relation between dehydration and performance, and core temperature in adolescents during a triathlon competition in tropical climate. **METHODS:** 15 junior (14-15 yr) and 21 senior (16-18 yr) athletes competed in a triathlon (750 m swim, 18 km cycle and 4 km run) in a hot and humid environment (WBGT=27.9°C; water temp=29.0°C), in July, between 7:30 to 9:30 am. Usable specific gravity (Uₙₒₚ) was measured upon waking the day of competition. Water and sports drinks were carried in bottles on the bike, and available for each athlete in a fluid station during the run. Sweat loss was calculated from change in body weight [BW] (corrected for creatinine output) and fluid intake. Dehydration was calculated as % change in BW. Core temperature was measured in two athletes pre-competition, and at the end of the swim, cycle, and run portions, using ingestible sensors. **RESULTS:** Mean USG (1.025±0.001 g/mL) indicated that athletes were not in an adequate state of hydration upon waking. Fluid intake (juniors=471.8±161.4 and seniors=551.3±263.2 mL) replaced 46% of the sweat loss and was higher during run (juniors=10.2±3.5 and seniors=12.3±8.2 mL/min) compared to cycle (juniors=6.1±2.5 and seniors=8.0±3.4 mL/min). P<0.05. At the end of the competition, 26% of juniors and 52% of seniors had dehydrated ≥1.5%. Dehydration was associated with finishing time in senior boys (r=-0.70; P=0.01) who also showed the highest sweat rate (1.3±0.8 L/h) and faster times. Core temperature rose to 40.1°C in the girl who placed 2nd, and to 39.6°C in the boy who placed 3rd. No athletes showed symptoms of heat illness. **CONCLUSIONS:** Young athletes participating in a triathlon in tropical climate show mild to moderate levels of dehydration. Higher dehydration in senior athletes may be due to higher sweat rates and faster racing. Competition organizers should be aware that young, dehydrated athletes may become hyperthermic during triathlons in tropical climate, and should be prepared for medical interventions if needed.

**Effects of Hypohydration on Markers of Catabolism in Females Following Resistance Exercise**

Joshua J. Gann1, Thomas L. Andre2, Brooke L. Roemer3, Darryn S. Willoughby4, FACSM, 1University of Louisville-Monroe, Monroe, LA; 2Clayton St. University, Morrow, GA; 3Bayler University, Waco, TX.

**BACKGROUND:** Cortisol is elevated in times of stress and works as an inhibitor of muscle protein synthesis through binding to its glucocorticoid receptor (GR). This GR is expressed throughout the body and regulates the expression of glucocorticoid responsive genes that are involved in catabolic pathways. **PURPOSE:** The purpose of this study was to determine the effects of previous night dehydration on markers of catabolism in resistance-trained females following resistance exercise. **METHODS:** Ten healthy, resistance trained females (age 22.0±2.1 years; height 164.5±5.0 cm; mass 61.9±19.0 kg; body fat 26.7±2.9%) completed two bouts of resistance exercise,
either dehydrated (~3% body weight) (DT) or heat exposed with fluid replacement (HT). Each exercise bout consisted of one rep maximum (1RM) followed by 5 sets to failure of 75% of 1RM for muscle press and leg press. Muscle press and leg press samples were obtained prior to and 1h following exercise. Blood samples were obtained to examine cortisol. From each muscle sample, glucocorticoid receptor (DNA-G/RNA) binding and mRNA expression were determined. Data was analyzed with separate 2 (trial) x 2 (time) analysis of variance (ANOVA). Significant interactions were further analyzed with paired t-tests. RESULTS: There were no significant interaction effects for session and time and for any markers of mRNA expression. There was no significant interaction or main effects for session and time for serum cortisol. There was a significant main effect for session for GR- DNA binding (p = .043). GR-DNA binding was significantly elevated post exercise for DT (p = .016). CONCLUSION: Hydropoydration appears to have little effect on proteolytic gene expression even though GR-DNA binding was increased. It is possible that gene expression was suppressed due to participants being resistance-trained. Further research is needed to determine if hydropoydration affects proteolytic gene expression in untrained individuals. Theoretically, if an individual were to be chronically hydropoydrated, a reduction in resistance training volume and increase in GR-DNA binding could diminish the anabolic response to resistance exercise and potentially lead to muscle atrophy. This study was supported by a doctoral research grant from the National Strength and Conditioning Association.

1415 Board #223 May 31 8:00 AM - 9:30 AM Factors Influencing Hydration Status during a NCAA Division 1 Soccer Preseason Yasuki Sekiguchi, William M. Adams, Ryan M. Curtis, Courtney L. Benjamin, Douglas J. Casa, FACSFM. 1University of Connecticut, Storrs, CT. 2University of North Carolina, Greensboro, NC. (No relevant relationships reported)

**PURPOSE:** To investigate the role that training and environmental conditions has on fluid balance during a collegiate men’s soccer preseason. **METHODS:** Twenty-eight male collegiate soccer players (mean±SD; age = 20±0.0y; body mass (BM), 79.9±6.7kg; height, 180.9±7.0cm; VO2max, 50.8±4.9mL·kg⁻¹·min⁻¹) participated in this study, which took place during the preseason period of the 2016 NCAA soccer season. Prior to each practice and game (PRE, BM and urine sample were collected to assess hydration status and then donned a heart rate and GPS enabled strap to measure training volume and intensity, including session time, total distance (TD), training load score, distance/session time, average heart rate, and average speed. Players consumed 500mL of water prior to and following each practice with ad libitum access to water during practice as team customized hydration strategy. Participants provided a post-session (POST) BM to assess percent body mass loss (%BML). Average ambient temperature (Tamb) and relative humidity (RH) were collected using an online environmental-based serve. Stepwise linear regression was used to identify which hydration, training, and environmental variables were predictive of %BML. Repeated measures ANOVA was used to assess changes in PRE-BM, POST-BM, and %BML across the 17-day preseason period. Significance was set a-priori p<0.05. **RESULTS:** TD predicted %BML during preseason training sessions (r²=0.252, p<0.001). When Tamb and RH were added to the model these factors significantly predicted %BML (r²=0.301, p<0.001). PRE-BM, POST-BM, %BML were significantly different over the course of the study (p<0.05). However, %BML never exceeded 2% of BM during any one session and daily variations in BM were <1% from baseline measures. **CONCLUSION:** TD, Tamb and RH were able to predict %BML during the preseason of a collegiate soccer season. The team customized hydration strategy utilized was successful at preventing fluid losses exceeding 2% of BM, which may adversely affect athletic performance. Future work is needed to assess 24-h fluid balance in this population to develop improved hydration strategies.

1416 Board #224 May 31 8:00 AM - 9:30 AM Pregame Hydration Status of Collegiate Basketball Players on Consecutive Days of Play Daniel N. Poel, Jason C. Dorman, Elizabeth H. Kasparek, Paul A. Thompson, Thayne A. Munce, FACSFM. Sanford Health, Sioux Falls, SD. (Sponsor: Dr. Thayne Munce, FACSFM) (No relevant relationships reported)

Collegiate basketball teams typically compete on non-consecutive days, allowing players ample time to recover from fluid loss incurred during a game and return to a euhydration state before the next contest. However, some NCAA conferences, tournaments and invitations require play on consecutive days, possibly leading to greater occurrences of hydropoydration, which could impair performance and/or increase injury risk. **PURPOSE:** To evaluate pregame hydration status of collegiate basketball players on consecutive days of competition and determine if these measures are associated with game performance. **METHODS:** Twenty-five collegiate basketball players (14 men, 11 women) from a NCAA Division II university participated in this study. Players’ urine specific gravity (USG) and body weight (BW) were assessed 1-2 hours prior to the start of 8 pairs of regular season conference games (16 games total) played on consecutive days (Fri & Sat). Upon arrival to the locker room, each athlete was weighed on a digital scale, wearing similar clothing each time, and provided a urine sample. USG was assessed using a hand-held clinical refractometer. Box score data were used to calculate player efficiency (PE) ratings as measures of in-game statistical performance. **RESULTS:** On Sat, 61.8% of players had a BW deficit (-0.60 ± 0.42 kg) compared to Fri, with 20.2% presenting with a BW deficit ≥1%; however, Fri vs. Sat BW differences were not significant (P = 0.693). Overall, 25.2% of players had USG values 1.020-1.024 and 27.0% of players had USG values ≥1.025 before their games. Players had USG values ≥1.020 more often on Fri (56.2%) than Sat (48.2%), though this difference did not reach statistical significance (P = 0.834). Neither changes in BW (P = 0.659) nor USG (P = 0.854) from Fri to Sat were significantly associated with PE on Sat. **CONCLUSION:** Approximately 50% of players were mildly to severely hydropoydrated before the start of each game; yet hydropoydration rates were similar before games played on consecutive days. Still, the majority of players had modest BW deficits before games played on the second day, indicating insufficient rehydration from the prior game. Although collegiate basketball players were consistently hydropoydrated before their games, hydration status was not associated with statistical performance in these contexts. 

1417 Board #225 May 31 8:00 AM - 9:30 AM Bilateral Differences in Muscle Activation Associated with Cycling in Varying Environmental Conditions Adam R. Jajtner, Brittany N. Followay, Jeremiah A. Vaughn, Eliott Arroyo, Savannah R. Hall, Cody S. Dunaley, Joseph A. Laudato, Ellen L. Glickman, FACSFM. Kent State University, Kent, OH. (No relevant relationships reported)

**PURPOSE:** To examine the influence of ambient temperature on bilateral differences (DF) in muscle activation. **METHODS:** Five recreationally active men (24.2±2.9 yrs; 1.84±0.06m; 80.0±4.47 kg; 11.7±2.8 %BF; 3.89±0.34 L·min⁻¹) completed four experimental visits: a VO2max test, and cycling in 5°C (LT), 23°C (MT) and 34°C (HT) in a counterbalanced fashion. Cycling consisted of 60 minutes at 60% of their previously determined VO2max (TC1), and a time to exhaustion trial at 90% of their VO2max (TT1). Electromyography (EMG) was monitored on the vastus lateralis of both legs from 0-2min, 8-10min, 18-20min, 28-30min, 38-40min, 48-50min, and 58-60min during TC1 as well as at the initial (PRE), middle (MID) and last (POST) 30-second periods during the TTE. Rectified EMG (RMS) and power spectra analysis (MPF and MedPF) were normalized to a standard 2-min cycling bout at 60% of VO2max in a thermoneutral condition. **RESULTS** between legs were calculated (dominant - non-dominant), and data analyzed via a within-subjects repeated measures ANOVA. **RESULTS:** During CT1, a main effect of trial (F = 5.34; p = 0.034; η² = 0.572) was observed with differences from LT (4.29 ± 6.28%) to MT (3.79 ± 6.98%; p = 0.033) and HT (7.36 ± 10.76%; p = 0.033). During CT1, no interaction was observed for MPF (F = 1.755; p = 0.227; η² = 0.305). An interaction (F = 2.883; p = 0.033; η² = 0.419) was observed for MedPF during CT1, No differences were observed across time in LT (p = 0.597) or MT (p = 0.287), though in HT 48-50min (10.17 ± 7.79%) was different (p = 0.05) from 8-10min (-1.91 ± 3.77%), 18-20min (2.40 ± 4.63%), and 28-30min (4.12 ± 2.97%). Additionally, at 8-10min, HT was different from MT (10.61 ± 5.14%; p = 0.004). During TTE, no interactions were observed for RMS (F = 0.660; p = 0.629; η² = 0.142) or MPF (F = 0.840; p = 0.520; η² = 0.174). An interaction was observed for MedPF (F = 3.808; p = 0.023; η² = 0.488) during TTE. Post hoc analysis indicated that during the LT trial, DF was different at MID (2.63 ± 8.34%) compared to PRE (3.12 ± 8.51%; p = 0.004) and POST (2.54 ± 7.77%; p = 0.004). **CONCLUSIONS:** During prolonged exercise in cold conditions, there appears to be a greater propensity to activate muscle from the dominant limb. Similarly, as an individual fatigues in a hot condition, it appears the rate of action potential depolarization may increase more in the dominant limb.
Changes in plasma osmolality (P$_o$) and arginine vasopressin (AVP)-mediated signaling regulate thirst and drinking behavior. Copeptin is a peptide derivative of the AVP prohormone and thought to be more stable and measurable than AVP as a biomarker of the hydration process. PURPOSE: This investigation aimed to evaluate hydration biomarkers, including copeptin, responses to exercise-induced dehydration and partial rehydration. METHODS: Fifty-two registrants (mean age: 52y, range: 21-72) in a 161km cycling event under warm and humid environmental conditions (mean = 26°C, 76%RH; maximum = 30°C, 93%RH) participated. P$_o$, urine specific gravity (U$_s$), urine color (U$_c$), thirst, and plasma copeptin were measured at 3 time points before (PRE) and shortly after (POST) the ride, and one hour following a 650mL water bolus at ambient temperature consumed in 6 increments within 3min (POST$_1$). Subjects consumed their typical diet during, but were not permitted to eat or drink between ride completion and the 1h post period. RESULTS: Subjects lost 2.2 ± 1.1% body mass at POST, and all variables significantly increased from PRE to POST (P$_o$ = 295.8 ± 3.9 to 399.1 ± 5.6 mmol kg$^{-1}$; U$_c$ = 1.017 ± 0.005 to 1.021 ± 0.006; U$_s$ = 3 ± 1 to 5 ± 2; copeptin = 7.50 ± 4.9 to 42.33 ± 35.74 pmol L$^{-1}$; thirst = 3 ± 1 to 5 ± 2; all p < 0.05). At POST$_1$ (body mass = 2.0 ± 1.1%) P$_o$ returned to PRE (294.4 ± 5.7 mmol kg$^{-1}$), while U$_c$ (1.02  ± 0.006), U$_s$ (5 ± 2), and thirst (3 ± 2) remained elevated compared to POST (all p < 0.05). Copeptin remained elevated at POST$_1$ vs. PRE (p < 0.0001) but decreased from POST to POST$_1$. CONCLUSION: Well-studied hydration biomarkers and the more recent biomarker copeptin tracked exercise-induced dehydration (PRE vs. POST), but differed in response to partial rehydration with a 650mL bolus (POST$_1$); copeptin tracked with partial rehydration, while P$_o$ would indicate adequate and urine markers inadequate fluid replacement occurred. Ongoing work includes analyses of the relationship between food intake during the ride and hydration biomarkers to determine factors that may contribute to change magnitude at POST and differences in biomarker responses at POST$_1$. Grant Funding: University of Hartford faculty grant; University of Connecticut ONSF, faculty start-up funds, and OUR.
PURPOSE: The purpose of this investigation was to compare the physiological responses to racing in veteran professional drivers and amateur drivers. METHODS: Four male sports car drivers, two professionals (PRO) and two amateurs (AM) participated in seven nationally sanctioned sports car races in the IMSA series. Rate of perceived exertion (RPE) was collected on the Borg scale (scale of 6-20) after their driving stint. Blood lactate was measured both before and after their driving stint. Pre and post nude body weights were collected as a measure of fluid loss. RESULTS: Over the course of the seven races, there was no significant difference in RPE between the professionals and amateurs. However, there was a significant difference in blood lactate following a driving stint (PRO: 4.82 mmol/L; AM: 5.2 ± 0.98 mmol/dl; p < 0.05). There was also a significant difference (P < 0.03) in fluid loss with the PRO losing 3.05 ± 0.78 lbs of sweat while the AM lost 4.09 ±0.78 lbs. CONCLUSIONS: These findings suggest that the level of racing experience plays a critical role for a driver in the amount of work done in a race car and the associated fluid loss. These factors indicate that AM could become fatigued faster and result in a decrease in driving performance.

Table 1. Thermoregulatory, physiological and perceptual responses

<table>
<thead>
<tr>
<th>Condition</th>
<th>COOL</th>
<th>HOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectal temperature (°C)</td>
<td>37.3 ± (0.4)</td>
<td>37.4 ± (0.3)</td>
</tr>
<tr>
<td>Skin temperature (°C)</td>
<td>32.2 ± (1.1)</td>
<td>34.3 ± (0.5)</td>
</tr>
<tr>
<td>HR (bpm)</td>
<td>62.0 ± (9.3)</td>
<td>64.2 ± (13.1)</td>
</tr>
<tr>
<td>Thermal comfort (°C)</td>
<td>2.6 ± (0.9)</td>
<td>4.0 ± (0.9)</td>
</tr>
<tr>
<td>Average error (degrees)</td>
<td>0.63 ± (0.2)</td>
<td>0.60 ± (0.2)</td>
</tr>
</tbody>
</table>

No significant interaction (F = 0.029) but not in CON (p = 0.547).

PURPOSE: To compare the whole-body sweating rate and percentage of weight lost by dehydration in two different types of indoor training in male college volleyball players. METHODS: 8 male college volleyball players were evaluated from February to March 2017. We calculated the whole-body sweating rate and the percentage of weight lost by dehydration in two different training session [Volleyball training (VO) and Volleyball training plus resistance training (VR)]. To evaluate the whole-body sweating rate, body and sport bottle were weighted before and after training to calculate changes in body mass and fluid intake (subjects were allowed to drink ad libitum during trainings). Subjects had to wear minimal clothing, to dry their skin with towels and to void their bladders before being weighed. Active time of each training was evaluated employing a stopwatch. Results are shown in median, minimum and maximum. RESULTS: The active time for VO were 117 min (72 - 135); on the other hand, for VR were 107 min (97 -126) (p= 0.96). A higher whole-body sweating rate was found from VO (11.8 ml/min, 5.7 - 13.3) than VR (10.1 ml/min, 7.0 - 12.3) but were not significantly different (p= 0.42). Conversely, a lower percentage of weight lost by dehydration was found from VO (0.7, 0.3 - 1.4 %) than VR (0.8, 0.2 - 1.3 %), but again were not significantly different (p=0.69).

CONCLUSIONS: In this study we found the sweating rate and body weight loss by dehydration were similar despite the training sessions were different. Maybe this happened because the active time was the same. However, it is known that intensity also plays a role in sweating rate, but it wasn’t measured here, and therefore, the differences in training intensity may soft the differences in sweating rate and body weight loss despite there were the same active time.

PURPOSE: To examine the effects of heat on muscular activation and fatigue during aerobic cycling exercise. METHODS: Five recreationally active men (24 ± 2.9 years; 183.1 ± 2.2cm; 80.5 ± 4.4kg; 11.3 ± 2.8%BF; 3.97 ± 0.34 L·min⁻¹) visited the laboratory on three separate occasions. Participants completed a VO2max test on a Velotron cycle ergometer and underwent skinfold assessment. The remaining two visits consisted of cycling for 60 min at 60% of their previously determined VO2max in either a high-temperature (35°C/45%RH) (HT), or a moderate-temperature (22°C/45%) (MT) in a counterbalanced fashion. Electromyography (EMG) of the vastus lateralis of the right leg was recorded during the 60-min exercise protocol during the first two minutes, and during the last two minutes of each 10-min period (0-2 min, 8-10 min, 18-20 min, 28-30 min, 38-40 min, 48-50 min, 58-60 min). Raw EMG recordings were normalized to maximal voluntary isometric contractions (MVICs), and analyzed for root mean square (RMS), mean power frequency (MPF) and median power frequency (MdPF). Data were analyzed using a within-subjects repeated measures ANOVA. RESULTS: No significant interaction (F = 0.519; p = 0.788) or main effects (Time: F = 2.069; p = 0.095; Condition: F = 2.742; p = 0.173) were observed for RMS. Additionally, no interaction was observed for MPF (F = 1.310; p = 0.291), however, a significant main effect of condition was observed for MPF (F = 15.325; p = 0.017), with a significantly higher MPF in HT (92.7 ± 3.03%) compared to MT (p = 0.017; 85.00 ± 3.07%). A significant main effect of time was also observed for MPF (F = 3.282; p = 0.017), with a significantly higher MPF at 58-60 min (89.30 ± 2.86%) compared to 8-10 min (p = 0.039; 86.34 ± 2.34%); No significant interaction was observed for MdPF (F = 1.214; p = 0.333), though a significant main effect of time was observed (F = 2.841; p = 0.031). Pairwise comparisons indicate this difference occurred between 0-2min (82.469 ± 0.998%) and 28-30min (p = 0.023; 85.834 ± 2.638%). Conclusion: Exercise in the heat resulted in a significantly higher MPF, with an increased MPF towards the end of exercise. These data suggest that heat exposure, as well as continuous aerobic exercise, may elicit an increase in action potential conduction velocity over the vastus lateralis.

Abstracts were prepared by the authors and printed as submitted.
The page appears to be a mixture of abstracts from various scientific presentations. Here is a summary of the key points extracted from the text:

**1425 Board #233**
May 31 8:00 AM - 9:30 AM
*Predicting The Onset Of Sweat During Cycling In Simulated Environments*

F. Michael Williams-Bell, Garrick Forman, Shilpa Dogra, Martin Agelin-Chaab, Michael W.R. Holmes. *Durham College, Oshawa, ON, Canada. Brock University, St. Catharines, ON, Canada. University of Ontario Institute of Technology, Oshawa, ON, Canada.

*No relevant relationships reported*

**PURPOSE:** To provide a starting point for the development of a regression equation that can predict sweat onset.

**METHODS:** Ten participants volunteered for this study. Participants committed to 5 experimental cycling sessions that varied by workload and climate. Participants cycled on an indoor bike trainer at 2 power outputs (25W and 75W) and 2 climate conditions (25°C @ 60% RH and 30°C @ 60% RH) until sweating commenced. Physiological measures included: electromyography, heart rate, skin temperature, core temperature, galvanic skin response, and VO2.

**RESULTS:** The average subjective sweat onset time for the 75W condition was less affected by the climatic condition than the 25W condition. The subjective sweat onset times for the 75W condition was 8.5±3.2 minutes and 5.8±1.4 minutes for the low and high temperatures, respectively. The subjective sweat onset times for the 25W condition was 23.5±7.4 minutes and 7.7±8.0 minutes for the low and high temperatures, respectively. A regression equation was developed and is able to predict subjective sweat onset with 61.5% of the variance explained with two measured variables. Workload alone explained 41.3% of the variance for sweat onset determination. When the regression was designed with workload as the outcome variable, it was able to predict sweat onset with 40.1% of the variance explained.

**CONCLUSION:** For the conditions simulated in this study, external temperature had less of an influence on sweat onset times than cycling workload. Sweat onset can be predicted with 61.5% of the variance explained using only two input variables. Heart rate was a poor indicator of sweat onset and simply using power output would be a better starting point. Overall, workload proved to be the most influential variable for predicting sweat onset.

This project was funded by the Natural Sciences and Engineering Research Council and the Engage Grant.

**1426 Board #234**
May 31 8:00 AM - 9:30 AM
*Folic Acid Improves Vascular Function, But Not Skin Blood Flow, In Heart Failure Patients*


*No relevant relationships reported*

**PURPOSE:** Heart failure (HF) patients are limited in their ability to manage a normal daily load during exercise secondary to impaired skin blood flow (SKBF). Folic acid has been shown to improve vascular function and accompanying changes in SKBF in healthy older individuals and those with metabolic and cardiovascular disease. Therefore, we examined the effect of folic acid on vascular function, and SKBF responses during exercise in 10 HF patients and 10 age-matched healthy controls (CON) similar in body size.

**METHODS:** Participants ingested 5mg of folic acid, once daily. At these time points (pre- and post-folic acid), vascular function was assessed using flow-mediated dilation (FMD). RESULTS: HFrEF was maintained at the same level for HF (pre: 332±46; post: 337±51, P=0.84) and CON (pre: 323±31; post: 317±40, P=0.72), and no differences were observed between groups in both exercise trials (p=0.05). Tcore increased to a similar extent for HF (pre: 0.40±0.39; post: 0.70±0.11, P=0.63) and CON (pre: 0.53±0.27; post: 0.45±0.25, P=0.84), however, the rise in Tcore was consistently higher in HF during both exercise trials (p<0.05). Similarly, CVC increased to a similar extent for HF (pre: 0.83±0.43; post: 0.39±0.45a/μgHg, P=0.80) and CON (pre: 2.01±0.79; post: 2.03±0.72a/μgHg, P=0.73), but the rise in CVC was consistently lower in HF during both exercise trials (p<0.05). Furthermore, folic acid improved FMD in HF patients (pre: 3.72±1.16; post: 5.88±1.29, P=0.00); however, no difference was observed in CON (pre: 5.47±1.98; post: 6.50±2.49, P=0.20). CONCLUSIONS: Collectively, these findings demonstrate that folic acid supplementation does not serve to enhance SKBF responses and attenuate the rise in core temperature during exercise at a fixed HFrEF in HF patients. However, folic acid improved vascular function to a greater extent in HF than CON.

**1427 Board #235**
May 31 8:00 AM - 9:30 AM
*Combined Heat Treatment and Exercise Prevents Skeletal Muscle Insulin Resistance in Wistar Rats Fed a High-Fat Diet*

JIE XIU ZHAO, FEI QIN, MINXIAO LU, CHAOYI QU, YANAN DONG, ZHONGWEI WANG, ZHINING HAN. *China Institute of Sport Science, Beijing, China.* (Sponsor: Craig Candall, FACSFM)

*No relevant relationships reported*

**PURPOSE:** Insulin resistance (IR) is associated with many related health complications. Previous studies demonstrate that heat and exercise independently reduce IR. The purpose of this study was to test the hypothesis that combined exercise and heating is even more favorable in reducing IR.

**METHODS:** Male Wistar rats were randomly divided into five groups: exercise (NE; n=10), heated (HC; n=10), exercise and heated (HE; n=10), sedentary (NC; n=10), and normal diet plus sedentary (CC; n=10). All but the latter group was fed a high-fat diet (60% calories from fat) for 10 weeks while receiving heat and/or exercise exposure for latter 8 weeks. Following this regimen, protein expression from the soleus and extensor digitorum longus muscles, serum, and brown fat were analyzed using Western blotting.

**RESULTS:** Exercise combined with heating shifted the metabolic characteristics of rats on a high-fat diet toward that observed in the rats on a standard diet. Specifically, eight weeks of combined heat and endurance exercise increased PGC-1α, CntA, Cdk5 and p38 MAPK protein expression in the soleus (P < 0.05), insulin protein expression in the serum (P < 0.05), and UCPI protein expression in the brown fat (P < 0.05), when compared to the high fat sedentary group. There were some significant differences in responses (i.e., body weight and Leptin & Adiponectin concentrations) between the combined exercise and heat group relative to the exercise alone group.

**CONCLUSIONS:** Exercise combined with heat exposure mitigates the development of IR, probably from the Irisin pathway. The study provides potential non-pharmaceutical methods for therapeutic treatment of IR.

**KEY WORDS:** Insulin resistance (IR); Exercise; Heat; Irisin

This work was supported by The National Natural Science Foundation of China (31371195).

**1428 Board #236**
May 31 8:00 AM - 9:30 AM
*The Effect of Mild Hydration on Performance and Thermoregulation in Male Cyclists: A Blinded Study*


*No relevant relationships reported*

**PURPOSE:** The aim of the present study was to examine the effect of mild dehydration on thermoregulation and exercise performance with subjects blinded to their hydration status via intravenous infusion (IV).

**METHODS:** Eleven male cyclists (weight 75.8±6.4 kg, VO2peak 64.9±5.6 mL kg⁻¹ min⁻¹, body fat: 12.0±5.8%; Power2peak 409±40 W) performed three sets of criterium-like cycling, consisting of 20 min of steady state cycling at 50% peak power output, each followed by a 5-km time-trial at 3% grade. Subjects completed the protocol, in counter-balanced fashion, on two separate occasions in dry heat (30 °C, 30% rh) either hypohydrated (HYP) or euhydration (EUH). In both trials, subjects ingested 25 mL every 5 min during the steady-state and 25 mL every 1-km during the 5-km time-trials. In the EUH trial, sweat losses were fully replaced via intravenous infusion of isotonic saline, while in the HYP trial, a sham IV was instrumented.

**RESULTS:** Following the exercise protocol, the subjects dehydrated by ~1.0±0.1% and ~1.8±0.2% of their body weight for the EUH and HYP trial, respectively. During the second and third time-trials, subjects displayed faster cycling speed in the EUH trial (27.5±3.0 and 27.2±3.1 km h⁻¹) compared to the HYP trial (26.2±2.9 and 25.5±3.3 km h⁻¹; both P<0.05). Core temperature (Tcore) was higher in the HYP trial throughout the third steady-state (P<0.05) and continued to be higher throughout the third 5-km time-trial (P<0.05). Final Tcore of the third time-trial for HYP and EUH trial was 39.1±0.3 vs. 38.6±0.6 °C (P<0.05).

**CONCLUSIONS:** These data suggest that full fluid replacement, even in a blinded manner, provided a performance advantage of faster cycling speeds. This benefit seems to be associated with concomitant decreased thermoregulatory strain.

---

**S288 Vol. 49 No. 5 Supplement**

**ACSM May 29 – June 2, 2018**

**Minneapolis, Minnesota**
During exercise recovery, autonomic thermoeffectors return to pre-exercise levels despite elevations in core temperature. It is unknown if thermal behavior follows a similar trajectory or compensates for elevated core temperature in lieu of autonomic thermoeffector withdrawal. PURPOSE: To test the hypothesis that thermal behavior during recovery remains engaged despite autonomic thermoeffector withdrawal. METHODS: In a 24 ± 1°C, 45 ± 10% RH environment, 10 subjects (6 females, 22 ± 1 y) cycled for 60 min (225 ± 46 W metabolic heat production), followed by 60 min passive recovery. Weighted mean skin (10 site) and intestinal temperatures, skin blood flow (forearm; laser Doppler), average local sweat rate (upper arm, trunk; ventilated capsule), and weighted mean skin wetness (4 site) were measured continuously. Subjects controlled the temperature of their dorsal neck to their perceived thermal comfort using a custom-made fluid filled tubing device. Device temperature provided an index of thermal behavior. Mean body temperature, calculated as the unweighted average of mean skin and intestinal temperatures, provided an index of the stimulus for thermal behavior. To directly determine the effect of prior exercise, post-exercise data were analyzed the minute mean body temperature recovered to pre-exercise levels within a subject. RESULTS: Mean body temperature returned to pre-exercise levels 28 ± 20 min into recovery (Pre: 33.5 ± 0.2, Post: 33.5 ± 0.2°C, P=0.20). At this point, mean skin temperature had recovered (Pre: 29.6 ± 0.4, Post: 29.5 ± 0.5°C, P=0.20), yet intestinal temperature (Pre: 37.3 ± 0.2, Post: 37.5 ± 0.3°C, P<0.01) and skin wetness (Pre: 0.2 ± 0.1, Post: 0.3 ± 0.0 a.u., P<0.02) were elevated. Post-exercise, skin blood flow (Pre: 59 ± 78, Post: 26 ± 25 PU, P=0.10) and local sweat rate (Pre: 0.05 ± 0.25, Post: 0.13 ± 0.14 mg/cm²/min¹, P<0.09) returned to pre-exercise levels, while neck device temperature was depressed (Pre: 27.4 ± 1.1, Post: 21.6 ± 7.4°C, P<0.03). CONCLUSIONS: Mean body temperature and autonomic thermoeffectors returned to pre-exercise levels, yet thermal behavior was active during recovery. Thermal behavior may compensate for autonomic thermoeffector withdrawal in the presence of elevated intestinal temperature and mean skin wetness post-exercise. Supported by lululemon athletica inc.
父母创造一个既温暖又支持的家居环境对儿童至关重要。鉴于临床意义，找到方法来帮助父母创建一个既温暖又支持的家居环境对于儿童的身心健康具有重要影响。在完成8周高热量饮食后，24名11-12岁双胞胎的SD大鼠体重被随机分配至相应的对照组（n=8）和HIIT组（n=8）。

**方法**：双胞胎家庭双生子研究。

**结论**：本研究中，尽管HIIT和MIT组均显示出体重的减轻，但HIIT组的减重效果更为显著。

---

**目的**

目的：考察α-actinin-3 (ACTN3) R577X多态性对年轻成人休闲时间体育活动的影响，并通过开放软件OpenMx对基因-环境交互作用模型进行分析。

**结果**：在ACTN3 R577X多态性和休闲时间体育活动水平等变量的年龄12和14年间具有显著的相关性（0.60, 95% CI 0.26-1.05; 0.55, 95% CI 0.29-0.80和0.52, 95% CI 0.19-0.87，分别）。双胞胎间的正向共同环境影响和行为、心理环境对在年轻成人休闲时间体育活动的影响，这些影响共同作用于家教环境在成年期的物理活动。

**结论**：研究证实，父母创建既温暖又支持的家居环境对儿童身心健康及其休闲时间体育活动水平具有显著影响。
CONCLUSIONS: This study has introduced retrorectalcalaneous approach of ultrasound guided posterior tibial nerve block. It can be as effective as, and even safer than the conventional method because visualization of the entire needle is possible and the needle is advanced from the opposite direction to the posterior tibial artery.

PURPOSE: Quadriiceps dysfunction following ACL reconstruction contributes to the development of knee osteoarthritis. Individuals with ACLR express long-term disability that is attributed to quadriiceps weakness. The purpose of this study was to (1) compare quadriiceps function between individuals with and without ACLR, and (2) determine the relationship between indices of quadriiceps function and self-reported disability. METHODS: Isometric peak torque (PT; Nm/kg) and rate of torque development (RTD; Nm/kg/s) and isokinetic (180°/sec) quadriiceps PT (Nm/kg) were measured in 46 individuals with ACLR (74% female; age=22.1±2.8 years; height=1.70±0.09 m; mass=71.6±15.7 kg) and 38 control participants (74% female; age=21.9±1.2 years; height=1.69±0.09 m; mass=66.2±11.7 kg). Self-reported disability was assessed using the International Knee Documentation Committee (IKDC) instrument. Dependence of variables was compared between the involved and uninvolved limbs using paired t-tests, and involved and uninvolved limbs were compared to control limbs using independent t-tests (adjusted α=0.017). Pearson correlation was used to determine the relationship between indices of quadriiceps function and IKDC (a priori α=0.05). RESULTS: Involved limbs had lower isometric PT (2.27±0.53 vs 2.57±0.73 Nm/kg; p=0.016), RTD (11.71±5.9 vs 15.31±6.9 Nm/kg/s; p<0.01) and PT at 180°/sec (1.72±0.48 vs 1.91±0.47 Nm/kg, p<0.01) compared to control limbs. Uninvolved limbs had lower PT (2.20±0.53 vs 2.57±0.73 Nm/kg; p=0.02), RTD (10.75±3.1 vs 15.3±6.9 Nm/kg/s; p<0.01) and PT at 180°/sec (p=0.16). Greater PT at 180°/sec (r=0.33, p=0.02), and greater RTD100 (r=0.28, p=0.03) were associated with higher IKDC score. Isometric PT was not associated with IKDC (r=0.15, p=0.31). CONCLUSION: Bilateral quadriiceps weakness was found compared to control participants. Greater isometric PT and RTD were associated with higher levels of self-perceived knee joint function while maximal isometric strength was not. Assessment of maximal isometric strength following ACLR may not comprehensively evaluate quadriiceps impairment after ACLR.

PURPOSE: To evaluate the response of muscle damage markers to acute heavy resistance exercise in female athletes with different ovarian hormone levels. METHODS: Eleven female college athletes were enrolled. They were divided into a muscle (low leg) cryotherapy, a joint (ankle) cryotherapy, and a control group (CYC). Measurements were taken under conditions (rest and exercise) over a 3-week period. Measurements in CYC were started after the start of menstruation (week 1). The exercise involved 6 sets of 5 squats at 90% 1-RM with a 3-min rest between each set. During rest, the athletes remained quiet and sat for 30 min while relaxed. Chemicals included were glutathione peroxidase (GPx) and superoxide dismutase (SOD). Results: The average of the 3 measurements were used for data analysis. Conclusions: Bilateral quadriiceps weakness was found compared to control participants. Greater isometric PT and RTD were associated with higher levels of self-perceived knee joint function while maximal isometric strength was not. Assessment of maximal isometric strength following ACLR may not comprehensively evaluate quadriiceps impairment after ACLR.

CONCLUSION: Ovarian suppression in athletes may lead to severs muscle damage because of lack of muscle protection by estradiol.

Introduction: The use of musculoskeletal ultrasonographic (US) measurements in Physical Therapy (PT) has recently increased and been reported to assist in the diagnosis of supraspinatus impingement syndrome (SIS). It has been proposed that the acromion-greater tuberosity distance (AGT) measurements when performed by novice (limited US training) individuals. Purpose: The purpose of this study is to establish the intrarater and interrater reliability of ultrasonographic measurements of the AGT in healthy individuals when performed by novice testers. Methods: Participants were 7 males and 13 females (26 years; 21-38 years) with an average BMI of 24.4 (18.9-32). Two PT students took measurements with a portable ultrasound device in brightness mode (B-mode) with an 8-13 MHz linear transducer. Ultrasound images (3) were taken with participants placed in standardized position with transducer placed on lateral surface of the right shoulder aligned with long axis of humerus. AGT was measured using on-screen calipers from the inferolateral edge of the acromion to the nearest margin of the superior aspect of the greater tuberosity. Each participant was then instructed to move out of the standardized position and 3 more images were taken. A second rater repeated the process. The average of the 3 measurements were used for data analysis. Intrarater and interrater reliability of measuring AGT was determined by calculating intraclass correlation coefficients (ICCs) with 95% confidence intervals. Results: Intrarater reliability for Rater A: .872 (CI: .683-.949) with AGT distance of 2.17 cm (1.68-2.59 cm). Interrater reliability for Rater B: .804 (CI: .503-.923) with AGT distance of 2.27 cm (1.94-2.91 cm). Interrater reliability for both raters was .741 (CI: .349-.897). Conclusions: This study demonstrates that intrarater and interrater measurements of AGT are very reliable in healthy individuals when performed by novice testers.

CONCLUSIONS: This study demonstrates that intrarater and interrater measurements of AGT are very reliable in healthy individuals when performed by novice testers.

Cryotherapy is a common intervention used to treat acute and chronic injuries, and it can be used to facilitate rehabilitation exercises. A common practice in athletic training is allowing a patient to return to activity after the application of some type of cryotherapy. However, the effect of applying cryotherapy to a muscle or a joint on functional performance is unclear. Purpose: To investigate if cooling a muscle compared to cooling a joint affects functional performance in healthy, active individuals. Methods: Forty-five healthy, college student volunteers (21 males; 24 females) with ages ranging from 18 to 23 years (M = 20.67; SD = 1.09) were randomly assigned to muscle (low leg) cryotherapy, joint (ankle) cryotherapy, or control (no cryotherapy) intervention for 20 minutes. After a 10 minute warm-up, subjects performed practice trials of a shuttle run and a squat lift (SLV). Subjects performed three trials of a shuttle run (4 – 6.1 m sprints) for time, and performed three trials of a SLV for height measured prior to and immediately following the intervention. A mixed model ANOVA with a Bonferroni Correction was used to determine significant interactions between intervention groups and times with an alpha level of .05 for statistical significance. Results: For the SLV, there was a significant interaction between the intervention groups and time; F(2,42)=3.349, p=0.045; however, group differences were unable to be determined. The muscle intervention group had a significant decrease in jump height between pre- (M=12.24, SD=3.61) and post-test (M=10.89, SD=3.21); p=0.01. For the shuttle run test, there were no significant interactions between group and time; F(2,42)=0.747, p=0.480. The joint (pre-M=7.43, SD=0.77; post-M=7.56, SD=0.70); p=0.036, and muscle (pre-M=7.63, SD=0.71; post-M=7.79, SD=0.78); p=0.013 intervention groups had a significant increase in run times between pre- and post-test. Conclusions: Cryotherapy application for 20 minutes to a muscle significantly decreased SLVJ.
height and increased shuttle run time, while, cryotherapy application for 20 minutes to a joint significantly increased shuttle run time pre-to-post-test. If cryotherapy application is utilized prior to performance, a warm-up should be initiated to prevent a decrease in functional performance.

Previous research has reported decreased physical activity levels in those with Chronic Ankle Instability (CAI). The impact of this decrease in physical activity is currently unknown in CAI subjects. PURPOSE: To measure VO_{2max} in those with CAI compared to healthy matched controls. METHODS: Sixteen subjects participated in the study. Eight subjects with CAI were matched by age (22.4±2.8 yr and 22.3±3.0 yr, respectively), height (165.3±8.5 cm and 167.8±8.2 cm), weight (68.5±8.2 kg and 65.5±8.2 cm) and gender (five females and 3 males / group), to subjects with no history of ankle injury. All subjects reported to the Health Risk Assessment lab for one session. Subjects completed the foot and ankle disability measure (FAAM and FAAM sport) and the NASA physical activity questionnaire. After the preliminary measurements, the subjects performed a treadmill maximal exercise test. Heart rate was monitored by ECG, while oxygen consumption and carbon dioxide production were monitored using standard techniques. Every minute of the test the subjects rated their effort of exertion using the Borg RPE scale (6 to 20 scale). For the treadmill test we used a two-minute progressive test until volitional exertion was attained. RESULTS: No differences were observed between groups for age (p=0.93), height (p=0.56), and weight (p=0.48). VO_{2max} (mL/kg/min) was significantly different between the injured and Control groups (p=0.0005; 32.5±5.1 vs. 50.5±10.0, respectively). Time to maximal exercise test completion (p=0.26), maximal RER (p=0.57), and VEmax (p=0.44) were not different between groups. Although maximal HR (p=0.30) and peak RPE (p=0.13) were not different between groups, resting HR was observed to be different between the Injured and Control groups (p=0.0078; 75.2±11.7 bpm and 58.9±7.5 bpm, respectively). FAAM (p=0.991), FAAM Sport (p=0.0001) and NASA (p=0.0001) were all observed to indicate differing activity levels between the groups. CONCLUSIONS: These findings suggest one's physical fitness level, as assessed by VO_{2max}, and resting HR differs in college-aged subjects with CAI, suggesting the reoccurrence of this musculoskeletal injury at a young age is serious enough to reduce physical activity levels and result in decreased fitness levels.

In 2015-2016, over 214,000 female athletes competed at the collegiate level in the U.S. The NCAA collects injury data; however, breast related injuries do not have a specific reporting category. The exact sequence of breast injury is unknown; however, a relationship between breast injury and fat necrosis, which mimics breast carcinoma, is documented outside of sport participation. Breast injuries related to motor vehicle collisions, seabelt trauma, and blunt trauma have been reported. For these reasons, it is important to investigate female breast injuries in collegiate sports.

PURPOSE: The objectives of this study are to report the prevalence of self-reported breast injuries in female collegiate athletes, explore injury type and treatment, and investigate breast injury reporting and impact on sports participation. METHODS: A cross-sectional study of female collegiate athletes at four U.S. Universities participating in basketball, soccer, softball, or volleyball. The main outcome measure was a questionnaire regarding breast injuries during sport participation. RESULTS: Almost half of the 194 participants (47.9%) reported a breast injury during their collegiate career, less than 10% reported their injury to health personnel with 2.1% receiving treatment. Breast injuries reported by sport include softball (59.5%), basketball (48.8%), soccer (46.7%), and volleyball (34.6%). CONCLUSION: The long-term effects and sequelae of breast injuries reported by female collegiate athletes during sport play is unknown. Nearly 50% of participants had a breast injury during sport. Although 18.2% indicated that breast injury affected sport participation, only 9.6% of the injuries were reported to medical personnel with 2.1% receiving treatment. From a clinical perspective, this information can be used to heighten the awareness related to female breast injuries and encourage health professionals to create an environment that encourages disclosure of injuries that may be perceived as personal or embarrassing to discuss. Supported by an Internal Grant - University of Michigan-Flint Physical Therapy Department 1

Objectives
We aimed to measure resource utilisation at the largest international aquatic sporting event in the hemisphere. We also aimed to measure epidemiological data including the type, location, sporting discipline and outcomes of medical contacts during the event.

Methods
This was a prospective observational study conducted under the auspices of the organising committee of the XXX Confederation Centroamerica y del Caribe de Natacion (CCCAN) championships held in Trinidad & Tobago. Anonymised data was collected from event medical contact records, screening and voluntarily reported contacts by team medical staff (for individuals who did not visit event medical staff). We excluded contacts by spectators. Data was collected over a 12 day competition period. Injury incidence rate (IR; number of injuries per 1000 athlete-days) and injury incidence proportion (IP; injuries per 100 athletes) were calculated.

Conclusions
There were 110 medical contacts for the event, with 80 occurring in athletes (72.7%). A significant number of non-sport related contacts was observed (60%) with a high number of complaints related to exhaustion and inadequate hydration. This was independent of country of origin. Acute gastroenteritis, ear and sinus infections were within expected frequencies. No EMS usage was necessary, and hospital transfers were for diagnostics in all cases. There were a total of 54 sport related contacts in 3956 athlete days (IR 13.65 injuries per 1000 athlete-days with an injury incidence...
Ankle sprains remain one of the most common orthopedic injuries, with a significant percentage of patients developing chronic ankle instability (CAI). The impact CAI has on overall health is unknown. PURPOSE: To measure body composition in those with CAI compared to healthy matched controls. METHODS: Sixteen subjects participated in the study. Eight subjects with CAI were matched by age (22.4±2.8 years and 22.3±3.0 yr, respectively), height (165.3±8.5 cm and 167.8±8.2 cm), weight (68.5±9.2 kg and 65.5±8.2 cm) and gender (five females and 3 males/group), to subjects with no history of ankle injury. All subjects reported to the Health Risk Assessment lab for one session. Subjects completed the foot and ankle disability measure (FAAM and FAAM sport) and the NASA physical activity questionnaire. Body composition was measured with DEKA. Subjects lay on the DEKA table supine, arms placed down by their side and fully clothed for approximately 15 minutes while the machine conducted a whole body scan. The following measurements were obtained: lean tissue mass (muscle), total/regional body fat, and bone mineral density. Bone mineral density in the form of AP Spine (5th lumbar vertebrae) and Dual Femoral (left and right pelvic joints). RESULTS: No differences were observed between groups for age (p=0.93), height (p=0.56), weight (p=0.48). Percent fat was different between Injured and Control groups (p=0.016; 35.6±5.6% and 25.6±8.3%, respectively). Fat mass was significantly different (p=0.024) while lean mass was found to be similar (p=0.89) between groups. Android/Gynoid was not different (p=0.58), suggestive of no differences in regional fat deposition between groups in college-aged subjects. Total BMD was not significantly different between the Injured and Control groups (p=0.055; 1.23±0.08 and 1.32±0.10, respectively). FAAM (p=0.0001), FAAM Sport (p=0.0001) and NASA (p=0.0001) were all observed to indicate differing activity/enactive levels between the groups.

CONCLUSIONS: These findings suggest CAI results in decreased physical activity levels in college-aged subjects that appears to be resulting in increased adiposity, a trend towards altered total bone mineral density, and no changes in lean body mass.
Cardiac rehabilitation (CR) is known to reduce the risk for all-cause mortality. However, little is known whether the health benefits of CR differ across different types of cardiac patients.

**PURPOSE.** To compare the impact of CR participation on all-cause mortality between cardiac patients that were diagnosed with ST elevated MI (STEMI), non-STEMI, unstable angina pectoris (AP), stable AP, chronic heart failure (CHF), and among patients that underwent revascularisation.

**METHODS.** A Dutch population-based cohort study was performed using insurance claim data from 4 million individuals. Cardiac patients eligible for the study were those with STEMI (n = 9,071), non-STEMI (n = 11,611), unstable AP (n = 12,182), stable AP (n = 20,594), CHF (n = 5284) and revascularisation (n = 1569). Adjusted proportional hazards models (hazard ratio, HR [95%-CI]) were used to assess the efficacy of CR against all-cause mortality. All HR were adjusted for confounding factors, such as age, sex, medication use, and cardio-thoracic surgical intervention.

**RESULTS.** Among the 60,581 (6712 yrs; 61.6% males) included patients, 16,598 (64:10 yrs; 71.9% males) participated in CR. After an average follow-up time of 4 years, 533 CR participants (3.2%) and 4728 non-CR patients (10.8%) died (P < 0.05). CR patients had a 42% lower all-cause mortality risk compared to non-CR patients (HR [95%-CI]: 0.52 [0.47-0.57]). We observed similar findings for each type of diagnosis (STEMI, HR: 0.95 [0.44-0.68]; non-STEMI, HR: 0.52 [0.44-0.62]; unstable AP, HR: 0.60 [0.47-0.75]; stable AP, HR: 0.63 [0.49-0.80]; CHF, HR: 0.40 [0.26-0.60]; and revascularisation, HR: 0.52 [0.41-0.67]).

**CONCLUSION.** Participation in cardiac rehabilitation programs lowers the risk of all-cause mortality irrespective of the initial cardiovascular diagnosis. These findings support the need for improved referral and participation rates of cardiac patients in CR programs.

Previous studies have documented a favorable effect of cardiac rehabilitation (CR) on patients undergoing percutaneous coronary intervention (PCI). However, participation in CR is sub-optimal, especially in China. Innovative models of CR are needed to improve participation. **Purpose:** The present study assessed the effect of a mobile phone-based CR (MBCR)program on exercise capacity and clinical outcomes in patients undergoing PCI. **Methods:**Totally 212 patients following PCI referred to the CR clinic of Chinese PLA General Hospital, between Jul, 2015 and Apr, 2016, were divided into 2 groups, to participate in MBCR (n=107) or usual care program (control, n=105). Individualized exercise prescription and educational materials were sent to the participants in the MBCR group by the App named “Heartguard” regularly. Cardiopulmonary exercise testing and questionnaires were measured in 12 months.

**Results:** Compared with those in the control group, participants in the MBCR group showed a greater increase in peak exercise capacity (+0.74 vs +0.08 METs,+16.4% vs +4.5%, p < 0.001), VO2 at anaerobic threshold , and dVO2/dWR, with a greater decrease in VE/VO2 slope in 12 months. Range of blood pressure lowering, angina symptoms and life quality in both groups were similar, but the proportion of smoking participants in the MBCR group was lower (6.7% vs 6.3%, p = 0.048). More significant lowering of low density lipoprotein, uric acid, as well as homocysteine was also showed in the MBCR group. During a median follow-up of 18 months, a lower incidence of unscheduled target vessel revascularizations , rehospitalizations , worsening angina, and combined endpoint (9/107 vs 23/105; p = 0.005), was also found in the MBCR group. Multivariable Cox regression analysis of correlation showed participation in MBCR was associated with a trend decreased clinical events (HR = 0.32, p = 0.0064) after adjustment for many factors. Subgroup analysis demonstrated that patients with a history of smoking are more likely to benefit from the MBCR program. **Conclusions:**
A progression of muscle atrophy (secondary sarcopenia, etc.) in lower extremity function in cardiovascular disease (CVD) inpatients leads to a high need for medical and nursing care. Previous study reported that the Short Physical Performance Battery (SPPB) may be an effective assessment tool for strength and lower extremity morphological evaluation for CVD patients (mixed inpatients and outpatients). However, it is unclear the SPPB can be used to evaluate mobility capability for only CVD inpatients, although which require special attention to nutrition status and body composition. PURPOSE: The purpose of this study was to examine if the SPPB can validated assessment tool for strength and lower extremity morphological evaluation and the relationships between the SPPB and clinical and laboratory factors for CVD inpatients. METHODS: CVD male (n=318) and female (n=172) inpatients were recruited. A stepwise multiple-regression analysis was performed to predict total SPPB scores and assess variable factors (physical characteristics, functional and morphological assessments, etc.). RESULTS: There were significant correlations between knee extensor strength and total SPPB scores for CVD male and female inpatients (both p<0.001). There were significant correlations between mid-thigh MTH and total SPPB scores for CVD male and female inpatients (both p<0.001). To predict total SPPB scores, the predicted handgrip, Controlling Nutritional Status score, % body fat, anterior mid-thigh muscle thickness (MTH), standing height and systolic blood pressure were calculated for males and anterior mid-thigh MTH, BMI, knee extension and fat mass were calculated for females. CONCLUSIONS: Total SPPB scores are an effective assessment tool for the functional and morphological evaluation for CVD male and female inpatients. Notably, quadriceps femoris MTH may play an important role in high SPPB scores in CVD in patients regardless of gender.

Knowledge and Perceived Physician Encouragement Toward Exercise in Congenital Heart Disease Patients and Their Sphere

Michaela F. Martinez, Matthew J. Garver. University of Central Missouri, Warrensburg, MO.

Background: Congenital heart disease (CHD) affects approximately 1 in 100 babies. Patients with CHD may be dissuaded or discouraged from activities, for reasons including fear of sudden cardiac arrest. Purpose: The primary purpose of this study was to examine exercise-related knowledge among patients and the patient's perception of physician encouragement toward exercise. A secondary purpose was to gauge these same variables among the sphere of influence (family and friends). Methods: Eligibility was limited to CHD patients and their sphere. Exercise-related knowledge and disease-specific knowledge (Leaven Knowledge Questionnaire) were assessed by questionnaire. Results: There were 71 volunteers (age 18-66, 38.7 ± 12.0 yrs). Patient Focus: Of the sample, 42 identified as CHD patients (females=36; males=6). For treatment, surgery (n=37) and medication (n=26) were common, but fear of sudden cardiac arrest.

Unstable Surface Training Is More Effective For Improving Stability Than Walking Training In Stroke Survivors

Younsun Son1, Eunkyung Park2, James Johnson2, Youngsoo Jim3, Jaehyun Yoo1. 1University of Houston, Houston, TX; 2University of Texas Rio Grande Valley, McAllen, TX; 3Bay College of Medicine, Houston, TX. 1Konkuk Medical College, Seoul, Korea, Republic of. 2Sahmyook University, Seoul, Korea, Republic of.

ABSTRACT: Falls are of great concern in the post-stroke population. Balance and gait deficits are major risk factors but may be improved through rehabilitation. However, little research has been done comparing the efficacy of different types of rehabilitation training programs. PURPOSE: The purpose of this study was to determine if unstable surface training is more effective than conventional walking training for improving stability among stroke survivors. METHODS: Twenty male chronic stroke patients were randomly assigned into two groups, the unstable surface training group (UST; n=10, 53.9 ± 8.3 yrs) and conventional walking training group (CON; n=10, 58.3 ± 12.1 yrs). Participants trained 3 d/wk for 60 min/d for 12 weeks with BOSU half ball (UST) or treadmill (CON). Stability was evaluated using the Biodex balance system. Anterior/Posterior (Sagittal Plane), Medial/Lateral (frontal plane), and overall scores were analyzed using ANCOVA. Zones and quadrants were reported with individual data. RESULTS: The UST group showed a significant improvement in Anterior/Posterior (1.63 ± 0.42 vs 1.15 ± 0.56, F(1, 17) = 12.62, p<.002), Medial/Lateral (1.3 ± 0.80 vs 0.64 ± 0.30, F(1, 17) = 31.38, p<.001), and overall (2.26 ± 0.81 vs 1.41 ± 0.66, F(1, 17) = 21.25, p<.001) scores whereas the CON group showed no significant improvements. CONCLUSION: The unstable surface training of 12-week was effective in significantly improving stability in chronic stroke survivors.
In the U.S., cardiovascular disease (CVD) is responsible for 1 in 4 deaths. There are known predictors (e.g., obesity, hypertension, and dyslipidemia) that increase the odds of developing CVD; however, risk is not proportionate among all ethnicities. While Hispanic Americans often display markers of elevated risk, they have longer life expectancies compared to non-Hispanic counterparts. Further exploration of this phenomenon is necessary to elucidate how risk engenders disease in different ethnic groups.

**METHODS:** To evaluate CVD risk factors and the incidence of adverse cardiovascular events among at-risk Hispanic and non-Hispanic adults. METHODS: We enrolled 10 Hispanic and 41 non-Hispanic men and women with Type 2 diabetes in a 10-week exercise program. Prior to initiating exercise, we documented demographic data, collected a health history, conducted 7 tests of physical functioning, and measured cardiometabolic variables, including body mass index (BMI), body fat percent (BF%), blood pressure, heart rate, and, HBA1C. We repeated all assessments following the intervention. Differences between ethnic groups in baseline values and exercise responses were evaluated with independent samples t-tests and chi-squared tests. RESULTS: Hispanic subjects had fewer diagnoses of hypertension (p<0.002) and no history of heart attack, compared to 25% incidence among non-Hispanics (p<0.077). Hispanic subjects were 8.1 years younger (p=0.032), 40% of them smoked (compared to 6%; p<0.001), and they had better body compositions as measured by BMI (p=0.038), BF% (p=0.021), and categorical obesity (p=0.030). Physical functioning was significantly better among Hispanic subjects as assessed by the 6-minute walk (p=0.010) and functional reach (p=0.029). Participants who completed the exercise program experienced improvement in all assessments but grip strength; there were no differences in improvement between ethnic groups. CONCLUSION: We found exercise to benefit Hispanic and non-Hispanic subjects similarly. Hispanic adults with diabetes exhibited lower incidence of heart attacks. This may be attributable to observed anthropometric differences; however, if nutritional or behavior customs confer cardioprotective effects in this population, it is important for future researchers to identify those variables.
The AMS walking equation used to estimate maximal aerobic capacity (VO2peak) was developed nearly 4 decades ago and based on relatively few (<100), young (19 to 26 years old) participants. The validity of estimated VO2peak in clinical populations remains uncertain. PURPOSE: To compare estimated VO2peak with actual VO2peak derived from maximal treadmill testing in breast cancer survivors. METHODS: In the context of a randomized controlled trial, 115 survivors (mean age, 59.7 yr) performed an incremental walking treadmill test to volitional fatigue with gas exchange to determine VO2peak. Estimated VO2peak was calculated using the ACSM walking equation and compared with actual VO2peak by examining the constant error (CE) and correlation coefficient (r). RESULTS: The ACSM equation significantly overestimated VO2peak (CE: 6.3 ± 5.0 ml/kg/min, p < 0.001; r = 0.65, p < 0.001). CONCLUSION: Alternative estimated VO2peak models should be considered given that low VO2peak is associated with a higher prevalence of acute and chronic treatment-related toxicities, higher symptom burden, and increased risk of all-cause and cancer-specific mortality. Supported by National Institutes of Health (CA-142566)
Purposes: Cardiorespiratory fitness (CRF) has been associated with metabolic risk factors and the clustering of metabolic risk factors. The Ball State University Adult Physical Fitness Study was performed to test the effect of age on physical functioning, holding potential confounders constant.

Methods: We enrolled 35 firefighters in California, collected demographic data, and performed a battery of tests, which included anthropometric assessments, grip strength, sit-and-reach, shoulder flexibility, vertical jump, push-ups, curl-ups, and VO₂ max. We compared mean data to normative data and used multiple linear regression to determine the relation between PA and submaximal (oxygen uptake efficiency slope (OUES)) and maximal (VO₂ peak) CRF.

Results: There may not be a need for firefighters to complete periodic CPAT assessments, but the implication is that duration spent as a firefighter is not related to functional decline. Age was not a significant predictor of performance in either assessment; the age to be a significant predictor of sit-and-reach (p=0.167) or VO₂ max. 58.1% were classified as poor or very poor in VO₂ max; 94.1% of firefighters were classified as poor in sit-and-reach and shoulder flexibility, vertical jump, push-ups, curl-ups, and VO₂ max. We compared mean data to normative data and used multiple linear regression to test the effect of age on physical functioning, holding potential confounders constant.

Conclusions: There may not be a need for firefighters to complete periodic CPAT assessments, but the implication is that duration spent as a firefighter is not related to functional decline. Age was not a significant predictor of performance in either assessment; the age to be a significant predictor of sit-and-reach (p=0.167) or VO₂ max. 58.1% were classified as poor or very poor in VO₂ max; 94.1% of firefighters were classified as poor in sit-and-reach and shoulder flexibility, vertical jump, push-ups, curl-ups, and VO₂ max. We compared mean data to normative data and used multiple linear regression to test the effect of age on physical functioning, holding potential confounders constant.
The six-minute walk test (6MWT) is a popular submaximal exercise test used in cardiac rehabilitation (CR) programs. Participants in CR characteristically have several cardiovascular risk factors present; therefore, the selection of the 6MWT over maximal treadmill testing reduces the likelihood of adverse events. Several established prediction equations exist for predicting VO2peak from six-minute walk speed (6MWS) and/or distance (6MWD). PURPOSE: To compare the predicted VO2peak values, calculated from 6MWS, obtained from CR patients using established equations. METHODS: Seventeen volunteers (age = 64 ± 16 yr) completed a pre- and post-6MWT prior to a High-intensity Interval Training (n = 6) or moderate intensity continuous exercise (n = 11) program. The Burr et al. (2011), Cahalan et al. (1996), and Ross et al. (2010) VO2peak prediction equations were examined for validity and reliability. A repeated measures analysis of variance (ANOVA), with subsequent paired sample t-tests, was conducted to compare differences within and between 6MWT the VO2peak prediction equations. A 3 x 2 mixed-design ANOVA was performed to examine the effects across VO2peak and time (pre- and post-). RESULTS: The repeated measures ANOVA revealed statistical significance within pre-[F(3,22) = 121.40, p< (0.001)] and post-program VO2peak values-[F(2,22) = 78.24, p< (0.001)]. Sequential paired sample t-tests showed a significant difference between the three equations for both pre- and post-program VO2peak values (df = 16, p< 0.001). The 3 x 2 mixed-design ANOVA observed no significant differences in VO2peak values across the two time points. CONCLUSION: The three prediction equations demonstrated reliability pre- and post-programming. However, insufficient literature exists comparing the validity and reliability of VO2peak prediction equations. Future research should increase the sample size and consider the use of criterion measurement system (i.e., wearable metabolic system which can measure gas exchange).

Peak oxygen uptake resulting from maximal graded exercise testing is considered a measure of cardioregulatory fitness. Post-exercise heart rate recovery (HRRec) measures have been used as a clinical indicator of health and mortality in older adults. However, the relationship between HRRec and cardioregulatory fitness in young, sedentary adults has not been fully elucidated. PURPOSE: To examine the association between peak oxygen uptake (VO2; ml·kg-1·min-1) and HRRec responses following a progressive maximal graded exercise test (MaxGXT; treadmill), and body composition measures in young, sedentary adults. METHODS: We examined peak VO2 and absolute (AbsHRRec; beats·min-1) and relative (RelHRRec; %) HRRec measures at 1.3, and 5 mins post MaxGXT in 27 young (mean ± SD, age = 26 ± 5.7) adults (16 females). All subjects were sedentary (~2 hrs weekly structured exercise), non-smokers, free of known cardiovascular disease risk and medications. Body composition measures including fat mass (kg), fat-free mass (FFM; kg), and percentage body fat (%Fat; %) were determined by total body DEXA scans. Pearson’s correlation analysis was used to determine if significant (p < 0.05) correlations were observed between peak VO2, AbsHRRec and RelHRRec, and body composition measures. RESULTS: No significant correlations were observed between peak VO2 (r = 0.4; r = -0.18; 3 min (67.3 ± 4.9; r = 0.20) or 5 min (62.9 ± 5.3; r = 0.21). Peak VO2 was significantly correlated with %Fat (35.1 ± 9.3; r = -0.42; p< 0.001) and fat mass (27.8 ± 11.9; r = -0.46; p< 0.001), but not significantly correlated with FFM (49.7 ± 14.0; r = -0.22) or MFM (47.0 ± 13.4; r = -0.22). CONCLUSION: Although heart rate recovery measures have been used as a clinical indicator of health and mortality in older adults, it may not be a valid measure of cardioregulatory fitness in sedentary, young adults.

Cardiovascular disease and risks factors are worldwide concerning problems leading to public health policies and strategies to avoid high costs and low outcomes to populations. Physical inactivity is a major risk factor and play an important role that should lead to global public health strategy for its cost-efficiency and cost-effectiveness. The main issues are the specific country-based public health policies, which continuously leads to campaign to avoid sedentary behavior and physical inactivity, and not population-based exercise programs policies. Purpose: The purpose of our study was to share data from a community-based exercise program (“Move it”) contextualized on the Brazilian public health policy (SUS) for the last 20 years. Methods and Results: The program “Move it” is a multidisciplinary program that runs on primary care facilities of a inner state city of São Paulo (Botucatu), Brazil, that has been implemented 25 years ago. So far, 2% of the city population has been involved (2800 participants; 55:9 years, 74% females and 68,7% under 60 years of age), participating on protocols that runs on city’s facilities (parks, public gyms and squares), involving diagnosis, fitness analysis and exercise program (80 minutes, 3 times a week). Metabolic Syndrome (ATP criteria) prevalence is 35%, with a successful response to the program of 20% after 10 weeks. VO2 max (Balke

The six-minute walk test (6MWT) is a popular submaximal exercise test used in cardiac rehabilitation (CR) programs. Participants in CR characteristically have several cardiovascular risk factors present; therefore, the selection of the 6MWT over maximal treadmill testing reduces the likelihood of adverse events. Several established prediction equations exist for predicting VO2peak from six-minute walk speed (6MWS) and/or distance (6MWD). PURPOSE: To compare the predicted VO2peak values, calculated from 6MWS, obtained from CR patients using established equations. METHODS: Seventeen volunteers (age = 64 ± 16 yr) completed a pre- and post-6MWT prior to a High-intensity Interval Training (n = 6) or moderate intensity continuous exercise (n = 11) program. The Burr et al. (2011), Cahalan et al. (1996), and Ross et al. (2010) VO2peak prediction equations were examined for validity and reliability. A repeated measures analysis of variance (ANOVA), with subsequent paired sample t-tests, was conducted to compare differences within and between 6MWT the VO2peak prediction equations. A 3 x 2 mixed-design ANOVA was performed to examine the effects across VO2peak and time (pre- and post-). RESULTS: The repeated measures ANOVA revealed statistical significance within pre-[F(3,22) = 121.40, p< (0.001)] and post-program VO2peak values-[F(2,22) = 78.24, p< (0.001)]. Sequential paired sample t-tests showed a significant difference between the three equations for both pre- and post-program VO2peak values (df = 16, p< 0.001). The 3 x 2 mixed-design ANOVA observed no significant differences in VO2peak values across the two time points. CONCLUSION: The three prediction equations demonstrated reliability pre- and post-programming. However, insufficient literature exists comparing the validity and reliability of VO2peak prediction equations. Future research should increase the sample size and consider the use of criterion measurement system (i.e., wearable metabolic system which can measure gas exchange).

Peak oxygen uptake resulting from maximal graded exercise testing is considered a measure of cardioregulatory fitness. Post-exercise heart rate recovery (HRRec) measures have been used as a clinical indicator of health and mortality in older adults. However, the relationship between HRRec and cardioregulatory fitness in young, sedentary adults has not been fully elucidated. PURPOSE: To examine the association between peak oxygen uptake (VO2; ml·kg-1·min-1) and HRRec responses following a progressive maximal graded exercise test (MaxGXT; treadmill), and body composition measures in young, sedentary adults. METHODS: We examined peak VO2 and absolute (AbsHRRec; beats·min-1) and relative (RelHRRec; %) HRRec measures at 1.3, and 5 mins post MaxGXT in 27 young (mean ± SD, age = 26 ± 5.7) adults (16 females). All subjects were sedentary (~2 hrs weekly structured exercise), non-smokers, free of known cardiovascular disease risk and medications. Body composition measures including fat mass (kg), fat-free mass (FFM; kg), and percentage body fat (%Fat; %) were determined by total body DEXA scans. Pearson’s correlation analysis was used to determine if significant (p < 0.05) correlations were observed between peak VO2, AbsHRRec and RelHRRec, and body composition measures. RESULTS: No significant correlations were observed between peak VO2 (r = 0.4; r = -0.18; 3 min (67.3 ± 4.9; r = 0.20) or 5 min (62.9 ± 5.3; r = 0.21). Peak VO2 was significantly correlated with %Fat (35.1 ± 9.3; r = -0.42; p< 0.001) and fat mass (27.8 ± 11.9; r = -0.46; p< 0.001), but not significantly correlated with FFM (49.7 ± 14.0; r = -0.22) or MFM (47.0 ± 13.4; r = -0.22). CONCLUSION: Although heart rate recovery measures have been used as a clinical indicator of health and mortality in older adults, it may not be a valid measure of cardioregulatory fitness in sedentary, young adults.

Cardiovascular disease and risks factors are worldwide concerning problems leading to public health policies and strategies to avoid high costs and low outcomes to populations. Physical inactivity is a major risk factor and play an important role that should lead to global public health strategy for its cost-efficiency and cost-effectiveness. The main issues are the specific country-based public health policies, which continuously leads to campaign to avoid sedentary behavior and physical inactivity, and not population-based exercise programs policies. Purpose: The purpose of our study was to share data from a community-based exercise program (“Move it”) contextualized on the Brazilian public health policy (SUS) for the last 20 years. Methods and Results: The program “Move it” is a multidisciplinary program that runs on primary care facilities of a inner state city of São Paulo (Botucatu), Brazil, that has been implemented 25 years ago. So far, 2% of the city population has been involved (2800 participants; 55:9 years, 74% females and 68,7% under 60 years of age), participating on protocols that runs on city’s facilities (parks, public gyms and squares), involving diagnosis, fitness analysis and exercise program (80 minutes, 3 times a week). Metabolic Syndrome (ATP criteria) prevalence is 35%, with a successful response to the program of 20% after 10 weeks. VO2 max (Balke
protocol) improvement is 30% and muscular strength (25%). Blood Pressure (BP) normalization occurs after 20 weeks, returning to basal levels (High BP) when deemed to occur (Hollyday). Heart Health Index (HII) and sedentary behavior (IPAQ and Baecke questionnaires) improves after 8 weeks. Figure 1. “Move-it”: Flow-chart and interactions with the national public health policy (SUS). Conclusion: Cardiorespiratory fitness, healthy eating index, lipid profile, insulin sensitivity and body composition were improved. Since the primary care system in Brazil is based on active search (“Estratégia Saúde da Família - agents comunitários”), the adherence, acceptance and effectiveness of this model should be encourage for nation wide application. Strategies leading transition from campaigns to programs should be encourage world wide.

1473 Board #281 May 31 9:00 AM - 10:30 AM
Scientific Abstract
Victor Andrews. Kansas State University, Manhattan, KS.
(No relevant relationships reported)

PERCEIVED PHYSICAL LITERACY IN COLLEGE AGED STUDENTS
Victor Andrews, Kansas State University, Manhattan, Kansas.
Individuals who fail to acquire adequate competencies in regards to physical activity may develop barriers that limit physical activity later in life. Physical literacy (PL) is a descriptive that is used to measure one’s competence, confidence, and motivation in regards to physical activity. The goal of PL is to have all youth to be considered competent by 12 years of age in order to allow them to be physical active throughout their life course. PURPOSE: To investigate the perceived physical literacy levels of college aged students. METHODS: The Physical Literacy Self-Assessment was distributed to college aged students to measure perceived PL through e-mail and social media. RESULTS: 94 college students responded (21 ± 3 years, 38 male, 56 female). SPSS vs 24 was used for frequency analysis and two independent samples t-test. Perceived PL scores were then divided into 4 graded categories: Very Low, Low, High, Very High. 49% of respondents were placed in the “Very High” category, 47% of respondents were categorized at “High”, 3% of respondents were categorized as “Low”, 1% of respondent was categorized as “Very Low”. The results indicate that there is no statistically significant difference between the PL score for males and females (t = 1.881, p = 0.63). CONCLUSION: The goal of PL is to have all individuals meet the criteria to be considered “Very High”. Individuals graded into categories other than “Very High” are considered in need of further education and support until they are perceived to be competent in all elements of PL. PL is still a new concept within the USA. Further research is needed to better understand PL within the USA population and relationships with current physical education levels in college aged populations.

1474 Board #282 May 31 9:00 AM - 10:30 AM
Prenatal Healthcare Provider Physical Activity And Nutrition Discussions According To BMI
Kiersten M. Mead, Samantha J. Deere, Rebecca A. Schlaff, Meghan Baruth. Saginaw Valley State University, Saginaw, MI.
(No relevant relationships reported)

Research suggests healthcare providers (HCP) do not regularly discuss physical activity (PA) and nutrition during patient interactions, particularly when patients are considered overweight/obese by body mass index (BMI). It is unknown if this trend extends to obstetric HCPs. PURPOSE: To investigate the differences in 1) patient value of prenatal HCP advice, and 2) the likelihood of prenatal HCP discussion/ recommendation of PA/nutrition behaviors according to BMI. METHODS: Participants (n=46) included pregnant women enrolled in a PA/nutrition behavioral intervention. A survey assessed 1) demographics, 2) pre-pregnancy height and weight, 3) the degree (1=do not value to 5=highly value) participants valued their prenatal HCP’s opinions, and 4) whether the patient’s prenatal HCP discussed PA behaviors, recommended PA participation, or gave nutritional advice. Means (SD) and percentages were calculated. Participants were categorized into BMI categories of normal weight (< 25 kg/m²) and overweight/obese (≥ 25 kg/m²). An independent samples t-test and chi-square analyses were utilized to assess differences in the value of HCP’s opinions, and whether or not the patient’s HCP discussed PA behaviors, recommended PA participation, or gave nutritional advice according to BMI category. RESULTS: Most participants were Caucasian (82%), married (70%), and college graduates (59%). Participants were 28.3(4.4) years of age, had a pre-pregnancy BMI of 28.9(7.9) kg/m² and valued their HCP’s opinions 4.6(0.6). Most participants discussed current PA habits (61%), received a PA recommendation (57%), and received nutritional advice (59%) from their prenatal HCP. Normal (45.6%) and overweight/obese (54.4%) participants valued their HCP’s advice similarly: 4.6(0.6) and 4.6(0.64), respectively (p=0.71). Although not statistically significant, more normal weight participants discussed PA and received a PA and nutrition recommendation than overweight/obese participants (p=0.01-0.50). CONCLUSION: Our sample highly valued prenatal HCP opinions. HCPs discussed/recommended PA/nutrition behaviors to women across BMI categories, yet many participants received no PA/nutrition advice. Future research should explore ways to consistently incorporate PA/nutrition discussions in obstetric appointments.

1475 Board #283 May 31 9:00 AM - 10:30 AM
Physical Activity Counselling and Exercise Prescription Practices of Physiotherapists in Nova Scotia
Myles W. O’Brien¹, Chris A. Shields², Kristin L. Campbell¹, Bonnie Doyle³, Sandra Crowell⁴, Patrick McGrath⁴, Jonathon R. Fowles¹. ¹Dalhousie University, Halifax, NS, Canada. ²Acadia University, Wolfville, NS, Canada. ³University of British Columbia, Vancouver, BC, Canada. ⁴Nova Scotia Health Authority, Halifax, NS, Canada.
(No relevant relationships reported)

PURPOSE: Physiotherapists (PTs) have education and scope of practice to promote the benefits of physical activity (PA) and prescribe exercise in their clinical interactions with patients. As such, they provide an avenue to increase the reach of Exercise is Medicine, to improve the PA levels of the Canadian population. However, no study has assessed Canadian physiotherapists’ perceptions and practices surrounding physical activity counselling and exercise prescription (PAE). METHODS: PTs working in Nova Scotia (n=146) completed an online self-reflection survey regarding their current practices, confidence, barriers, and facilitators in providing PAE to their patients. RESULTS: Overall confidence for PAE was high (most scores >80%) except for in helping patients maintain PA (72.8±25%) and in patients following through on PAE recommendations (66.3±22.5%). PTs include PAE in 85±23% of appointments and prescribe written exercise in 80±20% of appointments, but only refer to other exercise professionals or facilities in 27±12% of appointments. The most salient barriers to providing PAE were patient’s interest in PA, and patients’ preference for medication management over lifestyle intervention (2.3±0.68 and 2.1±0.66 respectively, out of 4), exceeding the typically cited barrier of lack of provider time. The most helpful facilitator was PTs’ perceived patients’ readiness to do PAE (3.5±0.7, out of 4). PTs are most comfortable providing PAE advice to those with arthritis and musculoskeletal issues (81%) and least comfortable with those with cancer (49%), insulin requiring diabetes (33%), respiratory disease (32%) and mental health concerns (28%). CONCLUSION: The primary barriers for PTs in providing PAE are patient-focused and PTs may benefit from avenues that allow greater referral access to other exercise professionals and a collaborative treatment approach to help patients maintain a physically active lifestyle, especially in those with other chronic disease beyond musculoskeletal disorders. Exercise is Medicine networks should consider greater collaborations between allied health and exercise professionals to support multi-disciplinary approaches to patient exercise management across the continuum of health care.

Support provided by: Lawson Foundation, Nova Scotia Health Authority

1476 Board #284 May 31 9:00 AM - 10:30 AM
Participation in an Exercise Education Rotation affects Medical Students Opinions Towards a Physician’s Role in Physical Activity Recommendations
Anthony A. Musto¹, Alexis Canaves², Michael A. Bello². ¹University of Miami, Coral Gables, FL. ²University of Miami, Miami, FL.
(No relevant relationships reported)

Physical activity is key for prevention of most chronic disease. In response, a global initiative called Exercise is Medicine was launched to encourage physicians to treat physical activity participation as a vital sign. However, medical students may not receive the necessary training which may inhibit the future physician’s likeliness to assess or recommend physical activity participation. PURPOSE: To determine if a five day exercise education rotation affects medical student’s opinion regarding a physician’s role in recommending physical activity. METHODS: Third year medical students (n=169) completed a mandatory education rotation at a University based fitness facility. The medical students completed an 8-item Likert scale pre-post survey (1 to 4, strongly disagree, disagree, agree, strongly agree, respectively) to assess their interest in physical activity and prescription education for special populations, explanation of the Exercise is Medicine Initiative and mandatory attendance to five group exercise classes. All exercise activities were led by an ACSM certified exercise physiologist at a University based fitness facility. The medical students completed an 8-item Likert scale pre-post survey (1 to 4, strongly disagree, disagree, agree, strongly agree, respectively) to assess their level of agreement with statements about a physician’s role in exercise prescription and personal fitness (Table 1). A paired t-test was used to compare the pre and post scores for each individual item. Significance was set at p < 0.05. Results: Table 1.
Chronic diseases are among the most common and costly health problems in the U.S. Physical activity (PA) has been shown to be effective in treating and preventing many chronic diseases. The Exercise is Medicine initiative aims to promote PA counseling among healthcare providers. However, little is known about the education and perceptions of medical providers related to PA counseling. PURPOSE: To learn about the knowledge and perceptions that students in primary health care professions have related to using PA counseling. METHODS: Students currently enrolled in a DO or MD medical school, physician assistant, or nurse practitioner program were recruited to take an online survey. Incorporating two previously validated surveys, students were asked about their own PA counseling training they have received, the knowledge and perceptions that students in primary health care professions have related to using PA counseling. RESULTS: Of the participants who completed the survey (n=72), 6.8% were MD, 52.3% were DO, 21.6% were physician assistant, and 18.2% were nurse practitioner students. Primary care students rated many aspects of PA as being important (59.4-76.7% agreed/strongly agreed), but reported low confidence in their education and abilities to do them (19.7-51.3% agreed/strongly agreed). The most common barriers to PA counseling were patient motivation/compliance, lack of education, time, support system for patients, and cost/billing. The most common solutions they proposed to overcome these barriers were more education for primary care professionals, being able to refer patients to specialists, and help with psychological aspects of counseling. There was strong interest in taking an elective course, attending a CME/continuing education course, and having a certified fitness and/or nutrition professional in the office. CONCLUSION: There is a clear disconnect between what primary care students find important and what they feel competent to do in the field. There is a need for improving medical education related to PA counseling. There are many opportunities for PA professionals to work with primary care providers on PA counseling. Educating our healthcare professionals is essential in making them confident in PA counseling.
PURPOSE: Exercise is Medicine on Campus (EIMOC) is an initiative promoting physical activity (PA) on college campuses. Pennsylvania State University, promoting EIMOC since 2010, has held an annual EIMOC Week since 2012. A focus of the EIMOC committee in 2017 was to expand its off-campus reach and community collaboration throughout the commonwealth of Pennsylvania and beyond. The purpose of this study is to analyze and describe the logistical challenges and lessons learned from expanding an EIMOC initiative to off-campus and out of town locations.

METHODS: During fall 2017, EIMOC events were expanded from one, on-campus week, to a month of activities including a day of coordinated events with off-campus local businesses, travel to commonwealth campuses, and a week of collaboration with alumni-led organizations nationwide. The logistical challenges of coordinating remote events were documented and evaluated. Observational data from each event assessed popular activities and feedback from participating partners regarding the planning and execution of events was gathered.

RESULTS: Analysis addressed three new initiatives. Partnership with local, off-campuses businesses, known as “EIM Off Campus Day,” involved local fitness centers offering no-cost access to students, faculty, and staff for one day, promoted via social media and our website. Reach was assessed through social media analytics (e.g. likes, retweets), website visits and unique page views. Traveling events to commonwealth campuses occurred during “Mobile EIM Week” and were assessed based on the type of activities included, number of partners involved, and number of participants engaged, as well as feedback regarding the perceived success of each event and suggestions to improve future collaborations. Finally, a week-long initiative engaged alumni nationwide (EIM Everywhere Week) relying on email campaigns and social media to spread the word and gauge participation.

CONCLUSIONS: The current study offered insights on the challenges and successes in leveraging an existing EIMOC program to spread the message into the community, including timing of advertising and better communication. Despite this, the new initiatives proved both popular and successful, and improving their execution will significantly benefit the future impact of EIMOC.

Widespread implementation of Exercise is Medicine on Campus (EIM-OC) has potential to address college student physical inactivity, however, limited research has comprehensively assessed how EIM-OC is operationalized at campuses. PURPOSE: To assess EIM-OC implementation, development, and outcomes at various academic institutions.

METHODS: A survey was developed in consultation with key EIM-OC stakeholders and administered online among EIM-OC representatives. Data collected included: institutional information; promotion, education, and healthcare system integration; partnerships; challenges; and goals. RESULTS: Initial responses (n=24) were received from a diverse group of academic institutions ranging in size (<10,000 to >50,000 students) and type (public, private). Campus health and recreation were considered the most important EIM-OC partners, which was attributed to these partners providing the most opportunities for and having the most interactions with students. A lack of time and wanting to focus on existing relationships were cited as reasons for not yet establishing working relationships with other partners. Multiple respondents cited lack of time, awareness, funding, and/or resources as the biggest challenges faced by their program. Bureaucracy surrounding the collaboration between university departments was also cited as a major challenge. Implementing the physical activity vital sign emerged as a common issue, with many institutions having no protocol in place for arranging a follow-up between students and physical fitness professionals after referral acceptances (n=5), and no protocol existing for referral declinations (n=9). Despite a stated desire for greater collaboration with other universities, particularly sharing of information and ideas (n=9), most respondents (83%) had not collaborated with other programs. Social media was under-utilized, with over a third (n=9) of respondents not utilizing any social media platforms. CONCLUSION: EIM-OC programs at various institutions experienced similar challenges. This research will serve to inform and improve upon the implementation, development, and outcomes of EIM-OC programs and ultimately contribute to helping academic institutions increase the physical activity of students and their local communities.
Aging, Maximal Aerobic Capacity, and Running Economy in Trained Distance Runners

Maximal aerobic capacity (VO₂max) tends to decline with age, even in trained long-distance runners. However, it is possible that running economy (RE), another predictor of performance, may be preserved. Furthermore, previous research has demonstrated no changes in CoP sway parameters with EO or EC. However, a significantly increased path length in an enveloped area with EC (21.5 cm² vs. 17.3 ± 3.0 cm², P < 0.05) was measured. The percent of VO₂max (%VO₂max) at which a submaximal run occurs is also related to performance. PURPOSE: To evaluate VO₂max, RE, and %VO₂max in runners across a wide age range and determine whether age is associated with these performance-related measures. METHODS: Runners aged 20-66 years completed two running tests. Study visits took place within four weeks of a goal race of 10-26.2 miles. Subjects ran for five minutes at 88% of their predicted age-based maximum heart rate, which approximates a marathon-intensity effort. Athletes then performed a VO₂max test. AlloVO₂max was calculated using body mass (kg). Energy cost was determined using caloric equivalents based on mean respiratory exchange ratio, which takes substrate utilization into account. Pearson’s correlations were used to determine relationships between age and running performance variables. RESULTS: Runners (n = 22, 11 females; body mass index 22.54 ± 2.9 kg/m²) had a mean VO₂max of 53.2 ± 10 ml O₂/kg * kg⁻¹ * min⁻¹ (range: 35.6-69.9). Age was not significantly correlated with VO₂max, alloVO₂max, or %VO₂max (respectively: r = -0.281, p = 0.205; r = -0.172, p = 0.470; r = -0.191, p = 0.42). Age was highly correlated with EC (r = 0.721, p = 0.001). CONCLUSIONS: In this population, age was not related to maximal or submaximal oxygen consumption. The strong positive relationship between age and EC suggests that substrate use during submaximal running may change with age in trained distance runners.
This study aims to assess serum traces of copper (Cu) and zinc (Zn), lipid profiles, geriatric depression level and activities of daily living (ADL) scale index in older adults affiliated with two different programs of physical activity (PA) levels. In the first program, Exercise for Health, members perform regular PA (at least 60 minutes, 3 times per week) and the second one represents a Nursing Home (NH) without regular physical activity each week. Methods: Sixteen men and women in the PA group (age: 64.7±4.8 years) and 34 men and women in the NH (age: 77.9±5.3 years) with no previous documented cardiovascular disease participated in the study. Anthropometric measurements were performed and blood was drawn from left arm. Serum traces of Cu and Zn were determined by atomic absorption spectroscopy, lipid profiles by absorbance and colorimetric assays, levels of geriatric depression with Yesavage’s scale index, and activities of daily living with Katz’s index of independency in ADL. Results: The results revealed similar serum trace cu of PA (P=0.62±0.02; NH: 0.64±0.02 mg/L) and zinc (PA: 0.29±0.01; NH: 0.31±0.01 mg/L), and lipid profile (total cholesterol, PA: 163.92±47.24, NH: 160.06±36.16 mg/dL; HDL, PA: 38.62±9.8 mg/dL; NH: 37.79±7.53 mg/dL; LDL, PA: 102.85±33.75, NH: 109.24±29.19 mg/dL; VLDL, PA: 20.69±8.6, NH: 13.03±4.26 mg/dL; triglycerides, PA: 103.38±45.13, NH: 65.62±21.19 mg/dL) between both older adults groups. However, NH group showed a higher level of geriatric depression (70.5% vs. 38.5%) and dependency when performing activities of daily living (ADL). Conclusions: Even though participants were involved in different levels of physical activity level, serum traces of Cu and Zn, and lipid profile were within a normal limits range, but institutionalized older adults showed higher tendency toward depression and difficulties with daily living activities.

**PURPOSE:** Lost of bone mineral density (BMD) could lead to a serious health consequence for middle age and older adults. It is well known that BMD declines as a person becomes aging. It is also observed that heavier individuals tended to have a better bone mineral density, which led an assumption that stronger persons should have a more dense bone. This hypothesis, however, has not been examined using the large population data. This study was to fill this gap.

**METHODS:** Data from the 2013-2014 National Health and Nutrition Examination Survey (NHANES) were used for the study, in which a sample of 3127 (representing a weighted national sample of 12654108 US adults), with age from 40 to 80 yr. old, were examined for their BMD, age, sex, height, weight and hand grip strength. The correlations between total femur bone mineral density (tBMD) and BMI (body mass index) and grip strength were examined by sex and by total. **RESULTS:** Statistical findings of the study are summarized as in the table:

<table>
<thead>
<tr>
<th>Correlation between total femur BMD and age, BMI and grip strength</th>
<th>Correlation</th>
<th>Age</th>
<th>BMI</th>
<th>Grip Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>-0.171</td>
<td>0.434</td>
<td>0.285</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>-0.449</td>
<td>0.496</td>
<td>0.414</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>-0.291</td>
<td>0.411</td>
<td>0.475</td>
<td></td>
</tr>
</tbody>
</table>

**CONCLUSIONS:** As expected, age has a negative correlation with bone density and BMI and grip strength has a positive one and this is especially true for female adults and older adults. Since BMI is often associated with overweight or obesity, the best approach to improve body density is to engage in strength and conditional related exercises regularly. Future studies should focus more on dose-response issues of needed strength exercise for a better bone.

The age-related declines in muscle mass and function are greater for women and the lower limb muscles, and these decrements accelerate during middle-age. However, it is less clear which lower limb muscles may be compromised more in middle-aged women. **PURPOSE:** To compare muscle function and architecture of the knee extensor and plantar flexor muscles in middle-aged and young women. **METHODS:** Twenty middle-aged (years: 54 ± 6) and eight young women (years: 22 ± 2) volunteered to participate in this study. In vivo muscle architecture measurements such as muscle thickness and pennation angle of four muscles including vastus lateralis (VL), rectus femoris (RF), Gastrocnemius medialis (GM) and lateralis (GL) were measured using a B-mode real-time ultrasound scanner. Each participant performed maximal voluntary isometric contractions (MVIC) of knee extensor and plantar flexor muscles 3-4 times in a single sitting position on the Biodex dynamometer. Interpolated twitch technique was used to assess voluntary activation (VA). Absolute and weight-normalized maximal strength and rate of torque development (RTD) were analyzed from VMIC torque data. Additionally 6 minute walk test and sit-to-stand task were performed. Age-related changes were tested using two-way ANOVA with repeated measures. **RESULTS:** Both absolute and normalized MVIC strength, RTD, and VA were similar (p > 0.05) between young and middle-aged women. There were no significant differences in muscular thickness between young and middle-aged women, however, VL thickness trended towards being larger in young women (23.1 ± 0.2 vs. 21.4 ± 0.22 cm, p = 0.067). GM pennation angle was significantly larger in young women (25.8 ± 2.5 vs. 23.6 ± 2.4 degrees, p = 0.038). Lastly, the young women performed significantly more repetitions during the sit to stand task (23.8 ± 5.7 vs. 18.3 ± 4.7, p = 0.013), whereas there were no differences in performance of the six minute walk test (p = 0.139). **CONCLUSION:** Isometric and explosive torque production was similar between young and middle-aged women. A greater decrease in GM pennation angle compared to other muscle groups suggest that the age-related alteration in muscle architecture may be more compromised for plantar flexor muscles than knee extensor muscles.

**Aging is commonly associated with a decline in muscle size, strength and power. As a result, daily physical function also declines. Recent studies have noted that declines in muscle power are the most significant cause for decreased functional performance for older persons. No previous studies have assessed the magnitude of improvements in functional movements (activities of daily living) by implementing different methods of periodization during training. **PURPOSE:** To analyze the effects of two different periodization styles on functional strength, power, and activities of daily living (ADL) in an elderly population over a 14-week (3x weekly) training period. **METHODS:** Pretest and post-test measurements included chest and leg press 1RM and pneumatic isometric peak power, as well as functional performance on 5 ADL measures (gallon jug test, 8-foot up and go, floor rise, 6m walk, laundry transfer, 5x repeated chair stand). After a 2-week familiarization period participants were randomly assigned to either a linear periodization group (n=16, age = 69.3±4.59 y) or a concurrent periodization group (n=14, age = 68.93±6.72 y). Each protocol consisted of 12 total strength (3 x 8 reps @70% 1RM), power (3 x 8 @50% 1RM), and translational training sessions. Linear periodization consisted of 4 wk strength training, 2 wk translational training, 4 wk power training, 2 wk translational training while the concurrent periodization group completed 12 weeks of day 1: strength, day 2, power, and day 3: translational. **RESULTS:** Both groups experienced significant improvement on all strength (p<0.001), power (p<0.001), and ADL measures relative to baseline (p<0.001), with no significant between-groups differences observed on any outcome variable. **CONCLUSION:** Linear and concurrent periodization were found to be equally effective at increasing muscular strength, power, and ADL performance over the course of a 14 week training study.
PURPOSE: The efficacy of aerobic training in a rehabilitation setting is often determined by comparing changes in aerobic capacity (VO2peak) using a cardiopulmonary maximal exercise test (CPX). In many studies, the reported pre- vs. post-training difference in VO2peak is ≤3 ml·kg⁻¹·min⁻¹ and it is assumed that subjects put forth a maximal effort in both tests. A concern therefore arises that a difference in effort between tests could account for a significant portion of the reported improvement in VO2peak; especially when those with chronic illness who are unaccustomed to maximal effort are tested. In the present study we retrospectively examined data to test the hypothesis that only individuals with an improvement in VO2peak have an improvement in steady state heart rate recovery (HRR) after completing a CPX test. METHODS: Thirty-seven chronically ill patients (57 ± 12 yrs) and non-responders (NRS) (n=19; VO2peak increased = 0.2 L·min⁻¹) were partitioned into a group of responders (RS) (n=18; VO2peak increased = 0.5 L·min⁻¹) and non-responders (NRS) (n=19; VO2peak increased = 0.2 L·min⁻¹). HRR was defined as the difference between peak HR and HR at each minute of cycling at 40% of the pre-training CPX test peak workload, which was compared between pre- and post-program tests. RESULTS: VO2peak significantly improved post program in RS (2.2 ± 0.6 vs. 2.6 ± 0.5 L·min⁻¹; p<0.05) but not NRS (1.9 ± 0.7 vs. 1.9 ± 0.7 L·min⁻¹). The RS pre-program VO2peak was 88% of age and gender predicted values vs. 107% in the NRS. Only RS had a greater HRR at 5 minutes (pre 39 ± 11 vs. post 46 ± 9 bpm; p<0.05) and NRS pre 37 ± 10 vs. post 39 ± 11 bpm, N.S.). Among RS, 14 of 18 improved their HRR by 0.5 L·min⁻¹, whereas 4 of 19 did not. VO2peak and HRR were significantly correlated (r=0.53). CONCLUSION: Including a fixed recovery workload following a CPX test to voluntary termination before and after a 12-week exercise rehabilitation program based on current guidelines for cardiac rehabilitation. VO2peak was defined as the highest rate of O2 uptake over 15s during the final stage of exercise. Participants were partitioned into a group of responders (RS) (n=18; VO2peak increased = 0.5 L·min⁻¹) and non-responders (NRS) (n=19; VO2peak increased = 0.2 L·min⁻¹). HRR was defined as the difference between peak HR and HR at each minute of cycling at 40% of the pre-training CPX test peak workload, which was compared between pre- and post-program tests. RESULTS: VO2peak significantly improved post program in RS (2.2 ± 0.6 vs. 2.6 ± 0.5 L·min⁻¹; p<0.05) but not NRS (1.9 ± 0.7 vs. 1.9 ± 0.7 L·min⁻¹). The RS pre-program VO2peak was 88% of age and gender predicted values vs. 107% in the NRS. Only RS had a greater HRR at 5 minutes (pre 39 ± 11 vs. post 46 ± 9 bpm; p<0.05) and NRS pre 37 ± 10 vs. post 39 ± 11 bpm, N.S.). Among RS, 14 of 18 improved their HRR by 0.5 L·min⁻¹, whereas 4 of 19 did not. VO2peak and HRR were significantly correlated (r=0.53). CONCLUSION: Including a fixed recovery workload following a CPX test may be useful for confirming post-program increases in VO2peak. In the present study, participants that improved VO2peak were more likely to have concurrent improvements in HRR after exercise-based rehabilitation.

PURPOSE: Cardiorespiratory fitness (CRF) provides an independent marker for endurance performance and all-cause and cardiovascular mortality. Oxygen consumption (VO2) during treadmill testing can be reasonably estimated from the attained speed, grade, and duration in men, women, and patients with coronary disease. Using our Cardiac Performance database and the Wicks equation (MSSE, 2011) to estimate maximal oxygen consumption (VO2 max), expressed as metabolic equivalents (METs), we examined directly measured VO2 max data on clients who self-reported performing vigorous physical activity ≥2 days per week to establish a normalization factor for this calculation in a sedentary cohort. ME 15OHD6: Our study cycle population (n = 177) was comprised of young, middle-aged and older adults (mean ± SD age = 53.7 ± 11.0 years), including 101 men and 76 women who had completed a standard Bruce treadmill protocol to volitional fatigue. Estimated VO2 max, expressed as maximal METs, was determined using the formula: Maximal METs = 6 × (heart rate [HR] index) − 5, where the HR index was calculated as the ratio between the maximal attained during cardiopulmonary exercise testing and the standing resting HR. These values were compared to the directly measured VO2 max values using age, body mass index (BMI), and gender to further modify the Wicks equation so that it more accurately estimated CRF for this active population. RESULTS: For the entire study population (n = 177), mean BMI was 25.6 ± 3.8 kg·m⁻². During exercise testing, resting HR increased nearly 2.4-fold (2.37 ± 0.39); directly measured VO2 max, expressed as mean ± SD METs, was 10.2 ± 2.8. Using a linear regression model and the maximal Wicks prediction equation, as well as gender, age, BMI, an r-squared value of 0.62 was obtained (P-value <0.001). Two separate equations were developed using this model: Maximal METs = 20.8 + (0.08 × age) - (0.29 × BMI) + 0.24 x (6 x heart rate index)−5 for men; and Maximal METs = 18.8 + (0.08 × age) - (0.29 × BMI) + 0.24 x (6 x heart rate index)−5 for women. CONCLUSION: These newly developed equations may help to more accurately estimate peak METs in physically active, fit men and women of varied ages. Future research with a larger patient population and additional modulators should serve to increase the coefficient of determination.

Background: Exercise training is well known to improve insulin sensitivity (SI). However, the duration in which exercise –induced improvements in SI persists varies significantly between studies, ranging from 0- to 72-hours following the last bout of exercise. One caveat that may explain the variability between studies is the magnitude of energy deficit following exercise. PURPOSE: To assess the chronic effects of 12-weeks of aerobic exercise training and the acute effects of exercise intensity for improving SI when measured under energy balanced (EB) conditions. METHODS: Thirty-three untrained premenopausal women were evaluated at baseline, after 12-weeks of training, 22 hrs after either an acute- bout of moderate-intensity continuous (MIC) aerobic exercise (50%-peak VO2) or high intensity interval (HII) exercise (84% peak VO2). Participants stayed in a room calorimeter during and after the exercise sessions. Food intake was adjusted to obtain EB across 24-hrs. SI was measured 22hrs after all conditions using the hyperinsulinemia euglycemic clamp. Muscle biopsies were obtained in a subset of 15 participants to examine mitochondrial oxidative capacity using high resolution respirometry. RESULTS: A significant increase in SI was observed only following the HII condition (P < 0.05). There were no significant improvements in SI following 12-weeks of training or the MIC session. A significant improvement in mitochondrial respiratory capacity occurred following all post-training conditions (P < 0.05). No significant differences between energy consumed and energy expended were found between all conditions. Conclusions: The primary finding from this study was that SI only improved following a bout of HII exercise when measured under EB, which suggests that energy deficit following exercise plays a role in exercise-induced improvements in SI. While we were unable to measure muscle glycogen, it is possible that glycogen deficit is important in determining the magnitude of these exercise-induced improvements in SI. Last, improvements in mitochondrial respiratory capacity occurred even when SI did not change, suggesting that these two responses are independent of one another.

PURPOSE: Habitual exercise is associated with marked reduction in both total and abdominal adipose tissue (AT); however, the optimal dose (amount and intensity) of exercise required to elicit the greatest reduction remains unclear. The purpose of this investigation is to determine the separate effects of increasing exercise amount and intensity on AT and skeletal muscle (SM) mass in sedentary, abdominally obese adults. METHODS: Participants in this study included 105 men (40%) and women (60%) who were randomly assigned to one of four conditions for 24 weeks: control (C; n=20); low amount low intensity (HALI: 180 and 300 kcal/session for women and men, respectively, at 50% of VO2peak, n=24); high amount low intensity (HALI; 360 and 600 kcal/session for women and men respectively at 50% VO2peak, n=31); high amount high intensity (HII: 360 and 600 kcal/session for women and men respectively, at 75% of VO2peak, n=30). AT and SM mass were measured by magnetic resonance imaging at baseline and 24 weeks. RESULTS: Reductions in total AT (%; C, -0.8; LALI, -7.9; HALI, -10.8; HAIL, -11.5), abdominal subcutaneous AT (%; C, -0.3; LALI, -6.7; HALI, -10.1; HAIL, -12.9), visceral AT (%; C, -0.2; LALI, -15.5; HALI, -18.4; HAIL, -17.1), weight (%; C, -0.8; LALI, -4.7; HALI, -6.8; HAIL, -6.4) and waist circumference (%; C, -1.2; LALI, -4.5; HALI, -6.1; HAIL, -5.6) were greater in all exercise groups compared to control (p<0.0001), independent of age and sex. Reductions in total AT and abdominal subcutaneous AT were greater in HAI compared to LAI (p<0.003). SM mass did not change at 24 weeks in any exercise.
group compared to control (p>0.05). CONCLUSION: Substantial reduction in visceral AT with a preservation of SM mass is observed independent of exercise amount and intensity; however, higher intensity (HI) may be more effective than guideline-recommended (LALI) exercise for reducing total and subcutaneous adiposity. Supported by Canadian Institutes of Health Research (grant OHN-63277)

---

**1527 Board #5**
May 31 1:00 PM - 3:00 PM
**Interval Training in Cardiac Rehabilitation**

Rochus Pokan, FACSM1, Stefan Heber1, Helmuth Ocnacek1, Serge P. von Duvillard, FACSM.1 1University of Vienna, Vienna, Austria, 2Cardiology Outpatient Cardiac Rehabilitation Center, Linz, Austria. 3University of Salzburg, 5400 Hallein/Rif, Austria. (No relevant relationships reported)

Rochus Pokan, FACSM1, Stefan Heber1, Helmuth Ocnacek1, Serge P. von Duvillard, FACSM

1University of Vienna, Vienna, Austria, 2Cardiology Outpatient Cardiac Rehabilitation Center, Linz, Austria, 3University of Salzburg, Salzburg, Austria.

Exercise training is a standard treatment for patients with coronary artery disease (CAD). Improvements in endurance capacity are an important aim of cardiac rehabilitation.

**PURPOSE:** We assessed the use of high intensity interval training (HIIT) on cardiopulmonary fitness (CRF) and body mass index (BMI) compared to the isocoric conventional endurance exercise training. **METHODS:** After initial exercise test, 50 patients were randomized to HIIT and a control (CG). In a controlled protocol, patients exercised for 12 wks, 4 x per wk. Between inclusion and week 6, patients exercised 4 x per wk and from wk 6 to 12, patients exercised 2 x per wk, both sessions were supervised in cardiac rehabilitation center and additionally 2 x per wk on individual basis at home. Patients in CG exercised continuously only, while patients in the HIT group completed 2 intervals and 2 continuous exercise training sessions per wk, in alternate sequence. After 6 wks and at the end of the training phase, exercise tests were repeated. Exercise protocol consisted of 5min of warm-up followed by 30min of continuous cycling at 60% of HRR, HIIT exercise protocol consisted of 5min of warm-up, followed by 30min of interval training at: P1 = 60% HRR, P2=50% HRR, P3 = 20% HRR, P4=10% HRR. Pre was the mean workload during the 30min of exercise, Pre was the peak workload intensity, Pre was the recovery workload, trec was the peak workload duration, trec was the recovery duration. For weeks 7-12, power output for each training session was recalculated according to Pre achieved in the second exercise test. **RESULTS:** The type of exercise training had a significant effect on BMI but not on absolute VO2max. The CG reduced the BMI (-1.2) after 12 wks.

**CONCLUSION:** Our results suggest that despite equal energy expenditure, HIT may be more effective in increasing muscle mass than endurance capacity.

---

**1528 Board #6**
May 31 1:00 PM - 3:00 PM
**Feasibility of Aerobic Interval Training in Non-Ambulant Persons after Stroke**

Sarah R. Valkenborghs1, Kirk I. Erickson2, Michael Nilsson1, Paulette van Vliet1, Robin Callister1. 1University of Newcastle, Newcastle, Australia. 2University of Pittsburgh, Pittsburgh, PA. (No relevant relationships reported)

**PURPOSE:** To investigate the feasibility of aerobic interval training in non-ambulant persons after stroke.

**METHODS:** Intervals of aerobic exercise were performed on a low entry upright (Ben2143, Monark) or semi-recumbent (RT2, Monark) cycle ergometer depending on individual ability and impairment. Participants were prescribed 4 x 4-minute intervals of exercise at 85%HRRmax with a 3-minute active recovery at 70% HRRmax between each interval per 30-minute session, 3 times per week for 10 weeks. Heart rate (T31, Polar), rating of perceived exertion (Borg 6–20), workload (W), cadence and duration of exercise achieved were recorded in the last 15 seconds of each interval. Workload was initially prescribed based on data from an incremental cycle ergometer test and, where tolerated, was progressively adjusted to maintain intensity.

**RESULTS:** 9 participants (aged 62±12, 5 male) unable to walk without assistance after stroke (2.9±3.9 years) were recruited. Those were no adverse events and I drop out (due to bronchitis). Attendance for the remaining 8 participants was 93±6%. After 12 weeks, showing a mean increase of 17±3 W (29%–40%).

**CONCLUSIONS:** Aerobic interval training at a moderate-high intensity on an upright or recumbent cycle ergometer is feasible and safe for persons who are non-ambulant after stroke. It should be further researched to investigate its potential to improve cardiopulmonary fitness after stroke and risk-factors for recurrent stroke. Funding body: National Stroke Foundation, Australia

---

**1529 Board #7**
May 31 1:00 PM - 3:00 PM
**The Effects Of HIIT On Body Composition And Muscular Strength In Sedentary, Obese Women**

Jamie DeRevere, Amy S. Clark, Annie B. De La Rosa, Todd A. Astorino. California State University San Marcos, San Diego, CA. (No relevant relationships reported)

Introduction: Obesity rates are increasing, with the incidence of obese U.S. adults increasing from 30.5% in 2000 to 37.0% in 2014 (Ogden et al., 2015). Additionally, more women suffer from obesity or extreme obesity compared to men (Ogden and Carroll, 2010). A consequence of sedentary lifestyles is poor muscular strength, which is a risk factor for diabetes and cardiovascular disease (Shirima et al., 2017), as well as all cause mortality (Rantanen et al., 2000). High intensity interval training (HIIT) is a time efficient and robust mode of exercise, which elicits similar adaptations versus moderate intensity continuous training (MCT) in obese adults (Kong et al., 2016). Previous data show that HIIT promotes weight and/or fat loss in overweight or obese populations (Gillen et al., 2013; Martins et al., 2016), yet in other studies, body composition was unchanged in response to HIIT (Nybo et al., 2010; Whyte et al., 2010; Astorino et al. 2015). A recent study (Farina et al., 2017) showed increased muscle strength in response to HIIT in active men.

**PURPOSE:** To investigate the effects of different types of HIIT on body composition and muscular strength in sedentary, obese women.

**METHODS:** 17 obese sedentary women (age = 37.5±10.53 yr) participated in a six-week exercise intervention consisting of three training sessions per week. They were randomized into low volume HIIT (LO) (n=9, BMI=37.2±3.3 kg/m2) or periodized HIIT (PER) (n=8, BMI=41.0±5.3 kg/m2) which were performed on a cycle ergometer. Body composition and muscle strength were measured pre- and post-training. Fat mass and fat free mass were measured using air displacement plethysmography via a BodPod. Peak knee extension and flexion torque at 60 deg/s was assessed using an isokinetic dynamometer. Measures of dietary intake and physical activity were also obtained during the study.

**RESULTS:** FFM was increased in LO (52.0±7.5 kg vs. 53.3±4.9 kg) and PER (54.4±6.64 vs 56.10±6.57 kg), (p<0.03), yet there was no interaction (p=0.33). There was no significant change in body mass (p=0.075), fat mass (p=0.19), or peak extension (p=0.35) for flexion torque (p=0.75).

**CONCLUSION:** Regardless of protocol, HIIT elicits body composition improvements including an increase in fat free mass, but has no effect on muscular strength or body fat in sedentary, obese women.

---

**1530 Board #8**
May 31 1:00 PM - 3:00 PM
**The Effects Of A High-volume And High-intensity Resistance Training Program On Arterial Stiffness**

Tim Werner1, Thomas K. Pellinger1, Nabil E. Boutagy2, Demetri Rossette1, Austin T. Ortoll1, Morgan M. Vance1, Salisbury University, Salisbury, MD. 1Yale University, New Haven, CT. (No relevant relationships reported)

Arterial stiffness has long been regarded as an indicator of disease and is an independent predictor of cardiovascular events. Controversies exist amongst the impact of resistance training protocols on the stiffening process in the major elastic arteries. This study was designed to address some of the controversies.

**PURPOSE:** To determine the acute increase of arterial stiffness (carotid-femoral (CF) pulse wave velocity (PWV)) induced by a typical one set of high-volume (HV), moderate resistance training program and a high-intensity (HI), moderate repetition training program on arterial compliance.**

**METHODS:** 21 otherwise healthy, male university students with limited resistance training experience (<6 months) were randomized into one of three groups: 7 control (CG) group (22±3 yrs), 6 HI resistance exercise group (22±3 yrs), and 8 HV resistance exercise group (21±3 yrs). All were subjected to a series of tests including anthropometry, ultrasonography of the carotid artery, applanation tonometry, blood pressure acquisition, and maximal strength assessment. Subjects were instructed to maintain normal dietary patterns throughout the study period. Food consumption was monitored. All subjects in the training groups performed the same 8-10 exercises on training days. Subjects in the HV group trained at 50-70% of 1RM with 10-15 repetitions and 2-4 sets per exercise for 3-5 days a week for 12 weeks. Subjects in the HI group trained at 70-95% of 1RM with 3-6 repetitions and 2-3 sets per exercise for 3-5 days a week for 12 weeks. Subjects randomized to the control group were instructed to refrain from both cardiovascular and resistance exercise during the study period. Arterial stiffness comparisons
were calculated with two-way ANOVA with repeated measures. RESULTS: 1-RM significantly increased for squat (52% vs. 25%, p<0.05), bench press (31% vs. 27%, p<0.05) and seated rows (22% vs. 13%, p<0.05) in the HV and HI groups respectively. Carotid femoral PWV did not change in the HI (7.6±2 vs. 8.1±2 m/s, p=0.05), HV (6.3±1 vs. 6.8±2 m/s, p<0.05), and CO (6.7±1 vs. 6.7±1 m/s, p<0.05) groups. Beta stiffness index did not change in the HI (5.9±3.5 vs. 5.7±2.6 U, p=0.05), HV (6.5±1.9 vs. 6.5±2.1 U, p=0.05), and CO (7.2±4.4 vs. 6.4±3.1 m/s, p<0.05) groups. CONCLUSION: 12 weeks of HI and HV training does not appear to augment indices for arterial stiffness in young, adult males.

D-09  Basic Science World Congress - Thematic Poster - Moderating Skeletal Muscle II Thursday, May 31, 2018, 1:00 PM - 3:00 PM Room: CC-Mezzanine M100C

1531 Chair: Christopher McGlory, McMaster University, Hamilton, ON, Canada.

(No relevant relationships reported)

Blood flow restriction (BFR) is becoming more widely used with strength training in sports medicine and rehabilitation. It can be used passively and actively to combat muscle atrophy and stress loss observed during unloading in early post-traumatic and surgical contexts. Varied cuff types and pressures have been used but quantification of interface pressures, safety and patient comfort have not been widely investigated.

PURPOSE: To investigate the interface pressure mechanics, perceptual and cardiovascular responses to different cuffs during acute bouts of passive blood flow restriction [BFR] and BFR exercise.

METHODS: Eighteen participants attended three experimental sessions in a randomised, crossover, counterbalanced design. Participants underwent inflations at 40% and 80% limb occlusive pressure (LOP) at rest and completed 4 sets of unilateral leg press exercise at 30% of one repetition maximum with BFR at 80% LOP. Different cuffs were used for each session: a rapid-inflation and handheld cuff. Cuff-to-limb interface and Set pressure (IP, SP) were measured using a universal interface device with pressure sensors. Perceived exertion and pain were measured after each set, mean arterial pressure (MAP) was measured pre-, 1-min post- and 5-min post-exercise. RESULTS: IP was lower than the SP in all cuff trials at rest (p<0.05). IP was, on average, 10.2±3.5, 8.0±1 and 47.5±33.95 mmHg higher than the SP for the rapid-inflation and handheld cuffs (p<0.01) and 2.1±7.60 mmHg lower than the SP for the variable-contour cuff (p<0.05) across all exercise sets. Pain and exertion were significantly greater in sets compared to the variable-contour cuff at 1-min and 5-min post-exercise (p<0.05) and 2.17±6.70 mmHg lower than the SP for the variable-contour cuff and 47.65±35.95 mmHg higher than the rapid-inflation and handheld cuffs. Different cuffs were used for each session: a rapid-inflation and handheld cuff.

CONCLUSION: BFR cuffs that apply higher pressures than prescribed amplify CV and perceptual responses. A variable-contour cuff that regulates pressure is the most safe and effective for rehabilitative purposes in clinical populations.

1532 Board #1  May 31 1:00 PM - 3:00 PM Interface Pressure Mechanics, Perceptual and Cardiovascular Responses To Different Cuffs In Blood Flow Restriction


(No relevant relationships reported)

1533 Board #2  May 31 1:00 PM - 3:00 PM Importance of Autophagy in the Recovery of Muscle Function After Injury in an Ovariecetomized Model

Anna S. Nichenko, W. Michael Southern, Alexandra Flemington, Bethany L. Graulich, Jarrod A. Call. University of Georgia, Athens, GA.

(No relevant relationships reported)

The lack of ovarian hormones accentuates the loss of muscle contractility after muscle injury. Mitochondria are required to meet the energetic demands of muscle contractility, but whether mitochondrial function is affected by muscle injury and impacts repair is unclear in the context of ovarian hormone depletion. PURPOSE: To test mitochondrial dysfunction after muscle injury in the context of ovarian hormone depletion and to investigate autophagy, a cellular process for degrading damaged and dysfunctional mitochondria, as a mechanism of mitochondrial repair during regeneration. METHODS: We subjected sham surgery wildtype (WT) and ovariecetomized (OVX) mice to traumatic muscle injury and assessed the recovery of in vivo muscle strength (i.e. ankle dorsiflexion) and state 3 respiration from permeabilized muscle fibers at 7 and 14 days post-injury. To investigate autophagy, expression of autophagy-related proteins Beclin1 (Atg6) and LC3 were assessed. To determine if an interaction exists between ovarian hormones and autophagy, muscle strength and state 3 respiration were assessed 14 days post-injury following sham or OVX surgeries on Ulk1 deficient mice, a necessary protein for mitochondrial-specific autophagy, and littermate controls. RESULTS: OVX resulted in a 10% reduction in muscle strength (p<0.045) pre-injury compared to sham. This was exacerbated by muscle injury (14 days post-injury: OVX 25% vs. sham 35% of pre-injury, p<0.038). For state 3 respiration, there was a main effect of injury demonstrating a substantial reduction in mitochondrial function at 7 and 14 days post-injury (p<0.0001), independent of ovarian hormones. There was a large induction of autophagy as indicated by greater Beclin1 and LC3 expression at 7 and 14 days post-injury, independent of ovarian hormones (p<0.001, p<0.014 respectfully). Interestingly, OVX-Ulk1-deficient mice demonstrated less recovery of muscle strength at 14 days post-injury compared to OVX-LM (p<0.016). CONCLUSIONS: After muscle injury a robust autophagic response is required to recover muscle function in a timely manner and this occurs in the presence and absence of ovarian hormones. However, decreased strength recovery in OVX-Ulk1 deficient mice suggests an interaction between ovarian hormones and autophagy during muscle regeneration.

1534 Board #3  May 31 1:00 PM - 3:00 PM Effect Of Diet And Exercise On Skeletal Muscle Morphology Following Radiation Therapy

Donna D’souza, Russell Emmons, Diego Hernandez-Sauvedra, Sophia Roubos, Jillian Larkin, Jessica Lloyd, Hong Chen, Michael De Lisio. University of Ottawa, Ottawa, ON, Canada. University of Illinois at Urbana-Champaign, Urbana, IL.

(No relevant relationships reported)

With an increase in long-term cancer survival, the late effects of radiation therapy, a common treatment option, is an area of clinical concern. Furthermore, while obesity and physical activity levels are known to be associated with the risk for cancer, little is known regarding the effect of these two physiological factors on health following radiation therapy. PURPOSE: The purpose of the current investigation was to evaluate the influence of obesity and physical activity on skeletal muscle morphology following a sub lethal dose of radiation (IR). METHODS: Four-week-old male CBA mice were divided into control (CON; n=20) and high fat groups (HF; 45% fat, n=20). At 9 weeks of age mice in each group were further divided into sedentary (SED, n=10) and exercise (EX, n=10) groups. EX mice completed 4 weeks of treadmill training. At 13 weeks of age all mice were administered a therapeutic IR dose (3 Gy), and subsequently continued their previous exercise and dietary protocol for an additional 4 weeks. RESULTS: At 10 weeks of age HF groups had a higher percentage of body fat and higher body weight compared to controls (p<0.05, n=9–10). At 16 weeks of age HF groups had significantly higher lean body mass and gastrocnemius/soleus complex mass compared to controls (p<0.05, n=9–10). Morphological sectional area (MCSA) analysis revealed an increase in EX groups (p<0.05, n=6–8), with a trend for an increase in HF groups (p=0.06, n=6–8). Fibre distribution analysis identified a decrease in 500-999 μm fibres (p<0.05, n=6–8), and a greater proportion of large fibres (>2000 μm, p<0.05, n=6–8) in EX groups. Myonuclei/fibre in HF-EX was 1.3-fold higher than CON-EX and HF-SED (p<0.05, n=6–8). CONCLUSIONS: Diet-induced obesity resulted in an increase in body weight, adiposity, lean mass, and muscle weight. However, exercise training, but not HF, increased MCSA, and the proportion of large fibres. The increase in myonuclei content in HF-EX mice may implicate a role for muscle stem cell populations in this adaptive response. Future evaluation of distinct muscle stem cell populations and muscle morphological characteristics will be completed to further characterize the effect of diet and physical activity on skeletal muscle morphology following radiation therapy.

1535 Board #4  May 31 1:00 PM - 3:00 PM Plasticity Of Insulin Sensitivity And Muscle Mass In Healthy Older Adults Following Inactivity And Re-ambulation


(No relevant relationships reported)

Many older adults undergo repeated cycles of inactivity as they encounter sickness or injury. It is unknown how readily the insulin sensitivity and muscle mass of healthy older men and women are affected by modest physical inactivity (step reduction) and if these outcomes recover following a return to habitual physical activity. PURPOSE: To determine the changes in insulin sensitivity and leg muscle mass and function following sets activity and recovery.

METHODS: Healthy older adults (5F/7M, 70±2y, 26 kg/m², BMI, HbA1c 5.5±0.1%) were assessed before (PRE), after 2-weeks of step reduction (RA: ~75% of normal...
activity), and then following 2-weeks of baseline activity level (REC) for insulin sensitivity (euglycemic-hyperinsulinemic clamp), leg muscle mass (via DXA and pQCT) and isometric knee extension (KE) strength.

RESULTS: Participants decreased step counts during RA by ~70%. Glucose infusion rate (ml/kg FFM/min) during the clamp was 14.3±1.4 at PRE, decreased (p<0.05) to 12.5±1.7 at RA which then rebounded above PRE (p<0.05) to 16.6±1.9 at REC. This response was largely driven by the men. After removal of an outlier (+4.5% increase after RA), leg lean lost decreased after RA (p<0.05) 13.0±5.5% and then returned to PRE values at REC. Calf muscle area (pQCT) decreased (p<0.05) 2.4±0.9% from PRE to RA and then returned to PRE values at REC. KE strength decreased (p<0.05) 8.0±3.5% after RA and remained depressed 7.4±1.4% compared to PRE.

CONCLUSIONS: In healthy older men and women, insulin sensitivity as assessed via the gold standard (euglycemic hyperinsulinemic clamp) decreased (15.6%) following 2-weeks of modest physical inactivity, but unexpectedly, was able to rebound (39±8%) after re-ambulation such that it was 14±5% higher than baseline. This response may be limited to healthy older adults and therefore warrants further investigation. These older adults experienced modest muscle mass loss with step reduction that was restricted to the legs and especially the lower leg muscles. Knee extension strength was decreased after RA but did not recover following re-ambulation. Follow-up analysis may provide additional insight into the molecular mechanisms associated to the current metabolic and muscle alterations that occur with short-term physical inactivity and re-ambulation. Supported by NIH Grant R01 AG050781

1537 Board #6 May 31 1:00 PM - 3:00 PM Impact of Short-term Sedentariness on Week-to-Week Myofibrillar Protein Synthesis Rates in Physically Active Young Men

Brandon J. Shad, Andrew M. Holwerda, Yaser S. Elhassan, Lue J.C. van Loon, Janice L. Thompson, FACSM, Gareth A. Wallis, University of Texas Medical Branch, Galveston, TX (Sponsor: Paddon-Jones, Douglas J, FACSM)

(Objective relationships reported)

Sedentary behaviour has been linked to the development of cardiometabolic disease and insulin resistance but little is known about its impact on the regulation of skeletal muscle mass. PURPOSE: To determine the impact of short-term sedentariness on week-to-week myofibrillar protein synthesis rates. METHODS: Utilising a within-subject design, eight physically active young men (22±1 y) completed 7 days of habitual physical activity (HPA) followed by 7 days of increased sedentariness (SED) using a step reduction model. Two days prior to the study, participants ingested 400 mL of deuterium oxide (D2O) with 50 mL D2O doses ingested daily thereafter for the remainder of the study. Daily saliva samples were collected throughout to assess body water deuterium (H2O) enrichments. Muscle biopsies were collected at the beginning of the study (D1), after 7 days of HPA (D8) and after 7 days of SED (D15) for assessment of week-to-week myofibrillar protein synthesis rates. RESULTS: Currently, eight participants have completed the intervention. Preliminary data indicate that step count was reduced by approximately 92% during SED (14052±797 to 1185±134 steps•d-1; P<.001) and this led to a substantial increase in the contribution of sedentary behaviour to daily activity (72.3±90.1%; P<.001) and decrease in the contribution of standing (17±2 to 8±1%; P<.001) and ambulation (10.0±6.4 to 1.0±0.2%; P<.01) to daily activity. H2O ingestion resulted in mean body water H2O enrichments of 0.64±0.04% during HPA and 0.70±0.06% during SED (P<.05). Week-to-week myofibrillar protein synthesis rates decreased by approximately 26% from 1.24±0.08 %•d-1 during HPA to 0.92±0.14 %•d-1 during SED (P<0.06). CONCLUSIONS: Preliminary data show a trend for short-term sedentariness to reduce week-to-week myofibrillar protein synthesis rates in physically active young men.
The improvement in UPDRS scores exceeded the threshold for minimally clinically important difference. Fall frequency was reduced only in the dual-task group, which indicates dual-task training is superior than single-task training at reducing falls in PD.

PURPOSE: The purpose of this study was to assess the effects of a novel training program on the field-based performance testing of speed, power and movement quality. METHODS: A total of 100 individuals with PD (age 63 ± 8 years, n = 38 females) were randomized into one of three groups. VE (n = 40), FE (n = 40), or no-exercise control (n = 20). The VE and FE groups exercised 3x/week for 8 weeks on a stationary semi-recumbent cycle ergometer in a target heart rate range of 60-80% of heart rate reserve. The FE group exercised on a stationary cycle with the assistance of a motor that augmented pedaling rate by 35% compared to their preferred exercise rate. The MDS-Unified Parkinson’s Disease Rating Scale (UPDRS) was used to characterize PD motor function. All clinical evaluations were completed while patients were ‘off’ antiparkinsonian medication (12 hr at baseline, end of treatment (EOT), EOT+4 week and EOT+8 week. Results: UPDRS-III scores significantly decreased from baseline to the EOT for both the VE and FE groups. The VE and FE groups demonstrated significant improvements in clinical ratings following exercise. The magnitude of improvement was 5.4 and 4.5 points for the VE and FE groups (p<0.001) at EOT. The significant decrease in UPDRS-III was maintained for the VE (-3.5) and FE (-3.2) during the EOT+8 week follow up. The control group exhibited a slight worsening, 2.2 increase, at EOT in clinical ratings. There were no significant differences between the VE and FE groups. Conclusion: Improvements in global motor performance following VE and FE interventions indicate high intensity aerobic exercise is likely enhancing central nervous function (CNS) which ameliorates basal ganglia dysfunction associated to PD. The clinical rating improvement in the VE and
Gait modification (GM) via real-time biofeedback (RTB) is a conservative intervention that has shown positive outcomes in post stroke and diabetic patients. Results from a recent systematic review support the effectiveness of this approach for increasing peak internal knee extension moment (iPKEM). iPKEM is a resistive moment to peak external knee flexion moment (ePKFM), which is associated with altered joint loading. Scarce information exists on the comparative effectiveness of existing GM strategies. PURPOSE: To compare the effectiveness of trunk lean (TL), medial knee thrust (MKT), and foot progression (FP) on iPKEM. METHODS: 10 healthy individuals volunteered for this study (28±3.8 years, 1.73±0.1 m, 75.3±12.5 kg). Mean and standard deviation (SD) for iPKEM, trunk angle, knee angle (KA), and foot angle during stance were calculated from 10 baseline trials using a motion capture system (200Hz) and force plates (1000Hz). 10 trials completed for each strategy. Dependent t-tests were conducted to compare joint angles between baseline and modification strategy (p<0.05). RESULTS: A significant difference between strategies was attained for iPKEM (p<0.001). MKT (53±.24) had higher iPKEM than all other strategies (Baseline: 31±.2, FP: 34±.12, TL: 31±.14). No other statistically significant difference was found (p>0.05). CONCLUSION: MKT gait increased iPKEM despite no significant differences in KA compared to baseline. The observed increase in iPKEM during MKT gait suggests that participants were successful at attenuating ePKFM during the absorption phase of stance. Lack of significant changes in joint angles across conditions suggests that overall gait kinematics were similar for all conditions. Future research employing greater values for kinematic change is needed to further understand the effect of GM on iPKEM.
BACKGROUND: To examine rural-urban differences in physical activity among cancer survivors in central Pennsylvania.

METHODS: Cancer survivors residing in central Pennsylvania were identified through the Pennsylvania Cancer Registry and mailed select questionnaires based on the Behavioral Risk Factor Surveillance Survey (BRFSS). The 2013 Rural/Metro Continuum Codes (RUCC) were used to classify cancer survivors as urban/metro (RUCC codes 1-3) or rural/nometro (RUCC codes 4-9). Cancer survivors were classified as meeting aerobic guidelines (yes/no) based on the American College of Sports Medicine (ACSM) recommendations, adjusting for cancer site, age, BMI, education, and income.

RESULTS: Cancer survivors residing in central Pennsylvania were identified (N = 521) cancer survivors from 27 counties in Pennsylvania completed mailed questionnaires. The prevalence of physical inactivity was higher in rural cancer survivors (rural 39.1%, urban 30.8%), but this difference was not statistically significant (p = .180). Urban cancer survivors were 1.8 times more likely to meet aerobic physical activity guidelines compared to rural cancer survivors (95% CI: 1.08-6.31, p = .040); however, this was only marginally significant after adjusting for covariates (OR=1.91; 95% CI: 0.98-3.76; p=.057). Adjusted analyses with the composite variable confirmed that urban cancer survivors were 2.6 times more likely than rural cancer survivors to meet the aerobic physical activity guideline compared to neither guideline (OR=2.62; 95% CI: 1.06-6.31; p = .03).

CONCLUSIONS: Culturally and contextually adapted interventions are needed to improve adherence with physical activity recommendations and reduce cancer health disparities in rural cancer survivors in Pennsylvania.

PURPOSE: Physical activity (PA) among breast cancer survivors (BCS) has been associated with quicker physiological and psychological recovery following cancer treatment. Yet, little study has examined the predictive utility of psychological beliefs on BCS's quality of life (QoL) and objectively-assessed PA. Therefore, this study examined whether BCS's psychosocial beliefs predicted QoL and daily PA, energy expenditure (EE), and steps/day, with an additional examination of whether QoL differed based upon whether BCS met PA recommendations.

METHODS: Forty BCS (Xcancer = 51.2 ± 10.0 years; Xeducation = 80.1 ± 19.7 kg) participated in baseline, consisting of two larger parent intervention trials. Participants completed validated surveys regarding social cognitive beliefs (i.e., self-efficacy, social support, enjoyment, outcome expectancy, and barriers) and QoL outcomes (i.e., anxiety, physical functioning limitations, fatigue, depression, sleep disturbances, pain interference/intensity, and ability to participate in social roles/activities). One-week daily sedentary behavior (SB), light PA (LPA), moderate-to-vigorous PA (MVPA), EE, and steps/day were assessed via ActiGraph GT3X+ accelerometers.

RESULTS: BCS participated in a daily average of 556.2 min, 119.9 min, and 31.3 min of SB, LPA, and MVPA, respectively, with respective daily EE and steps/day being 385.5 kcals and 4,808 steps. Stepwise multiple regression indicated self-efficacy was the only belief observed predictive of overall QoL—explaining 34.9% of the variance for this variable (F(1,37) = 19.3, p < .001). Further, only outcome expectancy was found predictive daily LPA (F(1,37) = 5.5, p = 0.03)—explaining 13.2% of the variance. Notably, however, independent t-tests showed no differences in any QoL outcome between BCS who met or did not meet PA recommendations.

CONCLUSIONS: Findings suggest health professionals concentrate first on increasing BCS PA self-efficacy and outcome expectancy to increase PA participation and improve QoL. Larger sample sizes might allow for broader investigations of the predictive utility of psychosocial beliefs on QoL and daily PA behavior.
significant positive effects on cancer patients’ CRF. CONCLUSIONS: This study concluded that Tai Chi/Qigong had positive effects on QoL and cancer related fatigue symptoms on cancer patients. The findings need to be interpreted with caution due to limited studies and relatively small sample size.

1552 Board #4 May 31 1:00 PM - 3:00 PM
Does Low Volume High-Intensity Interval Training Elicit Superior Benefits to Continuous Low to Moderate-Intensity Training in Cancer Survivors?
Kellie L. Toohey, AEP, University of Canberra, Bruce, Australia.
(No relevant relationships reported)

PURPOSE: It is generally recommended that exercise form part of the standard of care for all cancer survivors, however, the optimal evidence-based clinical exercise guidelines for cancer survivors are currently not clear. The aim of this study was to determine the effectiveness of low volume high-intensity interval training (LVHIIT) and continuous low to moderate-intensity exercise training (CLMIT) on health outcomes in cancer survivors.

METHODS: Sedentary cancer survivors (n = 75) within 24 months of diagnosis, aged 51 ± 12 y were randomised into three groups for 12 weeks of LVHIIT (n = 25), CLMIT (n = 25) or control group (n = 25). The LVHIIT group performed 7 × 30s intervals (≥ 85% predicted maximal heart rate), the CLMIT group performed continuous aerobic training for 20 min (≥ 55% predicted maximal heart rate) on a stationary cycle, three times per week.

RESULTS: An interaction effect (p < 0.01) for waist circumference in the LVHIIT group was found. The LVHIIT group had larger improvements in emotional well-being compared to the other groups (p < 0.01). Participants in the CLMIT and LVHIIT group demonstrated improvements in physical and functional well-being (p < 0.01).

CONCLUSIONS: LVHIIT elicited greater benefits in improving waist circumference and emotional well-being compared to the other groups in this study. Exercise positively impacted body composition, while blood cell count (WBC) and haemodynamic variables, without any adverse effects. Future research should explore the mechanisms involved in the changes reported in this study, so that clinicians can provide clinically relevant evidence-based exercise prescription for cancer survivors.

Substantial research supports the positive effect of moderate-to-vigorous physical activity (MVPA) on physical functioning among cancer survivors. Less research has examined the association of light physical activity (LPA) and physical functioning, or the potential moderating effects of MVPA on this association.

PURPOSE: To explore the independent association between LPA and physical functioning and any moderating effect of MVPA on this association.

METHODS: Self-report data from the American Cancer Society’s Studies of Cancer Survivors (version 1.1) were used. Using the Leisure Time Exercise Questionnaire, four LPA groups (0, 1-59, 60-119, and ≥120 minutes/week) and three MVPA groups (0, 1-149, and ≥150 minutes/week) were created. ANCOVAs assessed the independent associations of LPA and MVPA as well as the LPA by MVPA interaction on the SF-12 Physical Functioning scale. Covariates included age, time since diagnosis, race/ethnicity, cancer type by gender, cancer stage, and number of comorbidities.

RESULTS: Among cancer survivors reporting no leisure-time MVPA, LPA was associated with SF-12 Physical Functioning [F(6) = 17.19, p < 0.001]. Among those reporting 1-149 and 150+ minutes/week of MVPA, there was no association of LPA and physical functioning (p > 0.05).

CONCLUSIONS: Among cancer survivors reporting no leisure-time MVPA, LPA was positively associated with physical functioning. The effect was clinically meaningful at the highest level of LPA (≥120 min/week). Randomized control trials are needed to determine the impact of LPA on physical functioning among cancer survivors healthy enough to begin LPA.

1555 Board #5 May 31 1:00 PM - 3:00 PM
The Association Between Light Physical Activity and Physical Functioning Among Cancer Survivors
Elizabeth A. Fallon, Bennett McDonald, Tenbrooke Smith, Kassamg I. Alcaraz, J. Lee Westmaas, Alpa V. Patel. American Cancer Society, Atlanta, GA. (Sponsor: Melissa Bopp, FACSM)
(No relevant relationships reported)

INTRODUCTION: Approximately 12.7 million people are diagnosed with cancer each year and many undergo conventional treatments including chemotherapy, radiation, and surgery. Complementary and alternative medicine (CAM) practices can include, but are not limited to dietary supplementation, Chinese herbal medicine, and physical manipulation. A yearlong 2012 survey found that cancer survivors spent $4 billion on vitamins and minerals, $1.2 billion on non-vitamin or mineral natural products, and $500 million on massage. PURPOSE: To examine the use of CAM in cancer survivors currently participating in a structured exercise program.

METHODS: Participants from the University of Northern Colorado Cancer Rehabilitation Institute (N=29) were given a 28-question, traditional paper and pencil, CAM survey. Participants from the University of Northern Colorado Cancer Rehabilitation Institute (N=29) were given a 28-question, traditional paper and pencil, CAM survey. Participants from the University of Northern Colorado Cancer Rehabilitation Institute (N=29) were given a 28-question, traditional paper and pencil, CAM survey.

RESULTS: All respondents indicated that they were happy with the conventional medical treatments while alternative medicine refers to practices intended to replace traditional cancer treatments. Complementary and alternative medicine (CAM) practices can include, but are not limited to dietary supplementation, Chinese herbal medicine, and physical manipulation. A yearlong 2012 survey found that cancer survivors spent $4 billion on vitamins and minerals, $1.2 billion on non-vitamin or mineral natural products, and $500 million on massage. PURPOSE: To examine the use of CAM in cancer survivors currently participating in a structured exercise program.

METHODS: Participants from the University of Northern Colorado Cancer Rehabilitation Institute (N=29) were given a 28-question, traditional paper and pencil, CAM survey. Participants from the University of Northern Colorado Cancer Rehabilitation Institute (N=29) were given a 28-question, traditional paper and pencil, CAM survey. Participants from the University of Northern Colorado Cancer Rehabilitation Institute (N=29) were given a 28-question, traditional paper and pencil, CAM survey.

RESULTS: All respondents indicated that they were happy with the conventional medical treatments while alternative medicine refers to practices intended to replace traditional cancer treatments. Complementary and alternative medicine (CAM) practices can include, but are not limited to dietary supplementation, Chinese herbal medicine, and physical manipulation. A yearlong 2012 survey found that cancer survivors spent $4 billion on vitamins and minerals, $1.2 billion on non-vitamin or mineral natural products, and $500 million on massage. PURPOSE: To examine the use of CAM in cancer survivors currently participating in a structured exercise program.

METHODS: Participants from the University of Northern Colorado Cancer Rehabilitation Institute (N=29) were given a 28-question, traditional paper and pencil, CAM survey. Participants from the University of Northern Colorado Cancer Rehabilitation Institute (N=29) were given a 28-question, traditional paper and pencil, CAM survey. Participants from the University of Northern Colorado Cancer Rehabilitation Institute (N=29) were given a 28-question, traditional paper and pencil, CAM survey.
Board #8 May 31 1:00 PM - 3:00 PM


William A. Calo,1 Shirley Bluthethan,1 Wayne Foo,1 Eugene Lengerich,1 Scherezade Mama,2 Joel Segel,1 Renate Winkels,1 Joachim Wiskennan,1 Kathryn Schmitz, FACSM1. 1Penn State College of Medicine, Hershey, PA. 2Penn State College of Health and Human Development, University Park, PA.

(No relevant relationships reported)

PURPOSE: Racial/ethnic disparities in physical activity and behavioral risk factors are widely reported among the U.S. adult population. Little is known, however, about whether these racial/ethnic differences exist among cancer survivors. To address this gap, we examined the associations between race/ethnicity and meeting ACSM physical activity guidelines and behavioral risk factors among cancer survivors.

METHODS: We analyzed cross-sectional data from 585 cancer survivors who reside in central Pennsylvania. Survivors were identified using the Pennsylvania Cancer Registry and were mailed a survey using Behavioral Risk Factor Surveillance Survey-based items from May-September, 2017. We categorized race/ethnicity into: non-Hispanic whites (NHW; 89%), non-Hispanic blacks (NHB; 4%), Hispanics (4%), and others (3%). We classified respondents as participating in any physical activities/exercises, meeting aerobic guidelines (≥150 minutes/week), muscle-strengthening guidelines (≥2 times/week), or both guidelines. We also assessed whether participants were overweight/obese, current smokers, had multiple comorbid conditions, and perceived health status. Analyses were adjusted for sex, age, education, and income.

RESULTS: Sixty-seven percent reported participating in any physical activities in the past month. NHW reported higher levels of physical activity than NHB and Hispanics but these differences were not significant (p>0.05). Neither race/ethnicity was associated (p>0.05) with meeting the guidelines, muscle-strengthening guidelines, or both. More NHB were overweight/obese than NHW or Hispanics but these differences were not significant (p>0.05). Hispanics reported higher levels of smoking, however, race/ethnicity was not associated with smoking status (p>0.05). All groups reported similar levels of comorbid conditions and perceived health status.

CONCLUSIONS: It was encouraging to find no evidence of racial/ethnic disparities in physical activity and behavioral risk factors in our sample. However, non-adherence to physical activity guidelines was high in all racial/ethnic groups. Future studies with behavioral risk factors in our sample. However, non-adherence to physical activity guidelines was high in all racial/ethnic groups. Future studies with adequate sample sizes are needed to further explore racial/ethnic differences in physical activity and their potential impact on cancer survivors’ health.

D-12 Clinical Case Slide - Cervical and Thoracic Spine

Thursday, May 31, 2018, 1:00 PM - 2:40 PM
Room: CC-200E

Chair: John P. Batson, FACSM. Lowcountry Spine & Sport, LLC, Hilton Head Island, SC.

(No relevant relationships reported)

Discussant: Jeffrey M. Mjaanes, FACSM. Northwestern University, Evanston, IL.

(No relevant relationships reported)

Discussant: Sherrie L. Ballantine-Talmadge, CU Sports Medicine and Performance Center, Boulder, CO.

(No relevant relationships reported)

May 31 1:00 PM - 1:20 PM

Thoracic Pain in a Competitive Middle-Aged Tennis Player

Stacey Bennis1, Daniel Blatz2. 1McGaw Medical Center of Northwestern University/Shirley Ryan AbilityLab, Chicago, IL. 2Northwestern University/Shirley Ryan AbilityLab, Chicago, IL. (Sponsor: Joseph Ihm, MD, FACSM)

(No relevant relationships reported)

HISTORY: A 47-year-old male competitive tennis player presented to a musculoskeletal clinic with nine day history of acute right-sided mid-thoracic back pain that started after serving a tennis ball. One week later, the patient developed a thoracic rash, treated as herpes zoster by his internist. Eight months later, he returned to the musculoskeletal clinic with one week history of acute bilateral thoracic back pain and one day history of left thoracic rash. He described two prior episodes of herpes zoster (10 years prior, 8 months prior) and mild varicella zoster as a child. He denied neurologic complaints or immunocompromise.

PHYSICAL EXAMINATION: Initial examination revealed normal neurologic findings, negative lower limb dural tension tests, and right mid-thoracic paraspinal muscle tenderness exacerbated by left trunk rotation. At follow up, examination was stable except for a new erythematous vesicular rash with surrounding alodynia in dermatomal distribution at the mid-thoracic spine.


TEST AND RESULTS:
- MRI Thoracic Spine without Contrast: Multilevel degenerative changes. Moderate left foraminal stenosis at T7-8. Moderate to severe right foraminal stenosis at T9-10.
- HIV Ag/Ab: negative.
- Infectious Disease Consult: “heavy tennis playing may have resulted in re-activation of VZV.”

FINAL WORKING DIAGNOSIS:
1. Acute left thoracic radiculitis due to recurrent herpes zoster reactivation from heavy tennis playing
2. Acute right thoracic radiculitis due to zoster sine herpete versus thoracic neural foraminal stenosis
3. Chronic right thoracic pain due to post-herpetic neuralgia versus thoracic radiculitis

TREATMENT AND OUTCOMES:
1. Valtrex 1000mg PO TID x7 days and 1000mg TID at onset of any future symptoms
2. Topical lidocaine patch versus capsaicin patch for treatment of post-herpetic neuralgia neuropathic pain
3. Discussed possibility of gabapentin as an alternative option for management of post-herpetic neuralgia
4. 2-3 weeks rest from tennis, and rest from tennis at onset of any future symptoms
5. Follow up after MRI (patient has not yet followed up in the office)

Cervical Spinal Injury: Presenting Issue — Decreased Range Of Motion Globally, Mild-to-moderate Stiffness With Chronic Pain

Zenon R. Jimenez. Mercy College, Dobbs Ferry, NY. (Sponsor: M. Allison Williams, FACSM)

(No relevant relationships reported)
1562  May 31 1:40 PM - 2:00 PM
Spinal Trauma in a Division 1 Football Player
Arjun K. Ramprasad. Crozer-Keystone Health System, Springfield, PA. (Sponsor: Tom Kaminski, PhD, ACSM)
(No relevant relationships reported)

CLINICAL CASE SAMPLE

HISTORY: A division 1 football player developed acute onset shortness of breath after a tackle during game play. He made a proper form tackle but was struck in the sternum by an opposing player and the side by a teammate. On the field he initially complained of difficulty breathing but his airway remained patent. He then complained of rib and upper back pain but was able to walk off the field under his own power. A sideline examination demonstrated thoracic spinal tenderness. He was then transported to the ER via EMS.

PHYSICAL EXAMINATION: Initial on-field examination revealed no sternal or laryngeal tenderness but did show right sided rib tenderness. Additional sideline exam revealed midline thoracic tenderness around T6. He was neurovascularly intact and had full active range of motion of his neck and all extremities.

DIFFERENTIAL DIAGNOSIS:
1. Laryngeal fracture
2. Sternal fracture
3. Traumatic rib fracture
4. Vertebral fracture
5. Spinal cord trauma

TESTS AND RESULTS:
CT scan of cervical spine:
— No acute cervical spine fracture
CT scan of thoracic spine:
— Acute burst type compression fracture of T6 with 4mm of retropulsion
MRI or thoracic spine
— Acute burst fracture of T6 vertebral body with approximately 25% height loss along with narrow edema. A strain of the interspinous ligaments between T-6 & T-7 is also seen.

FINAL/WORKING DIAGNOSIS:
Acute traumatic burst fracture of T6 vertebrae

TREATMENT AND OUTCOMES:
1. The initial concern was for airway compromise, but his airway remained patent.
2. After admission, imaging and a discussion with orthopedics, it was decided not to use a thoracic body brace as he would need a cervical extension due to his T6 fracture.
3. He was kept overnight for observation then discharged with instructions to limit spine flexion and extension. Repeat MRI at 2 weeks showed no worsening of his fracture or ligament sprain. His pain was controlled with oxycodone and muscle relaxers.
4. The plan is to work with physical therapy to progress his movement as he heals.

1563  May 31 2:00 PM - 2:20 PM
Thoracic Radiculopathy Case
Malia Cali, Jacques Courseault. LSUHSC, New Orleans, LA.
(No relevant relationships reported)

HISTORY: A 44-year-old male with greater than 100 miles/week biking regimen presented to clinic with symptoms of chest pain, nausea and abdominal pain associated with a 30lb weight loss over 3 months. His pain was exacerbated by flexion and prolonged sitting. Pain was relieved by remaining in an upright position. Extensive cardiac work-up and MRI of the abdomen and pelvis were performed prior to presentation in clinic and were negative. A GI consultant was unable to establish a diagnosis.

PHYSICAL EXAM: Examination of the left upper abdomen near the insertion of the rectus on the rib cage exhibited severe active myofascial trigger points. Palpation of these trigger points induced nausea, abdominal, and chest pain. There was severe tenderness of the thoracic paraspinals from T6-T10. Reflexes and upper and lower extremity strength testing was normal. Sensation was normal.

DIFFERENTIAL DIAGNOSES:
1. Thoracic Radiculopathy with Active Myofascial Abdominal Trigger Points
2. Gastritis
3. Malignancy
4. Coronary Artery Disease

TEST AND RESULTS:
1. MRI of the thoracic spine:
   • Scattered small perineural cysts, the largest measuring 0.7cm in diameter in the T10-T11 foramen, as well as slight central posterior protrusion of the T6-T7, T8-T9, and T9-T10 discs.
2. EMG and NCV:
   • Findings consistent with inactive, subacute multilevel mid thoracic radiculopathy.

FINAL/WORKING DIAGNOSES:
Thoracic Radiculopathy due to Tarlov cysts and posterior protrusion of discs

TREATMENT AND OUTCOMES:
1. Trigger point injections under needle EMG guidance into the thoracic paraspinals and rectus abdominis were successful for symptom relief
2. Physical Therapy
3. Lyrica
4. Avoidance of prolonged flexion activities such as the cycling position
5. Returned to most daily activities. Symptoms improved significantly after trigger point injections and physical therapy with a focus on traction and extension-based exercises.

1564  May 31 2:20 PM - 2:40 PM
Persistent Right Upper Limb Weakness: Football
Melissa Lau, Michael Baria. Ohio State University, Columbus, OH.
(No relevant relationships reported)

HISTORY: Patient is a 15 year old previously healthy male lineman presenting with the chief complaint of right upper limb weakness after tackling an opponent. He completed a form tackle, hitting his opponent with the right shoulder. Upon contact he experienced immediate right upper limb dysesthetic pain down to the hand with concomitant loss of strength of his entire right arm. Over the next 24 hours, his pain resolved but profound weakness persisted with complete inability to abduct the upper limb.

PHYSICAL EXAM:
- Neurological: Strength exam demonstrated 1/5 weakness in all shoulder movements including flexion, abduction, and external rotation. He has 3/5 strength with elbow flexion, and 4/5 with wrist flexion and extension. Biceps reflex was depressed but present. Sensation was normal.
- Musculoskeletal: Full active range of motion in cervical spine, mild tenderness to palpation at approximately C5 but no step off appreciated. Shoulder examination demonstrated no deformity, tenderness, or range of motion impairment.

DIFFERENTIAL DIAGNOSIS:
1. Cervical spine injury with resultant spinal cord injury
2. Cervical radiculopathy
3. Cervical nerve root avulsion
4. Right upper trunk brachial plexopathy
5. Suprascapular and/or axillary neuropathy
6. Rotator cuff tear
7. Shoulder fracture / dislocation

TESTS AND RESULTS:
- XR cervical spine (flexion/extension) and XR right shoulder (AP views with internal/external rotation and axillary views): no acute pathology with no evidence of laxity
- MRI cervical spine: Mild right foraminal disc protrusion at C5-C6 contributing to mild neural foraminal stenosis. Torg ratio 0.77
- EMG: Severe C5 and moderate C6 radiculopathy. Severe axonotmesis without neurotmesis

WORKING DIAGNOSIS:
C5 and C6 radiculopathy with axonotmesis

TREATMENT/OUTCOMES:
1. Initial: C-spine precautions and R arm sling placement until cervical spine was cleared by MRI
2. 2 weeks post injury: Neuromuscular re-education and active assisted range of motion started

Return To Play: No sporting activity until neurologic recovery completed. It remains controversial as to whether he should resume football or wrestling. Given the Torg ratio and the severity of his injury, there is an unquestionable risk of recurrence if collision sports are resumed should he eventually regain full neurological function.
His main complaint was instability and his knee would buckle 3-4 times a week, but with 7 years of left knee “looseness.” He first noticed this following a soccer match.

A 24-year-old male soccer player presented to an orthopedic sports medicine clinic.

HISTORY: 16 year-old high school football and basketball athlete was referred to Sports Medicine. He could not recall a specific injury, but had 2 months of recurrent pain and swelling with high-impact activities. No neuropathic, mechanical, nor instability symptoms. No prior knee orthopedic history.

PHYSICAL EXAMINATION: Inspection showed slight genu valgum and small right knee effusion. No pain with palpation of all bony and soft tissue landmarks of the knee. Active range of motion was pain free and symmetric for knee flexion and extension. Strength was intact at 5/5 hip flexion, knee extension and knee flexion. Provocative maneuvers showed no pain with bunion and McMurrays, firm 1+ endpoint with Lachmans, anterior drawer, and posterior drawer. He was stable and symmetric with no laxity or pain during varus and valgus stressing of the knee at 0 and 30 degrees of flexion. No pain with patellar compression and negative dial testing.

DIFFERENTIAL DIAGNOSIS: Includes meniscus pathology, plica syndrome, patellofemoral pain, osteochondritis dissecans (OCD), stress injury.

TESTS AND RESULTS:
1. Standing knee x-rays showed medial femoral condyle OCD with knee effusion and loose body in suprapatellar space.
2. MRI of right knee showed 1.7 x 1.3 cm osteochondral defect at the central weight-bearing surface of the medial femoral condyle with displaced osteochondral fragment in the suprapatellar bursa.

FINAL WORKING DIAGNOSIS:
Grade IV osteochondritis dissecans lesion

TREATMENT AND OUTCOMES:
1. Recommended non-weight bearing and medial unloader brace requested while ambulation until harvested cells ready for implantation.
2. Diagnostic arthroscopy for loose body removal and biopsy for matrix-induced chondrocyte implantation.
3. Low impact activities only, physical therapy and medial unloader brace with compression and negative dial testing.
4. Matrix-induced autologous chondrocyte implantation was performed after 6 weeks of cell culturing.
5. Athlete treated with post-operative rehabilitation protocol.
6. MRI at 6 months demonstrated interval progression of healing medial femoral condyle OCD.
7. Athlete will continue post-operative rehabilitation protocol and will be assessed for readiness for sport progression at 12 and 18 months.

TREATMENT AND OUTCOMES:

PHYSICAL EXAM:
No discoloration or swelling of the left posterior knee. Full active and passive range of motion without pain at end range of motion. McMurry’s, Lachman’s, and anterior drawer were negative. Posterior drawer was 1+. Posterior sag was 1+. Negative dial test.

DIFFERENTIAL DIAGNOSIS:
1. PCL sprain or tear
2. Posterior lateral corner injury
3. Posterior horn of medial or lateral meniscus injury
4. Meniscocapsular ligament (ligament of Wrisberg or Humphrey) injury
5. Patellar subluxation/dislocation
6. Osteochondral defect
7. Cyst in the posterior knee

TEST AND RESULTS:
MRI revealed 8x7x6mm ganglion cyst adjacent to the posteros medial aspect of the PCL near the distal insertion on the tibia. Reverse KT1000 measurement revealed laxity of the left PCL that was 3mm greater than the right. Ultrasound of the insertional PCL visualized in long axis showed no pathology but appeared kinked at the proximal 1/3 when compared to the right. Cyst lying adjacent to the PCL in the posterior medial direction was visualized.

FINAL WORKING DIAGNOSIS:
PCL sprain and adjacent PCL ganglion cyst

TREATMENT AND OUTCOMES:
He was referred to our sports ultrasound clinic for sonographic evaluation and possible intervention. Sonographically guided intervention was performed from a distal to proximal approach with the patient supine. The cyst was fenestrated 10 times and 1mL of a 1:2:2 mixture of 50% dextrose, sterile water, and 1% lidocaine solution was injected into the cyst. An additional 2mL of the solution was injected peri-PCL. He had ~50% improvement in instability at 1 month. Repeat sonographic exam showed decompression of the cyst. He reported 80% improvement in the feeling of “looseness” and KT1000 testing (completed by the same provider as the initial measurement) revealed a 1mm difference in laxity of the PCL on the left compared to the right 7 weeks after the injection. He had no limit in daily activity.

HISTORY: A 16-year-old high school basketball player was evaluated for left knee pain and a moveable mass in his knee. He started having pain, swelling, and locking of his left knee when he played basketball. He would have to manually unlock his knee sometimes. He sat out the rest of the season, but now the pain and locking has returned, and he feels a moveable mass above his knee cap. He denied any specific injury or traumatic event. He was previously diagnosed with osteochondritis dissecans (OCD) in his right knee 2 years prior and was told to sit out of football that season, but now he is having trouble with his left knee. He denied any other joint complaints. He denied any constitutional complaints. Family history was significant only for osteoarthritis and rheumatologic disease in his mother.

PHYSICAL EXAMINATION:
Generally he is a well-nourished normal appearing 16 year old male. Examination of the left knee revealed lateral joint line tenderness and a moveable mass superior to his patella. McMurry’s test was positive for clicking, and he had a trace knee joint effusion on exam. Small abrasion over the tibial tubercle. He had some general laxity of his joints, but sensation, strength, range of motion, and ligamentous testing were all normal. Normal gait, no antalgic limp. Examination of the right knee was normal.

DIFFERENTIAL DIAGNOSIS:

TEST AND RESULTS:
Xray of left knee - lateral femoral condyle OCD, closed growth plates Xray of right knee - lateral femoral condyle OCD with sclerosis
MRI of left knee - small effusion with lateral femoral osteochondral defect about 2.5 cm
Arthroscopy of left knee - OCD with loose bodies and chondral defect

FINAL WORKING DIAGNOSIS:
Osteochondritis Dissecans with loose bodies

TREATMENT AND OUTCOMES:
He was treated with an arthroscopic procedure to remove the 2 loose chondral bodies. He had cartilage cobbles stored debrided and a microfracture procedure performed to help fill in the chondral defect. He then participated in 6 weeks of non-weight bearing and then a formal therapy program.

1571 May 31 2:00 PM - 2:20 PM
Anterior Knee Pain - Golf
Shawn D. Falcon, Arie J. van Duijn, Mitchell L. Cordova, FACSM. Florida Gulf Coast University, Fort Myers, FL. (Sponsor: Mitchell L. Cordova, FACSM) (No relevant relationships reported)

HISTORY:
Athlete is a 71-year-old recreational golfer. Athlete’s previous medical history includes bi-lateral Achilles tendon repairs, contralateral quadriceps tendon repair and Right supraspinatus tendon repair. Athlete is borderline diabetic with developing osteoarthritis.

PHYSICAL EXAMINATION:
Athlete fell while walking on pine straw on anterior knee causing right leg to be hyper flexed under weight of the patient. The athlete was unable to move and EMS summoned for transport. Upon physical exam, individual had palpable deformity proximal to the patella. Individual unable to actively extend right leg. Individual appeared with obvious swelling. Neurological and circulatory exam WNL. No signs or symptoms of fracture. Ultrasound imaging was performed and revealed a full thickness hypoechoic area indicative of a quadriceps rupture.

DIFFERENTIAL DIAGNOSIS:
1. Anterior Knee Contusion
2. Posterior Cruciate Ligament Tear
3. Medial meniscus tear
4. Anterior Cruciate Ligament Tear
5. Quadriceps Tendon Rupture

TEST AND RESULTS:
DDX Ultrasound - Full thickness hypoechoic lesion in the quadriceps tendon was visible both on the long and short axis views of the quadriceps tendon indicating full thickness tear, with hypoechoic areas around the surrounding structures suggestive of interstitial bleeding.

MRI w/o contrast - Portion of Quadriceps tendon extensor mechanism completely torn - Superficial aspect of rectus femoris is avulsed from its patellar attachment and retracted proximally - Marked anterior swelling - Patellar tendon intact

FINAL WORKING DIAGNOSIS:
Quadriceps tendon injury, superficial aspect (rectus femoris) avulsed and retracted proximally.

TREATMENT AND OUTCOMES:
Athlete underwent surgical repair of the right quadriceps tendon. Following immobilization athlete began contemporary rehabilitation program and has made full recovery without problems or complaints. This case report demonstrates the use of ultrasound imaging in a clinical setting that was as precise as of late follow-up MRI. Furthermore, it is imperative for clinicians to ensure both long and short axis views of the quadriceps tendon to ensure proper diagnosis.

1572 May 31 2:20 PM - 2:40 PM
Knee Swelling in a Football Player
Daniel Evering, Jr.1, David Webner1, Kevin DuPrey1, A.J. Duffy, III2, 1Crozer Keystone Sports Medicine, Springfield, PA. 2Widener University, Chester, PA. (Sponsor: Dr. Thomas Kaminski, FACSM) (No relevant relationships reported)

HISTORY:
An 18-Year-Old Male Division III quarterback presented to the office with left knee swelling and pain. He was playing in a game 10 days prior in which he was sacked twice, each time landing on his left knee and medial thigh. Right after the game, he noted swelling over the superior aspect of the patella and pain with direct pressure and full flexion. He described the pain as sharp and fiery, non-radiating, 3/10, waxing and waning. He has been wearing a compression sleeve and icing his knee.

PHYSICAL EXAMINATION:
Examination of the patient’s Left knee revealed decreased ROM with flexion and extension to 120/0 degrees. Large, 4+, suprapatellar effusion. Strength intact. Negative patellar compression test for pain and crepitus. No patellar instability. No ligamentous laxity to anterior, posterior, varus and valgus (30°) stress testing. Negative Lachman’s testing. Negative anterior and posterior drawer testing. No joint line tenderness. Negative McMurray’s testing. No patellar tendon tenderness. No pes anserine bursa tenderness. The patient was otherwise neurovascularly intact.

DIFFERENTIAL DIAGNOSIS:
1. Suprapatellar Bursitis
2. Prepatellar Bursitis
3. Patella Fracture
4. Patellar tendinitis

TEST AND RESULTS:
Ultrasound exam revealed large collection of fluid in the suprapatellar and medial thigh region. X-ray showed no fracture and moderate soft tissue swelling anterior to the left patella.

FINAL WORKING DIAGNOSIS:
Morel-Lavallée lesion

TREATMENT AND OUTCOMES:
1. Under US guidance 75 cc of serosanguinous fluid was aspirated from the suprapatellar bursa on the left knee on the first visit.

Compression wrap applied. 2. 75 cc of serosanguinous fluid was aspirated 3 days later. Compression continued. 3. 50 cc of serosanguinous fluid was aspirated 4 day later, 7 days after the initial visit 4. 1 week later there was only mild accumulation of fluid. No aspiration was required. He had near full ROM and no pain with activity. He was cleared to return to football at that visit and successfully returned with no issues.

1573 May 31 2:40 PM - 3:00 PM
Knee Injury-soccer
Ankur Verma1, Melody Hrubes2, Terry Nicola, FACSM. 1University of Chicago/Schwab Rehabilitation Hospital, Chicago, IL. 2University of Illinois-Chicago, Chicago, IL. (Sponsor: Terry Nicola MD, FACSM) (No relevant relationships reported)

HISTORY:
A 17-year-old male high school varsity soccer player with a history of right knee patellar dislocation 6 months ago managed non-operatively with physical therapy and bracing with successful return to sport presented with right knee swelling, pain, and decreased range of motion after being stuck on the lateral aspect of his right knee during a game yesterday. He felt a pop and had swelling. He is unable to bear weight, and is unable to fully extend or flex his knee. He has been icing. He denies numbness, tingling, or weakness.

PHYSICAL EXAMINATION:
Examination revealed moderate effusion and tenderness to palpation over the lateral aspect of his patella, as well as the MPFL. There was some tenderness over the MCL. He has a positive apprehension sign with positive ballottement. There was no tenderness over the ICL. There was a negative Lachman’s test and posterior drawer sign. There was no joint opening with varus or valgus stress. There was no medial or lateral joint line tenderness. McMurray’s was unable to be attempted because of limited range of motion. He can actively extend his knee to 20 degrees short of full extension and actively flex his knee to 90 degrees.

DIFFERENTIAL DIAGNOSIS:
1. Patellar dislocation 2. Ostovochondral defect 3. MPFL tear

TEST AND RESULTS:
MR Right Knee without Contrast - Acute lateral patellar tracking injury with medial patellar avulsion fracture, kissing contusion on the femoral condyle, and high-grade medial patellar retinaculum sprain

FINAL WORKING DIAGNOSIS:
Medial patellar avulsion fracture

TREATMENT AND OUTCOMES:
Re-initiate the Lateral Patella Knee Brace for stabilization

Orthopaedic Surgery referral. Surgery was recommended once swelling subsides

Plan is for surgery 3-4 months after injury

D-36 Thematic Poster - Body Composition - Sport and Physiologic Considerations
Thursday, May 31, 2018, 3:15 PM - 5:15 PM
Room: CC-Mezzanine M100C

1642 Chair: Kelly Massey. Milledgeville, GA. (No relevant relationships reported)

1643 Board #1 May 31 3:15 PM - 5:15 PM
Comparison of Bone and Body Composition in the Affected and Unaffected Arms in Breast Cancer Survivors
Ashley Artese, Rachael L. Hunt, Daniel R. Marshall, Jeong-Su Kim, Michael J. Ormsbee, Robert Moffatt, Lynn B. Pantou, FACSM. Florida State University, Tallahassee, FL. (No relevant relationships reported)

Following surgery and treatments, breast cancer survivors (BCS) may experience weakness, pain, and swelling in the arm next to the breast where the cancer was present (affected arm), resulting in decreased use of that arm. Treatments can also cause losses in bone mineral density (BMD), lean mass (LM), and gains in fat mass (FM). There is a lack of research on the effects of cancer treatment on BMD and body composition specifically in the affected compared to the unaffected arm. PURPOSE: To examine BMD, LM and FM in the affected compared to the unaffected arm in BCS. METHODS: Arm BMD, LM, and FM were assessed on 43 BCS (60 ± 8 yrs) using dual-energy X-ray absorptiometry. Paired t-tests were used to compare arm BMD, LM, and FM. Significance was accepted at p ≤ 0.05. RESULTS: BCS were 6.6 ± 7.3 yrs post treatment. Mean values of arm BMD, LM, and FM were 0.681 ± 0.097 g/cm²; 2.23 ± 0.52 kg, and 1.79 ± 0.75 kg, respectively. The affected arm had lower BMD (0.674 ± 0.106 vs 0.732 ± 0.097 g/cm², p = 0.002), lower LM (1.97 ± 0.46 kg vs 2.46 ± 0.66 kg, p = 0.01), and higher FM (1.17 ± 0.35 kg vs 0.57 ± 0.24 kg, p = 0.001). These results suggest that BCS experience changes in BMD, LM, and FM in the affected arm, which may contribute to reduced functionality and quality of life in this population.
Resistance exercise leads to an increase in skin thickness (T) in the area of the exercised muscle. Non-contact infrared thermography seems to be applicable to identify these primary used functional muscles with measuring T changes. In previous studies, lean men showed homogenous T patterns after standardized exercise protocols. Purpose To examine the influence of body fat percentage (BF%) and skinfold thickness on T changes. Method 38 male subjects (19–32 years, BMI 20.4–52.2 kg/m²) participated. Means (min–max) of BF% and skinfold thickness of biceps brachii were 19.2% (6.2–51.5) and 9 mm (2–38) respectively. BF% and skinfold thickness showed a negative correlation with T (r=-0.49, p<0.001; for skinfold thickness: r=-0.66, p<0.001). All subjects up to a skinfold thickness of 10 mm showed a homogeneous T pattern in reaction to the exercise with a minimum ΔT of 1.3°C and a time to Trest between 2 and 9 min. The T patterns in subjects with a higher skinfold thickness were heterogeneous and some of these subjects did not respond to the resistance exercise with an increase of T.

Conclusion A higher BF% and a higher skinfold thickness is associated with delayed and lower increases in T after resistance exercise. In contrast to lean subjects, identifying the primary used functional muscles by infrared thermography in obese subjects seems to be challenging. 

PURPOSE: To evaluate total body composition measures across player positions in NCAA Division I male and female softball players using dual X-ray absorptiometry (DXA). METHODS: Three hundred and twenty-nine male and female (201/128) collegiate baseball and softball athletes from multiple universities (M/F: age = 19.8±1.4/19.7±1.4 yrs.; height = 1.8±0.09/1.8±0.09 m; weight = 85.0±4.2/73.1±3.0 kg; body mass index = 25.3±4.0/20.6±7.2 kg/m²) were scanned via DXA. RESULTS: Male IF had significantly (p<0.001) lower total LM (59.3±4.7 kg) and FM (19.2±2.6 kg) compared to the unaffected arm (53.6±3.9 kg and 20.7±3.1 kg respectively). Female OF had significantly (p<0.01) lower total LM (51.8±4.0 kg) and FM (17.0±2.1 kg) compared to the unaffected arm (57.0±3.8 kg and 20.0±2.0 kg respectively). CONCLUSIONS: The differences in body composition in the affected arm following cancer treatments may be related to the larger field dimensions and demands of the game. These values may be used for normative DXA data for collegiate softball and baseball players.
and SG (11.0±3.0; 10.9±3.0; p>0.001), but not PG (12.5±4.4 kg; p>0.025), and greater total LM (89.9±8.9; 84.1±5.5 kg) compared to PG, SG, and SF (68.9±6.1; 73.3±6.1; 75.6±5.2 kg; p<0.001). Male C and PF VAT measurements (0.4±0.24; 0.43±0.1 kg) were significantly higher compared to SF, SG, and PG (0.23±0.11; 0.22±0.12; 0.26±0.12 kg; p<0.001). Before and after adjustment for weight, males did not show significant differences in BMD across position (p=0.156; p=0.559). In females, C had significantly greater (p<0.001) total FM compared to all other positions. SF, PF, and C had significantly (p<0.001) greater total LM (56.6±6.3; 59.5±6.0; 60.6±5.5 kg) compared to PG and SG (48.0±3.4; 51.4±3.9 kg). After adjustment for weight, no significant differences were observed in BMD across position (p=0.276). Female C had significantly higher VAT (0.29±0.24 kg) compared to PG and SG (0.06±0.06; 0.07±0.04 kg; p=0.005) but not SF and PF (0.13±0.14, 0.19±0.18 kg; p=0.11-0.44).

CONCLUSIONS: Within collegiate male and female basketball players FM, LM, and VAT differed by position. After adjustment for weight, BMD was not significantly different for males or females. These position-specific measurements provide normative data on male and female basketball players.

### Positional Body Composition of Division I Volleyball Players, Consortium of College Athlete Research (C-CAR) Study

Katie L. Bischof, Tyler A. Bosch, Aaron Carbuhrn, Philip R. Stanforth, Jonathan M. Oliver, Jack W. Ransone, FACSAM, Andreas Kreutzer, Donald R. Dengel, FACSAM. University of Minnesota, Minneapolis, MN. University of Kansas, Lawrence, KS. University of Texas at Austin, Austin, TX. Texas Christian University, Fort Worth, TX. University of Nebraska, Lincoln, NE. (Sponsor: Donald R. Dengel, FACSAM) (No relevant relationships reported)

**PURPOSE:** To identify normative values for total and regional body composition by position for female NCAA Division I collegiate volleyball players using dual X-ray absorptiometry (DXA).

**METHODS:** Eighty-nine female volleyball players (ages 17-23) from multiple universities received a DXA scan. Athletes were categorized by position: Middle Blocker (MB=30), Outside Hitter (OH=19), Setter (ST=9), and Libero (LB=18). Total fat mass (FM) and lean mass (LM) were measured by DXA, as well as abdominal visceral adipose tissue (VAT) and total and regional measures of bone mineral density (BMD). An ANOVA assessed the effect of position on body composition and BMD measurements. Tukey’s HSD post-hoc analysis test identified significant differences among positions.

**RESULTS:** As expected, height was statistically significant (p<0.01) between all positions: MB (185.8±4.6 cm) > OH (181.7±4.1 cm) > ST (174.7±3.7 cm) > LB (167.8±8.0 cm). Weight was significantly greater in MB and OH (80.1±9.3 kg, 76.6±7.8 kg) compared to LB (64.5±7.6 kg, p<0.001), and MB compared to ST (69.7±5.7 kg, p<0.006). Body percent fat was not statistically significant by position (mean = 25.3%). Total LM was greater in MB and OH (55.7±4.6 kg, 54.1±4.7 kg) compared to LB and ST (45.9±4.9 kg, 48.3±3.2 kg, p<0.01). Total FM was significantly greater in MB than ST (21.0±5.9 kg, 16.1±4.0 kg, p=0.016). VAT mass was not significantly (p=0.05) different between positions. After adjusting for weight, total BMD was significantly greater in MB (1.39±0.1 g/cm³, p<0.001) and OH (1.41±0.09 g/cm³, p=0.002) compared to LB (1.30±0.08 g/cm³), but not ST (1.31±0.07 g/cm³, p=0.05). Leg BMD was higher in MB and OH (1.54±0.11 g/cm³, 1.53±0.11 g/cm³) compared to LB and ST (1.39±0.09 g/cm³, 1.4±0.06 g/cm³, p=0.001-0.008). Spine BMD was higher in MB and OH (1.32±0.15 g/cm³, 1.33±0.12 g/cm³) compared to LB (1.22±0.09 g/cm³, p=0.03).

**CONCLUSIONS:** Total body composition measures vary significantly by position; however, the similarities in percent body fat imply differences may be influenced primarily by height. Future studies should examine the distribution of mass. BMD differences may be influenced by repeated impacts of jumping during the attacking and blocking actions of front row players. These data provide some normative DXA data for collegiate volleyball players.

### Body Composition of Division I Collegiate Female Equestrian Athletes

Olivia H. Dengel, Christiana J. Raymond-Pope, Jonathan M. Oliver, Tyler A. Bosch, Donald R. Dengel, FACSAM. College of St. Benedict, St. Joseph, MN. University of Minnesota, Minneapolis, MN. Texas Christian University, Fort Worth, TX. (Sponsor: Donald R. Dengel, FACSAM) (No relevant relationships reported)

**PURPOSE:** To compare measures of total and regional body composition using dual X-ray absorptiometry (DXA) in NCAA Division I collegiate equestrian athletes to a group of age, sex and BMI matched non-athlete college students.

**METHODS:** Thirty-one female collegiate equestrian athletes were matched to a population of normal, non-athlete college students by age (19.8±0.2 vs. 19.8±0.2 yrs.), body mass index (22.3±0.4 vs. 22.6±0.4 kg/m²), sex and ethnicity. Total and regional fat tissue mass (LM), lean tissue mass (LM), bone mineral density (BMD), and abdominal visceral adipose tissue (VAT) were measured by DXA. Paired t-tests assessed total and regional differences between collegiate equestrian athletes and controls. RESULTS: Equestrian athletes had a lower total fat percentage (%fat) than controls (30.7±0.9 vs. 33.1±1.0%, p<0.03). There was a trend for the equestrian athletes to have lower total FM (18.4±0.8 vs. 20.0±0.9 kg, p=0.06) than controls. There were no significant differences in total LM (41.0±0.9 vs. 39.9±0.8 kg, p=0.03), total BMD (1.15±0.02 vs. 1.15±0.02 g/cm³, p=0.92) and VAT (0.13±0.03 vs. 0.16±0.03 kg, p=0.25) between equestrian athletes and controls. However, equestrian athletes, when compared to the controls, had significantly lower leg %fat (33.0±0.8 vs. 37.3±0.9%, p<0.001), leg FM (7.0±0.3 vs. 8.0±0.4 kg, p=0.01) and higher leg LM (14.1±0.4 vs. 13.2±0.3 kg, p=0.04). The greater leg lean mass in equestrian riders resulted in a smaller upper to lower body lean mass ratio (1.706±0.191 vs. 1.812±0.030, p=0.005) compared to controls. There was no difference in leg BMD between equestrian athletes and controls (1.19±0.02 vs. 1.21±0.02 g/cm³, p=0.46). CONCLUSIONS: The lower total percent body fat in equestrian athletes seems to be influenced by differences in leg composition with equestrian athletes having significantly more lean mass and less fat mass. These results are consistent with the role the legs play in horseback riding and demonstrate an effect of either training or horseback riding on body composition compared to matched controls.

### Exercise Training in Cancer Patients

Karen M. Mustian. University of Rochester/James P. Wilmot Cancer Center, Rochester, NY. (No relevant relationships reported)
Each year, approximately 1.6 million Americans are diagnosed with cancer. The consequences of cancer and its associated treatment include elevations in cardiovascular risk, deteriorating body composition, and diminishing physical function. Exercise is an effective countermeasure; however, limitations in adherence may compromise the magnitude of improvement experienced. PURPOSE: To evaluate cardiovascular, anthropometric, and functional adaptations to an exercise program in cancer survivors. METHODS: We conducted a 10-week exercise intervention on 157 cancer survivors; 58 were retained through follow-up. At baseline, we recorded demographic, anthropometric, cardiovascular, and functional data. Anthropometric measurements were weight, body mass index (BMI), and body fat percent (BF%). Cardiovascular measurements were blood pressure and heart rate. Functional tests were VO2 max, six-minute walk, timed up-and-go, chair stand, sit-to-stand, arm curl, grip strength, Universal Machine (UM) push and pull, epic lift, sit-and-reach, functional reach, and back scratch. Paired-samples t tests measured changes from baseline to follow-up. RESULTS: Anthropometric variables did not change: body weight (p=0.585), BMI (p=0.477), and BF% (p=0.367). Cardiovascular variables did not change: systolic blood pressure (p=0.560), diastolic pressure (p=0.292), and heart rate (p=1.000). Improvement was detected in 11 of 13 functional tests: VO2 max (p<0.005), six-minute walk (p=0.001), chair stand (p=0.001), sit-to-stand (p=0.005), arm curl (p=0.001), grip strength (p=0.001), UM push (p=0.001), UM pull (p=0.001), epic lift (p=0.005), and functional reach (p=0.001). Mean values improved in sit-and-reach (p=0.321) and back-scratch (p=0.099), but pre-post comparisons were not significant. CONCLUSION: Exercise had no effect on anthropometric or cardiovascular profiles, but physical functioning improved in nearly every domain. In this population, maintenance of functional capacity can help preserve the ability to perform tasks of daily living, and it associates with survival. Although we found exercise to improve strength, aerobic capacity, and flexibility, the high rate of attrition is a potential limitation; further research is necessary to confirm our findings.

Exercise in cancer patients is safe and can improve a range of outcomes including cancer-related fatigue, physical functioning and quality of life. Preliminary trials suggest an acute exercise bout during chemotherapy infusion may improve the treatment efficiency. It would also present an additional opportunity for supervised exercise. Potentially, this intervention to cancer patients during chemotherapy infusion may be a safe and feasible addition to chemotherapy. Larger data collection is required to evaluate drug delivery efficiency, symptom reduction and opportunity for physical activity increase.

CHEMOTHERAPY-INDUCED PERIPHERAL NEUROPATHY SYMPTOMS IN WOMEN WITH BREAST CANCER

Kelcey A. Bland1, Amy A. Kirkham2, Josh Bovard1, Tamara Shenker1, David Zucker1, Margot K. Davis3, Don C. McKenzie4, Karen A. Gelmon5, Kristin L. Campbell6, 1University of British Columbia, Vancouver, Canada. 2British Columbia Cancer Agency, Vancouver, BC, Canada. 3Evelina London Women’s Cancer Research Centre, University of East London, London, UK. 4British Columbia Cancer Agency, Vancouver, BC, Canada. 5Swedish Cancer Institute, Seattle, WA. 6Austin Health, Melbourne, Australia. (No relevant relationships reported)

Chemotherapy-induced peripheral neuropathy (CIPN) is a common, dose-limiting side effect of taxane treatment for breast cancer. Given the limited medical or pharmacological treatment options to reduce CIPN, understanding the role of lifestyle interventions is of interest. PURPOSE: To evaluate the effect of exercise during taxane treatment on CIPN symptoms in women with breast cancer. METHODS: Women with early-stage breast cancer were randomized to supervised exercise (EX) or usual care (UC) during taxane treatment (~4 cycles, 2-3 weeks apart). Exercise included thrice-weekly progressive aerobic (50-75% HR reserve) and resistance training (~60 min, 3 times per week). CIPN symptoms were evaluated via: 1) the EORTC-QLQ CIPN20 subscale (scored from 0-100, with higher scores indicating greater symptom burden, and summarized as % of participants experiencing symptoms “quite a bit” or “very much”); and 2) quantitative sensory testing at the foot (vibration sense, pinprick). RESULTS: Exercise occurred: 1) baseline (pre-taxane chemotherapy); 2) post-taxane cycle 3; and 3) end of chemotherapy. RESULTS: Twenty-seven women enrolled (UC: n=15, EX: n=12). Relative to baseline, both groups reported worse total sensory symptoms post-cycle 3 (A16.3, p=0.01) that progressed further by the end of chemotherapy (A24.3, p=0.01). At post-cycle 3, sensory symptoms were 38% lower in EX compared to UC but this was not statistically significant (UC=-26.3±4.7, EX=-16.3±5.4, p=0.17). The most reported symptoms were tingling and numbness in both the hands and feet. Post-cycle 3, foot numbness was less prevalent (UC=50%, EX=9%, p=0.04), and foot tingling trended toward reduced prevalence (UC=43%, EX=9%, p=0.08) in the EX group. No group differences were found at the end of chemotherapy, or for hand symptoms at any time point. In UC participants who had impaired vibration sense post-cycle 3 (UC=67%, EX=17%, p=0.02). There were no group differences for pinprick testing. CONCLUSION: Multi-modal exercise during taxane treatment may delay CIPN symptom progression in breast cancer patients. Specifically, our findings indicate that exercise may reduce patient-reported and quantitative sensory symptoms in the feet after three taxane treatment cycles, where onset is frequently reported.
Lung cancer is the second most commonly diagnosed form of cancer, and is often treated surgically via tumor resection and lobectomy. Removal of lung tissue often impairs cardiopulmonary function, reduces activities of daily living, and lowers quality of life. Exercise interventions improve cardiopulmonary health and may attenuate the negative effects of lung cancer and its treatment. 

**Purpose:** To evaluate the response of lung cancer patients who had previously undergone a lobectomy to a structured, supervised 12-week exercise intervention, and compare these results with all other cancer patients completing the same exercise intervention.

**Methods:** Nine male and female lung cancer survivors who had previously undergone a lobectomy, were recruited to participate in a 12-week exercise-based rehabilitation program. The program consisted of one hour sessions, three days per week, and included cardiovascular endurance, muscular strength and endurance, balance, and flexibility exercises. Subjects completed pre and post assessments of cardiopulmonary function, consisting of a graded exercise test, yielding peak oxygen consumption (VO₂ peak), and spiroergometry, yielding forced vital capacity (FVC) and forced expiratory volume (FEV₃).

Subjects were divided into two groups: surgical resection including lobectomy (LOB, n = 9), and non-optimal resections (AOC, n = 20). **Results:** There were significant improvements in VO₂ peak in the LOB group (Pre: 15.2 ± 2.5 mL/kg/min; Post: 19.1 ± 2.4 mL/kg/min; +20%; p = 0.003) and no significant changes in FVC and FEV₃. There were significant improvements in VO₂ peak in the AOC group (Pre: 21.1 ± 0.5 mL/kg/min; Post: 24.0 ± 0.6 mL/kg/min; +13%; p = 0.000) and FEV₃ (Pre: 95 ± 1%; Post: 97 ± 1% predicted; +2.2%; p = 0.002) in the AOC group. Between group comparisons revealed no significant difference in improvement to VO₂ peak or AOC (p = 0.77). **Conclusion:** Results from this study demonstrate that lung cancer patients who have previously undergone a lobectomy can safely and effectively complete an individualized, prescriptive exercise intervention. This data also show that lung cancer survivors who have previously undergone a lobectomy are able to improve cardiopulmonary function to the same degree as all other cancer survivors completing a rehabilitative exercise intervention.

---

**S320** Vol. 49 No. 5 Supplement

**D38** Thematic Poster - Hydration

**Chair:** Samuel N. Cheuvront, FACSM. USAIEM, Natick, MA.

**Room:** CC-Lower level L100C

**No relevant relationships reported**

**Board #1** May 31 3:15 PM - 5:15 PM

**Ad Libitum Fluid Consumption off-sets Thermal and Cardiovascular Strain Exacerbated by Dehydration during Heat Waves**

Connor Graham, Nathan B. Morris, Ollie Jay, FACSM. University of Sydney, Sydney, Australia. (Sponsor: Ollie Jay, FACSM)

**No relevant relationships reported**

**Purpose:** We compared the impact of different fluid replacement practices on the development of dehydration and the associated changes in thermal and cardiovascular strain throughout 3 hours of light exercise in peak heat wave conditions (40°C, 40%RH).

**Methods:** Seven participants completed four separate 180-min trials exercising at 3 METs in 40°C, 40%RH. In each trial a different hydration plan was employed; i) ad libitum consumption of 20°C water (ALTB); ii) ad libitum consumption of 4°C water (ALCHILL); iii) no fluid replacement (NOFR); iv) full replacement of sweat loss (FULLFR). Fluid consumption (FC), resultant dehydration (%DEH), rectal temperature (Tₑ), mean skin temperature (Tₛ), heart rate (HR), whole body sweat rate (WSR), and local sweat rate (LSR) were measured. **Results:** Compared to NOFR, FC was greater in FULLFR (1.39±0.27 L; P=0.001), ALTB (1.36±0.46 L; P=0.001), and ALCHILL (1.04±0.39 L; P=0.002). FC was greater in ALTB than ALCHILL (P=0.01). %DEH was greater in NOFR (1.79±0.18%) compared to FULLFR (0.03±0.14%; P=0.001), ALTB (0.8±0.65%; P=0.002) and ALCHILL (0.46±0.59%; P=0.004). The rise in Tₑ from rest was greatest in NOFR (1.13±0.34°C) compared to ALTB (0.86±0.32°C; P=0.01), ALCHILL (0.45±0.30°C; P=0.001) and FULLFR (0.72±0.35°C; P<0.001). HR was higher after 180 min in NOFR (100±11 beats·min⁻¹) compared to ALTB (86±12 beats·min⁻¹; P=0.001), ALCHILL (87±15 beats·min⁻¹; P=0.001), and FULLFR (91±11 beats·min⁻¹; P=0.003). No differences in Tₛ, LSR or WSR were observed between trials. **Conclusions:** No fluid consumption throughout 3-h heat wave exposure with light physical activity exacerbated both thermal and cardiovascular strain, although differences in Tₑ were not due to difference in sweating. Ad libitum consumption of 4°C or 20°C water was sufficient to prevent levels of dehydration that exacerbate physiological heat strain. Preliminary findings show 4°C water seems to blunt thirst, and hence fluid intake relative to 20°C water.

---

**1659** Board #2 May 31 3:15 PM - 5:15 PM

**Energy Drink Consumption and Running Performance in a Hot Environment**

Emma L. Reed, Lindsay N. Russo, Zachary J. Schlader, Jennifer L. Temple, David Hostler, FACSM. ¹University at Buffalo, BUFFALO, NY. ²University at Buffalo, Buffalo, NY. (Sponsor: Dave Hostler, FACSM)

**No relevant relationships reported**

Energy drinks have been reported to have an ergogenic effect on exercise performance but there are few objective reports on the interaction of energy drinks and exercise in the heat in healthy, young adults. **Purpose:** To determine if energy drink consumption prior to a 5-km trial improves performance or alters thermoregulation when running in a hot environment.

**METHODS:** Experienced runners (4 males and 1 female; age: 22 ± 2.9 y; VO₂max: 51.16 ± 7.55 ml/kg/min) completed two 5-km trials in a double-blinded, randomized, crossover design 45 minutes after consuming a 500ml solution of a commercially available energy drink (ED) (~215 mg caffeine, ~480 mg taurine) or an equal volume of similarly flavored placebo (P). Both trials were completed on a treadmill in an environmental chamber set to 34°C and 40% relative humidity. Subjects were instructed to complete the 5-km run as fast as possible but were blinded to time, speed, and distance. Subjects were told the distance completed every 500 m. Physiological and perceptual variables were collected during the trials. **RESULTS:** There was no difference in time to complete the 5-km trial (1447 ± 296 ED vs. 1440 ± 264 sec (P)). Core temperature (39.27°C ± 0.33°C (ED) vs. 39.14°C ± 0.53°C (P)), skin temperature (36.2°C ± 0.4°C (ED) vs. 35.3°C ± 1.2°C (P)), rate of perceived exertion (both 9.4 ± 0.5), and heart rate (193 ± 9 bpm (ED) vs. 193 ± 12 bpm (P)) at the end of exercise did not differ. **CONCLUSIONS:** Consuming an energy drink before running a 5-km trial in the heat did not affect thermoregulation or improve performance.

---

**1660** Board #3 May 31 3:15 PM - 5:15 PM

**100% Orange Juice Consumption on Hydration, Electrolyte, and Cardiovascular Measures Following Exercise In The Heat**

Melani R. Kelly, Dawn M. Emerson, Evan J. Landes, Evan R. Barnes, Philip M. Gallagher. University of Kansas, Lawrence, KS.

**No relevant relationships reported**

Compared to commonly consumed carbohydrate electrolyte beverages (CEB), 100% orange juice (OJ) has a similar carbohydrate content, less sodium, and an increased amount of potassium, vitamins, and minerals, making it a possible fluid replacement option. **PURPOSE:** To investigate OJ, water (W), and CEB on hydration, electrolyte, and cardiovascular measures following exercise in the heat. **METHODS:** We used a randomized, controlled, single-blind design to determine the effects of OJ, a commercially available flavored W, and a commercially available CEB on plasma osmolality (Posm); plasma sodium (PNa⁺), potassium (PK⁺), calcium (PCa⁺), and chloride (PCl⁻); urine volume (Uvol); fluid volume (Fvol); heart rate (HR); and blood pressure (BP). Participants (n = 26, 20 male, 6 female, age: 22.1 ± 3.3 y; VO₂max: 51.16 ± 7.55 ml/kg/min; 72.9 ± 10.0 kg; height: 174.3 ± 7.9 cm; VO2max: 48.8 ± 7.3 ml/kg/min) cycled 80 min at 70% VO2max in a hot, humid environment (30.1 ± 0.2°C, 51.6 ± 4.0% relative humidity) on 5 consecutive days. After exercise, participants consumed 237 mL (8 oz) of assigned beverage then rested 1 hr in an ambient environment. Dependent measures were taken pre-, during, post-, and 1 hr post-cycling. **RESULTS:** There were no significant differences between conditions at any time point for Posm, PNa⁺, PCa⁺, PCl⁻, Fvol, Uvol, HR, or BP. Participants began exercise euhydrated (Posm = 266.9 ± 16.6 mOsm/L) and maintained hydration to post- (266.3 ± 19.5 mOsm/L) and 1 hr post-cycling (261.6 ± 12.8 mOsm/L). PK post-cycling was significantly greater in OJ (4.3 ± 0.2) than CEB (4.0 ± 1.0, P > 0.04). PK 1 hr post-cycling was significantly lower in CEB (3.9 ± 0.1) than W (4.0 ± 0.3, P < 0.003) and OJ (4.2 ± 0.3, P = 0.01). Overall, PK (3.9 ± 1.9 mOsm/L) was significantly lower than post- (4.2 ± 0.2 mOsm/L, P < 0.001) and 1 hr post-cycling (4.1 ± 0.3 mOsm/L, P < 0.001). **CONCLUSION:** Consuming 8 oz of OJ on multiple days after moderately intense cycling in the heat...
maintained fluid, electrolyte, and cardiovascular measures similar to W and CEB. Only PK was significantly affected by OJ, with post-cycling measures being higher, but within normal limits. 100% OJ is a viable rehydration option after exercise. Funded by the Florida Department of Citrus (#STE0075600).

1661 Board #4 May 31 3:15 PM - 5:15 PM
Rehydrating Efficacy of Maple Water After Exercise-Induced Dehydration: Potential Sex
Alexs A. Matias, Monique D. Duder, Josip Kauzlaric, Kimberly A. Frederick, Stephen J. Ives. Skidmore College, Saratoga Springs, NY. (Sponsor: Paul J. Arciero, FACSM)
(No relevant relationships reported)

BACKGROUND: Physical work, exacerbated by environmental heat stress, can induce dehydration, impairing physiological function. Therefore, understanding efficient rehydration strategies is paramount. The rehydrating effects of carbohydrate-electrolyte drinks and coconut water are well documented. To the best of our knowledge, no studies have investigated the rehydrating efficacy of maple water (MW).

PURPOSE: Investigate the rehydrating efficacy of MW following exercise-induced dehydration. METHODS: 26 healthy college-aged (24±1 kg·m², 22±1 y) males (n=13) and females (n=13) participated in a single blind, counterbalanced, crossover design study investigating the rehydrating efficacy of MW vs. maple flavored water after exercise-induced dehydration (<2.0±0.3% Body Weight [BW]) in an environmental chamber (30°C, 50% RH). Post-exercise, participants consumed either 1L of MW or control. Assessments of hydration (BW, salivary and urine osmolality [Sosm/Uosm]), urine specific gravity (USG), urine output (UO), urine color (UC), thirst, fatigue, heart rate (HR), and HR variability (HRV) were taken at baseline, immediately post-exercise, and 0.5, 1, and 2h post-consumption.

RESULTS: Following dehydration (p<0.05), MW had no differential (p>0.05) impact on hydration. Third phase dehydration was 12% higher than the control condition (p<0.05). When analyzed by sex, females had lower UO (30%, p<0.05), higher UBV (25%, p<0.05), USG (p<0.05), and Uosm (23%, p<0.05), but similar Sosm (p>0.05). Analysis of MW revealed higher electrolyte content (Ca²⁺, K⁺, Mg²⁺, Mn²⁺, CO₃⁻, PO₄³⁻, SO₄²⁻, Cl⁻, but not Na⁺), osmolality (81 vs. 11 mOsm/kg), and antiportant potential (AP; FRAP assay, 3.9 ± 0.6 vs. 1.0 ± 0.1), which tended to increase urine AP following MW consumption (9.4 ± 0.7 vs. 7.6 ± 1.0 mmol; MW vs. control). When analyzed by sex, females had lower UO (30%, p<0.05), higher UBV (25%, p<0.05), USG (p<0.05), and Uosm (23%, p<0.05), but similar Sosm (p>0.05). Analysis of MW revealed higher electrolyte content (Ca²⁺, K⁺, Mg²⁺, Mn²⁺, CO₃⁻, PO₄³⁻, SO₄²⁻, Cl⁻, but not Na⁺), osmolality (81 vs. 11 mOsm/kg), and antiportant potential (AP; FRAP assay, 3.9 ± 0.6 vs. 1.0 ± 0.1), which tended to increase urine AP following MW consumption (9.4 ± 0.7 vs. 7.6 ± 1.0 mmol; MW vs. control).

CONCLUSION: MW is an equally effective rehydrating beverage to water, but has higher electrolyte concentration and osmolality which might better trigger thirst mechanisms when rehydration is performed ad libitum. Further, MW has a superior antiportant capacity, which tended to increase urinary antiportant capacity and might reduce free radicals associated with exercise. There are apparent sex differences in urinary (UO, UBV, USG, Uosm, but not salivary, based measures of rehydration and warrants further study.

1662 Board #5 May 31 3:15 PM - 5:15 PM
Commercial Hydration Beverages Effectively Prolong Positive Fluid Balance in Older Adults Compared to Water
Megan M. Clarke, Anna E. Stuniewicz, W. Larry Kenney, FACSM. The Pennsylvania State University, University Park, PA. (Sponsor: W. Larry Kenney, FACSM)
(No relevant relationships reported)

Glucose-based beverages are often prescribed when mild-to-moderate dehydration is suspected because glucose-sodium cotransporters in the small intestine facilitate active transport of Na⁺ and resultant water diffusion. Alternatively, amino acid (AA)-based beverages use AA-sodium cotransporters to facilitate increases in vascular fluid volume after an overnight fast. We hypothesized that (1) older subjects would stay in positive fluid balance. Time in positive fluid balance was significantly longer following consumption of MW than water (291±49 vs. 204±35 min, P=0.02). Consumption of Enterade (291±49 vs. 152±18 min; P<0.01), and Enterade-AD (228±27 vs. 216±25 min; P=0.04) and was significantly increased in O with Enterade compared to water (291±49 vs. 204±35 min, P=0.02). CONCLUSIONS: After a bolus fluid load, healthy older adults exhibit a prolonged time course for urine excretion due to decreased GFR. Ingestion of commercially-available hydration solutions prolongs positive fluid balance compared to water ingestion in healthy older -- but not young -- adults. An AA based hydration product was the most effective short-term (0-4 h) oral hydration strategy for older adults.

1663 Board #6 May 31 3:15 PM - 5:15 PM
Consumption of a Caffeinated Soft Drink during Exercise in the Heat Worsens Dehydration
Christopher L. Chapman, Blair D. Johnson, James R. Sackett, Mark D. Parker, Zachary J. Schleder. University at Buffalo, Buffalo, NY. (Sponsor: Dave Hostler, FACSM)
(No relevant relationships reported)

Chronic dehydration is linked to kidney dysfunction in workers regularly exposed to hot environments. Sugar-rich beverages, such as soft drinks, are regularly consumed on worksite. Such hypertonic drinks decrease plasma and extracellular fluid volumes during rest. Consuming a soft drink-like beverage after resting heat exposure worsens dehydration in rats. It is unknown if drinking a caffeinated soft drink exacerbates dehydration during exercise in the heat.

PURPOSE: Test the hypothesis that consuming a caffeinated soft drink during exercise in the heat increases the magnitude of dehydration.

METHODS: Twelve healthy subjects (age: 24±5 y, 3 females) completed randomized soft drink (Mtn Dew, Soda) and water control (Water) trials. Subjects completed four 1 h work-rest cycles (45 min exercise, 15 min seated rest) in a 35°C, 65% RH environment. During rest, subjects drank 500 mL of the assigned rehydration beverage (−1°C). Physiological variables, and venous blood and urine samples were taken pre-POST, and post-exercise (POST) after 15 min supine rest in a moderate environment. Percent changes in plasma volume were estimated from changes in hemoglobin and hematocrit. Data are reported as a change from Pre (means±SD).

RESULTS: Subjects (Males: 6, Females: 6) had higher dehydration rates than control trials. Water consumption (Water: 14±7 mL · kg⁻¹ · h⁻¹, Soda: 29±11 mL · kg⁻¹ · h⁻¹, p<0.01) and peak heart rates (Soda: 200±10 bpm, Water: 180±10 bpm, p<0.01) were higher in Soda compared to Water. Subjects had lower post-exercise plasma osmolality (Soda: 2±3 mOsm/kg, Water: 3±3 mOsm/kg, p<0.01). At POST, plasma osmolality was higher in Soda (2±3 mOsm/kg) and reduced in water (−1±1 mOsm/kg, p<0.01). Urine osmolality was higher at POST (p<0.01), but there were no differences between trials (Soda: 69±368, Water: 185±311 mOsm/kg, p=0.12). Plasma volume was lower in Soda at POST (p<0.02), but there were no differences between trials (Soda: −5.6±2.7%, Water: −2.7±2.7%, p=0.15). Elevations in heart rate were higher in Soda at POST (20±12, Water: 12±12 bpm, p<0.03). Mean arterial pressure was elevated in Soda (p<0.01) at POST, but was not different between trials (Soda: 105±11, Water: 95±11 mmHg, p=0.33).

CONCLUSION: These data indicate that consuming a caffeinated soft drink during exercise in the heat worsens dehydration and elevates cardiovascular strain.

1664 Board #7 May 31 3:15 PM - 5:15 PM
Effects of Different Water and Sodium Consumption Volumes on Fluid Retention and Hyperhydration
David M. Morris, Elizaveta Roslanova. University of Texas - Permian Basin, Odessa, TX. (No relevant relationships reported)

Previous research has shown that co-consumption of sodium and water prior to exercise is effective in promoting hyperhydration. However, optimum fluid and sodium consumption volumes for attaining hyperhydration have not been systematically studied. While consumption of larger volumes of fluid may seem to be advantageous, overconsumption of fluid may trigger excess diuresis and, thus, not provide advantages over smaller fluid does. PURPOSE: To compare the effects of different water and sodium doses volumes on fluid retention.

METHODS: Urine excretion was measured during four separate 2-hr hyperhydration protocols in 13 well hydrated male subjects (24 ± 4.7 yr, 77.0 ± 8.9 cm, 75.2 ± 9.5 kg) who were free from known renal, digestive, and cardiovascular disease. Each protocol began with a complete bladder void and assessment of urine specific gravity (USG). Subjects then consumed water and NaCl in an isotonic mixture in four different dosing strategies: 20 mL H₂O · kg⁻¹ · h⁻¹ with 94 mg NaCl · kg⁻¹ · h⁻¹ (20), 15 mL H₂O · kg⁻¹ · h⁻¹ with 70.5 mg NaCl · kg⁻¹ · h⁻¹ (15), 10 mL H₂O · kg⁻¹ · h⁻¹ with 47 mg NaCl · kg⁻¹ · h⁻¹ (10), or 5 mL H₂O · kg⁻¹ · h⁻¹ with 23.5 mg NaCl · kg⁻¹ · h⁻¹ (5). Protocols were applied in a randomized, crossover fashion. Each treatment was divided into three equal portions and consumed at 0, 45, and 90-min of the 2-hr hyperhydration period. Total urine excretion for the two hour period was subtracted from the fluid consumed to determine total fluid retention (TFR). USG and TFR, expressed in mL · kg⁻¹ · h⁻¹, were compared using separate, one-way repeated-measures ANOVAs and Sidak post hoc analyses.

RESULTS: USGs were 1.00±0.005 (20), 1.01±0.028 (15), 1.01±0.003 (10) and 1.00±0.005 (5) (P = 0.93 - 1.00) indicating that subjects were well and similarly hydrated at baseline, immediately post-exercise, and 0.5, 1, and 2h post-consumption. Total fluid retention was significantly lower in the 5 mL condition (MW vs. control).

CONCLUSION: Salt supplementation during hydration potentially affords a greater fluid retention.
CONCLUSIONS: The data suggest that, when consuming a water and NaCl mixture in volumes ranging from 5 - 20 mL H2O·kg bw -1, fluid retention rates are approximately 50% regardless of the volume of fluid consumed. Thus, to achieve maximum hyperhydration, at least 20 mL H2O·kg bw -1 should be consumed.

D-39 Thematic Poster - Knee Biomechanics
Thursday, May 31, 2018, 3:15 PM - 5:15 PM
Room: CC-Lower level L100F

1665 Board #1 May 31 3:15 PM - 5:15 PM Dynamic Knee Hyperextension in Competitive High School Soccer Players
Stacy J. Ingraham1, Jon-Paul W. Ciszewski2, David W. McGehee3, Jessica N. Schnidler4, Sarah J. Ingraham5, William W. Newhouse4, Daniel D. Hanson6, Jane R. Yank2. 1Crosstown College, St. Bonifacius, MN; 2Bethel University, St. Paul, MN; 3Norwich University, Northfield, VT; 4University of Minnesota, Minneapolis, MN; 5Wheaton College, Wheaton, IL. (No relevant relationships reported)

Purpose: The purpose of this study was to explore the incidence of dynamic knee hyperextension in high school soccer athletes by sex and team level (freshman, junior varsity, and varsity) as observed through high-speed photography. In addition, the data was gathered to explore if the difference in dynamic hyperextension noted between men and women was similar to the differences found in ACL injury surveillance data incidence statistics. Methods: Dynamic knee extension of 87 male (n=41) and female (n=46) high school soccer athletes was captured using high-speed photography while capturing a soccer ball 5 times in a single session. One photo demonstrating each athlete’s maximal knee extension was assessed for degree of extension, both visually and using Kinovea, a motion analysis software program. Results: Multinomial logistic regression regarding certainty of hyperextension with a 5-point scale by two judges showed no significant differences by sex of the player (p=0.456) or team level (p=0.064). The incidence of hyperextension for females and males across all skill levels was approximately 16/41 (39%) and 16/36 (44%), respectively. Results of binary logistic regression on the presence or absence of observed hyperextension showed no significant differences by sex of the players (p=0.702) or by team level (p=0.191). Results of categorical data analysis showed no significant differences among six player groups consisting of freshman, junior varsity, and varsity levels for both boys and girls (chi-square=3.928, p=0.560). Interestingly, there was a marginal increased incidence of hyperextension in freshman high school athletes (p=0.099). The incidence of hyperextension among all participants of this study is not congruent with published ACL injury surveillance, confirming the multifactorial nature of ACL injuries. Conclusion: The results indicate that with a larger sample size, a difference between team levels may emerge. The lack of difference in hyperextension incidence between males and females suggest hyperextension incidence is not a good predictor of injury differences between sexes. More research is needed to identify the relationship between observed dynamic knee hyperextension, recoll and ACL injury.

1666 Board #2 May 31 3:15 PM - 5:15 PM A Novel Approach To Investigate Differences In Knee Mechanics After ACL Reconstruction Using Inertial Sensors
Jasper Reenalda1, Erik Maertens2, Jaap Buurke3, Mary Lloyd Ireland, FACSM4, Brian Noehren, FACSM5, Roessingh Research and Development, University of Twente, Enschede, Netherlands. 1University of Kentucky, Lexington, KY. (Sponsor: Brian Noehren, FACSM) (No relevant relationships reported)

Hop testing after an Anterior Cruciate Ligament reconstruction (ACLR) is a common functional test to determine return to play status. However, hop tests are not very sport specific, as they do not capture other tasks in sports like accelerating, decelerating, cutting and turning. A figure 8 running task is proposed as an alternative, involving these sport specific movements. Knee mechanics during this task can be objectified using inertial sensors. These sensors have been used previously to objectify hop tests and showed differences in knee kinematics in ACLR patients. PURPOSE: To investigate sagittal knee mechanics in ACLR patients during a 5 minute figure 8 running task, using inertial magnetic measurement units (IMUs).

METHODS: 5 ACLR patients (2M, 3F, 20.4 ± 2.1 yrs, 164.2 ± 10.7 cm, 69.1 ± 23.5 kg) one year post ACLR, and 10 healthy controls (7M, 3F, 21.8 ± 2.0 yrs, 178.3 ± 10.2 cm, 73.5 ± 14.3 kg) performed a 5 minute figure 8 running task wearing a lyra suit equipped with 8 IMUs at the feet, tibia, upper legs, sacrum and sternum. Sagittal knee mechanics were determined at the strains since this is the most standardized part of the figure 8. The absolute difference in peak knee flexion (ADPK) during stance phase was determined between reconstructed and healthy leg for the ACLR group and between both legs for the healthy (HLTH) population. An independent Mann-Whitney U-test was used to test for a statistical difference in ADPK between ACLR and HLTH. RESULTS: ADPK was significantly higher (p < 0.05) for the ACLR group versus the healthy population. CONCLUSIONS: Subjects who have had an ACLR have a larger difference in peak knee flexion between their reconstructed and healthy leg (less flexion in the reconstructed knee) at the straights of a figure 8 running task compared to healthy controls. The figure 8 test might serve as a new test to determine return to play and to assess re-injury risk. Future research should test this and include (frontal plane) knee mechanics during cutting and turning.

1667 Board #3 May 31 3:15 PM - 5:15 PM Reductions in Peak Knee Adduction Moment in Three Previously Studied Gait Modification Strategies: Preliminary Analysis
Bryndan Lindsey1, Oladipo Eddo1, Shane Caswell2, David Hollinger1, Jessica Pope1, Matt Prebble1, Ana M. Azevedo2, Nelson Cortes3. 1George Mason University, Manassas, VA. 2University of Lisbon, Lisbon, Portugal. (No relevant relationships reported)

First peak knee adduction moment (PKAM) has been associated with osteoarthritis (OA) progression. Gait modification strategies using real-time biofeedback (RTB) including lateral trunk lean (LT), medial knee thrust (MKT), and reduced forward progression angle (FPA) have reduced PKAM in both healthy and OA populations. However, heterogeneity between limited study designs makes it unclear which strategy most effectively reduces PKAM. PURPOSE: To compare the effects of TL, MKT, and FPA strategies on PKAM in healthy individuals during gait. METHODS: 10 healthy individuals volunteered for this study (28.4 ± 3.8 years, 1.73 ± 0.1 m, 75.3 ± 12.5 kg). Mean and standard deviation (SD) for PKAM, trunk angle, knee angle (KA), and foot angle during stance was calculated from 10 baseline trials using a motion capture system and force plates. 10 trials completed for each strategy using RTB so that joint angles fell within a determined range (1-5 SD) relative to baseline. Visual 3D was used to calculate joint angles relative to the contralateral limb (i.e. limb symmetry index [LSI]) has been used for comparison.

Hop testing after an Anterior Cruciate Ligament reconstruction (ACLR) is a common functional test to determine return to play status. However, hop tests are not very sport specific, as they do not capture other tasks in sports like accelerating, decelerating, cutting and turning. A figure 8 running task is proposed as an alternative, involving these sport specific movements. Knee mechanics during this task can be objectified using inertial sensors. These sensors have been used previously to objectify hop tests and showed differences in knee kinematics in ACLR patients. PURPOSE: To investigate sagittal knee mechanics in ACLR patients during a 5 minute figure 8 running task, using inertial magnetic measurement units (IMUs).

METHODS: 5 ACLR patients (2M, 3F, 20.4 ± 2.1 yrs, 164.2 ± 10.7 cm, 69.1 ± 23.5 kg) one year post ACLR, and 10 healthy controls (7M, 3F, 21.8 ± 2.0 yrs, 178.3 ± 10.2 cm, 73.5 ± 14.3 kg) performed a 5 minute figure 8 running task wearing a lyra suit equipped with 8 IMUs at the feet, tibia, upper legs, sacrum and sternum. Sagittal knee mechanics were determined at the strains since this is the most standardized part of the figure 8. The absolute difference in peak knee flexion (ADPK) during stance phase was determined between reconstructed and healthy leg for the ACLR group and between both legs for the healthy (HLTH) population. An independent Mann-Whitney U-test was used to test for a statistical difference in ADPK between ACLR and HLTH. RESULTS: ADPK was significantly higher (p < 0.05) for the ACLR group versus the healthy population. CONCLUSIONS: Subjects who have had an ACLR have a larger difference in peak knee flexion between their reconstructed and healthy leg (less flexion in the reconstructed knee) at the straights of a figure 8 running task compared to healthy controls. The figure 8 test might serve as a new test to determine return to play and to assess re-injury risk. Future research should test this and include (frontal plane) knee mechanics during cutting and turning.

1668 Board #4 May 31 3:15 PM - 5:15 PM Lack of Association Between Clinical Measures of Symmetry and Knee Loading Mechanics After ACL Reconstruction
Lindsey K. Lepley, Julie P. Burland, Steven M. Davi, Adam S. Lepley. University of Connecticut, Storrs, CT. (No relevant relationships reported)

Distance hopped in the anterior cruciate ligament reconstructed limb (ACLR) limb relative to the contralateral limb (i.e. limb symmetry index [LSI]) has been used
as a clinical criterion to help guide safe return to sport. However, it is unclear if laboratory measures of knee kinematic and kinetic loading symmetry are related to clinical symmetry in knee loading mechanics or predispose the individual to recurrent injury. Identifying whether clinical symmetry is related to knee loading symmetry is important to fully understand readiness to return to sport.

**PURPOSE:** To evaluate whether clinical limb symmetry, measured by distance hopped during the single leg hop for distance (SLHD) test, is associated with landing mechanics in patients with a history of anterior cruciate ligament (ACL) injury. **METHODS:** LSI ([JABL limb/contralateral limb] x100) was calculated for the following parameters collected during the landing phase of the SLHD: distance hopped, peak knee flexion angle at initial contact, peak knee flexion angle, peak knee extensor moment, and the area under the curve (AUC) for knee flexion angle and knee extensor moment. Spearman correlations were used to determine if symmetry in distance hopped was associated with symmetry landing mechanics. **RESULTS:** Distance hopped symmetry (99.5±5.1%) was not associated with peak knee flexion angle at initial contact (72.8±26.9%, rho=0.164, p=0.651), peak knee flexion angle (90.1±10.7%, rho=0.100, P=0.777), AUC knee flexion angle [88.3±14.8%, p=0.006, P=0.987], peak knee extensor moment (89.9±19.2%, rho=0.576, P=0.082) or AUC knee extensor moment (87.0±23.5%, rho=0.188, P=0.653) symmetry. **CONCLUSION:** Clinical symmetry was not associated with any laboratory measures of knee kinematic or kinetic loading symmetry. The lack of association between clinical symmetry and knee loading mechanics suggests that individuals with a history of an anterior cruciate ligament injury have individually unique limb biomechanical strategies to achieve the same functional outcomes. This finding suggests that additional assessment of loading mechanics may be warranted to help guide safe return to sport after ACLR.

**PURPOSE:** To investigate the effects of using knee wraps on vertical displacement, lifting duration, and work performed during the concentric phase of the back squat exercise. **METHODS:** Resistance-trained men performed a back squat protocol over three testing sessions, along with two training days, over a 2-week period. Each testing session involved performing six single repetition sets of the back squat with 5-min of rest. During each testing session, participants underwent 2 different treatments such that the first three sets were performed unassisted (U) and the second three sets were performed with knee wraps (W). The two training days occurred between the second and third testing sessions. On these training days, participants were randomly assigned to a back squat training group; one that trained with knee wraps (W) and one that trained without knee wraps (TU; n=7) (Age: 24±5yrs, Height: 1.78±6.4m, Mass: 81.4±3.8kg, 1RM: 143±25kg). A linear position transducer was used to measure lifting duration, and one that trained without knee wraps (TU; n=7) (Age: 24±5yrs, Height: 1.78±6.4m, Mass: 81.4±3.8kg, 1RM: 143±25kg). A linear position transducer was used to measure lifting duration, and work [Force*distance] performed during the concentric phase of the back squat testing session. 

**RESULTS:** To investigate the effects of using knee wraps on vertical displacement, lifting duration, and work performed during the concentric phase of the back squat testing session concentric vertical displacement (D1,41), lifting duration, and work [Force*distance] were significantly greater (p<0.001) during the third back squat testing session (D1,41). Concentric work was also significantly greater (p<0.001) during the third session (D1,41) compared to the first two sessions (D1,41). This resulted in a significant acute improvement in hip extension ROM and DB measures. However, knee joint replication error results showed nonsignificant improvement over time in either stretching group.

**EXPOSURE TO ACUTE HIGH TRAINING LOADS (HTL) RESULTS**

**PURPOSE:** To examine the acute effects of two hip flexor stretching techniques on hip extension range of motion (ROM), knee JPS and dynamic balance performance (DB). **METHODS:** Thirty-six healthy college age students (24 males, 11 females, mean age 22.37 ± 1.63 years, height 171.05 ± 9.64 cm, and weight 72 ± 13.70 kg) with THP participated in this study. Hip extension ROM, knee JPS and DB were measured pre- and post-stretching using a digital inclinometer, an iPod touch and the Y-balance kit, respectively. Subjects were randomly divided into dynamic stretching (DS), and hold-relax proprioceptive neuromuscular facilitation (PNF) groups. Three-way mixed analysis of variance (ANOVA) was used to explore an interaction existed between the groups (DS vs. HR-PNF), time (pre-post) and side of hip (right vs. left) in hip extension ROM, knee JPS and DB measurements. **RESULTS:** There was a significant effect of time on hip extension ROM in both stretching groups (p = 0.007, 9.37°, 6.94°, vs post = 0.18°, 0.27°, right and left hips, respectively, p = 0.001). Also, there was a significant effect of stretch type on hip extension ROM (3.87°, -2.48°) and (-0.90°, -0.26°) right, left, PNF versus DS group, post-stretching time points, respectively; p = 0.004 favoring HR-PNF over DS. There was a non-significant effect of time on mean knee JPS replication error in both groups. In DB measurement, there was a significant main effect of time and directions of reach on the Y-balance test’s mean distance. The total mean distance of reach to posterolateral direction for both stretching groups (p = 0.01, 96.10% vs. 96.24%) was larger than the total mean distance of reach to posterioromedial direction (p = 0.01, 96.10% vs. 96.24%) which was in turn larger than the total mean distance of reach to the anterior direction (p = 0.01, 96.10% vs. 96.24%). **CONCLUSIONS:** DS and HR-PNF stretching resulted in a significant main effect of time and directions of reach on the Y-balance test’s mean distance.

**THURSDAY, MAY 31, 2018**

1670 Board #6 May 31 3:15 PM - 5:15 PM

Acute Effects of Hip Flexor Stretching Techniques on Knee Joint Position Sense and Balance

Hussain Aslan1, Richard W. Willy2, Juan Cardyl Trionfante3, Erica Marshall1

1Louisiana State University, Baton Rouge, LA. 2University of Montana, Missoula, MT. 3Western Carolina University, Greenville, NC. (Sponsor: Paul DeVita, FACSM)

(No relevant relationships reported)

**PURPOSE:** Acute effects of two hip flexor stretching techniques on knee joint position sense (JPS) and dynamic balance performance (DB) were evaluated using preferred foot contact forces.

**RESULTS:** Exposure to acute high training loads (HTL) induces biomechanics associated with knee joint injury. **PURPOSE:** To examine the acute effects of two hip flexor stretching techniques on hip extension range of motion (ROM), knee JPS and dynamic balance performance (DB). **METHODS:** Thirty-six healthy college age students (24 males, 11 females, mean age 22.37 ± 1.63 years, height 171.05 ± 9.64 cm, and weight 72 ± 13.70 kg) with THP participated in this study. Hip extension ROM, knee JPS and DB were measured pre- and post-stretching using a digital inclinometer, an iPod touch and the Y-balance kit, respectively. Subjects were randomly divided into dynamic stretching (DS), and hold-relax proprioceptive neuromuscular facilitation (PNF) groups. Three-way mixed analysis of variance (ANOVA) was used to explore an interaction existed between the groups (DS vs. HR-PNF), time (pre-post) and side of hip (right vs. left) in hip extension ROM, knee JPS and DB measurements. **RESULTS:** There was a significant effect of time on hip extension ROM in both stretching groups (p = 0.007, 9.37°, 6.94°, vs post = 0.18°, 0.27°, right and left hips, respectively, p = 0.001). Also, there was a significant effect of stretch type on hip extension ROM (3.87°, -2.48°) and (-0.90°, -0.26°) right, left, PNF versus DS group, post-stretching time points, respectively; p = 0.004 favoring HR-PNF over DS. There was a non-significant effect of time on mean knee JPS replication error in both groups. In DB measurement, there was a significant main effect of time and directions of reach on the Y-balance test’s mean distance. The total mean distance of reach to posterolateral direction for both stretching groups (p = 0.01, 96.10% vs. 96.24%) was larger than the total mean distance of reach to posterioromedial direction (p = 0.01, 96.10% vs. 96.24%) which was in turn larger than the total mean distance of reach to the anterior direction (p = 0.01, 96.10% vs. 96.24%). **CONCLUSIONS:** DS and HR-PNF stretching resulted in a significant main effect of time and directions of reach on the Y-balance test’s mean distance.

**THURSDAY, MAY 31, 2018**

1671 Board #6 May 31 3:15 PM - 5:15 PM

Acute Effects of Two Hip Flexor Stretching Techniques on Knee Joint Position Sense and Balance

Hussain Aslan1, Richard W. Willy2, Juan Cardyl Trionfante3, Erica Marshall1

1Louisiana State University, Baton Rouge, LA. 2University of Montana, Missoula, MT. 3Western Carolina University, Greenville, NC. (Sponsor: Paul DeVita, FACSM)

(No relevant relationships reported)

**PURPOSE:** Acute effects of two hip flexor stretching techniques on knee joint position sense (JPS) and dynamic balance performance (DB) were evaluated using preferred foot contact forces.
and 7.5% longer step lengths. METHODS: Sixteen male Army ROTC Cadets (20.1 ±2.5 years, 77.4 ±13.4 kg) completed walking treadmill trials (1.3 m/s) with and without 20-kg load carriage. Trials were then collected with altered step lengths (+7.5%) with load carriage. Joint contact forces normalized to body weight (BW) per step and per 1-km were estimated for the mTFJ and PFJ via musculoskeletal modeling.

RESULTS: At preferred step length, the load carriage increased peak mTFJ contact force per step by 19.3% (p<0.001, d=1.33) and mTFJ impulse per 1-km by 22% or 89 additional BW*s per km (p=0.001, d=0.69). There was a 1:2 relationship between the load carriage and absolute peak mTFJ contact force versus a more modest 1:1 relationship between load carriage and absolute peak PFJ contact force increase. Compared with preferred step length with load carriage, a short step with load carriage did not alter mTFJ or PFJ contact forces (all p>0.05). Shorter steps were used to influence walking and designing communities with these features may help improve walkability in the U.S.

CONCLUSION: To examine trends in the prevalence and volume of self-reported walking (transportation and leisure) in the U.S., as highlighted in former Surgeon General’s Call to Action to Promote Walking and Walkable Communities. Public health monitoring of walking behaviors can guide future efforts to promote walking. The proportion of adults who walk for transportation or leisure increased overall, but slowed to 2015 (linear: p<0.05). Leisure walking prevalence increased overall, but slowed to 2015 (linear: p<0.05). There was a 1:2 relationship between the load carriage and absolute peak mTFJ contact force increase versus a more modest 1:1 relationship between load carriage and absolute peak PFJ contact force increase. Compared with preferred step length with load carriage, a short step with load carriage did not alter mTFJ or PFJ contact forces (all p>0.05). In contrast, a long step magnified the effect of load carriage on all metrics of mTFJ and PFJ contact forces. Specifically, a long step with load carriage increased peak mTFJ contact force by 9.0% (p=0.004, d=0.63) and mTFJ impulse per 1-km by 6.6% or 32.8 additional BW*s per km (p=0.001, d=0.48). A long step increased peak PFJ contact force by 26.6% (p=0.004, d=0.68) and PFJ impulse per 1-km by 22.7% or 27.1 additional BW*s impulse per km (p=0.001, d=0.48) compared with preferred step length with load carriage. A long step with load carriage resulted in 1:3.2 and 1:2.4 relationship between added load weight and absolute increases in peak mTFJ and PFJ contact forces, respectively.

RESULTS: The added load carriage was preferentially borne by the mTFJ with a smaller increase in PFJ contact forces. A short step was not an effective strategy to reduce mTFJ and PFJ loads. A longer than preferred step length, often observed in shorter individuals during formation marching, increased both mTFJ and PFJ contact forces with greatest increases noted in the PFJ.

Table: Prevalence and volume of mTFJ and PFJ

<table>
<thead>
<tr>
<th>Measure</th>
<th>2005</th>
<th>2010</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalence of mTFJ (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any transportation</td>
<td>8,302</td>
<td>25.1</td>
<td>4,506</td>
</tr>
<tr>
<td>Any leisure</td>
<td>11,775</td>
<td>28.7</td>
<td>15,744</td>
</tr>
<tr>
<td>Both transportation and leisure</td>
<td>4,506</td>
<td>15.5</td>
<td>6,353</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mean volume of walking (minutes/week)</th>
<th>99.2</th>
<th>3.5</th>
</tr>
</thead>
</table>

**Notes:**
- This study used stepwise logistic regression to identify walking and self-reported walking for leisure or transportation participation.
- Significant linear trend from 2005 to 2015 (p<0.05).
- Significant quadratic trend from 2005 to 2015 (p<0.05).

**Step It Up!** The Surgeon General’s Call to Action to Promote Walking and Walkable Communities calls for community design that makes it safe and easy to walk for people of all ages and abilities. Determining which community design features are associated with walking at the national level can inform strategies to improve monitor walkability in the U.S.

**PURPOSE:** To document the associations between walking and walkable supports and destination types among U.S. adults.

**METHODS:** Adult respondents (n=29,925) to the 2015 National Health Interview Survey reported the presence of two near-home walkable supports (roads, sidewalks, paths, or trails; sidewalks on most streets) and four destination types (shops, stores, or markets; bus or transit stops; movies, libraries, or churches; places that help one relax, clear one’s mind, and reduce stress). Stepwise logistic regression was used to identify features significantly associated with self-reported walking for leisure or transportation in the past week. From the resulting model, the prevalence of walking was calculated for each combination of features.

**RESULTS:** When combined in a single model, one support and three destination types were associated with walking: roads, sidewalks, paths, or trails (prevalence ratio [PR], present vs. absent [95% confidence interval]: 1.11 [1.07-1.16]; transit: 1.07 [1.04-1.10]; movies, libraries, or churches: 1.07 [1.04-1.11]; places to relax (1.39 [1.34-1.44]). For specific combinations of the four, 7.4% reported absence of all features, 36.5% of whom reported any walking. In comparison, 32.5% reported presence of all features, 73.7% of whom reported any walking (PR: 2.02 [1.82-2.22]). The prevalence of walking was generally higher among adults who reported a greater number of features (p<0.001 for linear trend).

**CONCLUSIONS:** Among U.S. adults, one near home walkable support (roads, sidewalks, paths, or trails) and three walkable destination types (transit; movies, libraries, churches; places to relax) were associated with walking. Walking was two times more common among adults who reported all four features versus no features. These results support the idea that multiple built environment features may combine to influence walking and designing communities with these features may help improve walkability in the U.S.
Built environments (BE) may influence health behaviors and subsequently obesity. However, most research in the BE literature has been fraught by methodological problems including self-selection bias and structural confounding. Twin studies provide a quasi-experimental approach to address these issues. PURPOSE: This study examined relationships among BE walkability, health behaviors, and body mass index (BMI) between and within twin pairs, and how these relationships differ when considering walkability of the home neighborhood and each twin’s full activity space. METHODS: Geocoded home addresses and continuous physical activity data from accelerometers and GPS loggers were obtained in 144 identical twin pairs over 2 weeks. Dietary energy density (DED) was assessed by food frequency questionnaire, and BMI was derived from measured height and weight. Walk Score™ (WS) was used to estimate walkability; home WS refers to walkability of the home neighborhood and GPS WS refers to the mean of individual WS values matched to every GPS point collected by each participant, reflecting the walkability of each twin’s activity space. RESULTS: Home WS was related to GPS WS between-pairs (r = 0.52; 95% CI: 0.38, 0.63); the relationship was attenuated but significant within-pairs (r = 0.25; 95% CI: 0.08, 0.41). DED was related to GPS WS but not home WS (r = -0.20; 95% CI: -0.36, -0.04) between-pairs; this relationship was significant within-pairs. Moderate-to-vigorous physical activity (MVPA) performed outside of the home neighborhood, defined using both 833 and 1,666m buffers, was related to GPS WS between-pairs (both r = 0.22; 95% CI: 0.06, 0.38); the relationship was attenuated but significant within-pairs (both r = 0.18; 95% CI: 0.00, 0.35). BMI was related to GPS WS but not home WS (r = -0.23; 95% CI: -0.36, -0.04) between-pairs; this relationship was not significant within-pairs. BMI was related to walking bouts and MVPA performed within and between the 1,666m home buffers; BMI was related to GPS WS (both r = 0.38, -0.06), but not within-pairs. However, BMI was not related to DED levels either between or within-pairs. CONCLUSIONS: Twin studies support the concept that aspects of the BE are indirectly associated with BMI through its influence on health behaviors, particularly physical activity. Supported by R01AG042176.


**Lower limb amputation can be a life-altering event given the critical role the lower limb plays in transferring, standing, and walking. The physical impairments an individual may experience can decrease his or her ability to function in the free-living environment. It has been reported that, on average, civilians with lower limb amputations spend all levels of walking only 2,000–3,000 steps per day. Although potentially not surprising that they are less active than able-bodied individuals, the magnitude of the activity gap is remarkable. PURPOSE: To quantify physical activity in Service Members with lower limb loss in the months following amputation. METHODS: Activity data were collected on 27 Service Members who received amputations during the recent military conflicts (N=16 unilateral transfibial, N=7 unilateral transfemoral, N=4 bilateral transfemoral) using a StepWatch3 (Orthocare Innovations, Oklahoma City, OK) secured to the prosthesis and worn for one week. RESULTS: Service Members with lower limb amputations fell substantially below the recommended 10,000 steps per day to maintain an active lifestyle and averaged only 3,142 ± 1,308 steps/day. The individuals included in this data set were tested during their rehabilitation at the Center for the Intrepid and Walter Reed Medical Center and had been walking with a prosthetic limb for an average of 7.3 ± 3.6 months (range 2 to 12 months). There were no indications that individuals farther along in the rehabilitative process walked more steps per day than those in the earlier stages of rehabilitation (R2=0.008). CONCLUSION: Although these young and previously highly active Service Members have extensive access to rehabilitative care and prosthetic technology, these data raise considerable concern about activity levels after amputation. These low activity levels indicate high risk for progressive declines in overall physical health. One limitation of this study was that these individuals may have been engaging in strength training or other exercises without a prosthetic limb as part of physical therapy, or recovering when not in therapy. It is unknown if their step counts are representative of activity once discharged from rehabilitation. Funding: Military Ampute Research Program W81XWH-06-2-0073

**Leisure-time physical activity (PA) with the incidence of kidney stones. PURPOSE: The purpose of this study is to investigate the independent and joint effects of leisure-time PA (LTPA) and work-related walking (WRW) on the incidence of kidney stones among Japanese workers in the Niigata Wellness Study. METHODS: A cohort of 16,458 Japanese men (median (IQR) age 49 (43-53) years) and 7,140 women (median (IQR) age 48 (43-52) years) free of kidney stones completed a medical examination, and reported on LTPA and WRW in 2001. The participants were divided into three categories (0 min/week; LTPA-none, 1-119 min/week; LTPA-M, ≥120 min/week; LTPA-M, ≥120 min/week; LTPA-M, ≥120 min/week) based on LTPA, and also divided into two categories based on existence of WRW (no; WRW-no, yes; WRW-yes). The development of kidney stones during follow-up from 2002 to 2006 was based on self-reports from questionnaires at another medical examination in 2006. Odds ratios and 95% confidence intervals (95%CI) for the incidence of kidney stones were obtained using logistic regression models while adjusting for sex, age, body mass index, cigarette smoking (5 categories), and alcohol intake (3 categories). RESULTS: During the 5 year follow-up period, 169 participants developed kidney stones. In regards to the independent effects of LTPA and WRW. Using LTPA-none as reference, odds ratios and 95% CIs for LTPA-M, and LTPA-M, were 0.72 (0.44-1.17) and 0.64 (0.40-1.02) (P for trend=0.034). Also, using WRW-no as reference, odds ratios and 95% CIs for WRW-yes was 0.85 (0.62-1.17). With regards to the joint effects of LTPA and WRW, using LTPA-none and WRW-no group as reference, odds ratios for WRW-yes was 0.72 (0.42-1.24) for the LTPA-M, and WRW-no group, 0.39 (0.16-0.97) for LTPA-M, and WRW-yes group, respectively. CONCLUSIONS: These results suggest that there...
is an independent effect of LTPA on the incidence of kidney stones. Also, there is a strong joint effect of LTPA and WRW on the incidence of kidney stones in Japanese workers.

### Board #7
May 31 3:15 PM - 5:15 PM
**HealthSteps Lifestyle Prescription Program Can Increase Physical Activity and Decrease Blood Pressure in At Risk Adults**

Robert J. Petrella, FACSM1, Dawn P. Gill1, Wendy Blunt1, Roseanne W. Pulford2, Adam Gavarkovs2, Narlon C. Boa Sorte Silva1, Cassandra Bartol1, P. Karen Simmavong1, Ashleigh De Cruz1, Guangyong Zou1,2. 

1Western University, London, ON, Canada. 2Harvard University, Cambridge, MA. 

(No relevant relationships reported)

Approximately 30% of Canadian adults have one or more chronic diseases. This number is expected to grow as the Canadian population ages and risk factors for chronic disease continue to climb. **PURPOSE:** 1) To evaluate the effectiveness of HealthSteps (HeS), a 6-month lifestyle prescription program, on increasing physical activity (PA) and decreasing systolic blood pressure (SBP) in adults at-risk for chronic disease; 2) To explore long-term maintenance of these outcomes. **METHODS:** Pragmatic randomized controlled trial where adults from 5 primary care settings in Ontario, Canada (N = 118; mean age 57 (SD=12) years; 76% female) with ≥1 chronic disease risk factor (metabolic syndrome or type 2 diabetes; body mass index ≥25 kg/m²; exercise ≤150 min/wk; sit ≥3 h/d; eat ≤8 servings of fruit and vegetables/d) were randomized to intervention (HeS) or comparator (wait-list control; WL). Over 6 months, HeS included 4 bi-monthly coaching sessions (setting lifestyle prescriptions and strategies to achieve goals) and access to eHealth technologies (phone coaching; social network; smartphone apps; website). From 6 to 12 months, in-person coaching was removed but participants could access all eHealth technologies. By 12 months, participants only had access to publically available technologies. We examined within and between group differences in mean steps/day (Yamax Digi-Walker SW-200 pedometers) and SBP (BP-Tru BPM-100 automated BP monitors) using linear mixed models adjusted for age, sex and site. **RESULTS:** By 6 months, HeS increased their steps/day more than WL [mean change (95% CI): p-value for difference = HeS: 1646 (786, 2507); WL: -1486 [-2312, -559]; p<0.001]. By 12 months, the increase in PA was still evident within HeS [mean change from baseline (95% CI): 1800 (888, 2892)]. Although there were no differences between groups (p=0.93), both groups decreased their SBP (mmHg) over 6 months [mean change (95% CI) = HeS: -6.38 (-10.43, -2.33); WL: -6.61 (-10.52 to -2.70); p=0.083]. HeS maintained this to 18 months [mean change from baseline (95% CI): -6.58 (-11.35, -1.81)]. **CONCLUSION:** HeS was effective in improving physical activity over 6 months, compared to usual care, in adults at risk for chronic disease; these improvements were maintained 1-year later. Results also suggest that HeS may reduce SBP in both the short and long-term.

### Board #8
May 31 3:15 PM - 5:15 PM
**The Effect of 2 Walking Programs on HbA1c in Sedentary Employees During a 10 Week Intervention**


Auburn University, Auburn, AL. (Sponsor: David D. Pascoe, FACSM)

(No relevant relationships reported)

Physical activity is related to many benefits for metabolic impairments such as type 2 diabetes. However, it remains unclear whether different physical activity programs affect blood glucose in the same way. **PURPOSE:** The present study examined changes on HbA1c in sedentary employees exposed to two different walking programs during 10-week intervention. **METHODS:** 67 sedentary employees were enrolled in a 10-week walking intervention. Participants were randomly assigned to one of three groups: intermittent walking (Age = 46±9.9, BMI= 30.33±5.79 kg/m²), continuous walking (Age = 48±9.9, BMI= 30.53±16.7 kg/m²), or a no intervention control group (Age = 42±10, BMI= 27.66±5.11 kg/m²). Notably, the two walking groups were instructed to complete a program time and intensity matched. A1cNOW was used to test HbA1c from finger prick blood and accelerometer assessed physical activity. **RESULTS:** Statistically significant changes were observed in HbA1c as the overall analysis (F(1,64) = 4.229, p = 0.044) with a medium size effect of n² =0.062. Bonferroni Post-Hoc test shows that the continuous walking group was significantly affected, F=8.463, p = 0.009, with a large size effect size n² =0.297. There were no changes within the multiple break group or control group (p>0.05). Accelerometry showed a main effect of time by group interaction (F(12,4) = 0.591, p = 0.65) with a large effect size n² = 0.14. The Post-Hoc indicated that the continuous walking group took significantly longer bouts at moderate to vigorous intensity at week-6 compared to pre-test (p=0.009). There were no changes in the length of bouts in the intermittent or control groups.
IgA secretion rate, absolute IgA and relative IgA (~ mean values when URTI/ Mean values when no URTI)). The saliva was analyzed using an ELISA assay kit (Salivary Secretory IgA Enzyme Immunoassay Kit, Salimetrics, USA). After normality checkings through Shapiro-Wilk tests, Spearman rank correlations were used for the evaluation of relations between URTI, immune parameters and fatigue. RESULTS: Over the 69 weeks, 28.3 ± 1.5 URTI episodes and 99.5 ± 0.89 URTI symptoms with a mean fatigue score of 5.8 ± 0.6. During this period, 632 saliva samples were collected and analyzed. Analysis of the basic values: 120 ± 40.49 μg·ml⁻¹ for absolute IgA concentration, 119.17 ± 0.83 μg·ml⁻¹ for IgA secretion rate and 101.10 ± 0.03 % for relative IgA values. A significant correlation was found between URTI symptoms and relative IgA concentration (R=0.171, P=0.003).

CONCLUSIONS: Values for amount of URTI’s and immunological parameters of young elite gymnasts were similar to those of adult sailors (Neville et al., MSSE. 2008; 40: 1229-36), with relative IgA concentrations being associated with the development of URTI symptoms. Thus, young athletes are as prone as adult athletes to develop URTI’s. However, since these athletes exercise indoor in contrast to an outdoor sport as sailing, environment may have an impact on the prevalence of URTI’s.

**1686**

**May 31 4:45 PM - 4:45 PM**

**The Percentage Of Non-classical Monocytes In Obese Individuals Is Reduced By High-intensity Interval Training**

Fabiano T. Amorim¹, Mariana Aguiar de Matos², Bruna C. Chaves Garcia¹, Kaio C. Pinhal², Vanessa O. Fernandez², Denia V. Vargas², Flávio de Castro Magalhães², Etel Rocha-Vieira².¹University of New Mexico, Albuquerque, NM. ²Universidade Federal dos Estados do Jequitinhonha e Mucuri, Diamantina, Brazil. (Sponsor: Dr. Ann Gibson, FACSM) (No relevant relationships reported)

Obesity is associated with both metabolic and inflammatory disturbances. Exercise training represents an efficacious strategy to modulate these deleterious aspects of obesity. **PURPOSE:** To evaluate the effects of high-intensity interval training (HIIT) in monocyte subtypes distribution patterns of obese individuals. **METHODS:** Nine lean control (CON, BMI = 20.8 ± 1.7 kg·m⁻²), nine obese insulin sensitive (OBS, BMI = 35.1 ± 3.8 kg·m⁻²) and nine obese insulin resistant (OBR, BMI = 37.8 ± 4.6 kg·m⁻²) subjects were used in this study. The OBS and OBR underwent 8 weeks of HIIT, 3x/week, using a cycle ergometer, with progressive increases in intensity and volume (8 to 12 bouts of 1 min at 80 to 110% of the maximum power output separated by 1 min active recovery at 30 W). Insulin resistance was defined as homeostasis model assessment index (HOMA-IR) ≥ 2.71. Venous blood was collected after 12 h fasting, before and after HIIT for the quantification of monocyte subtypes (classics, intermediaries and non-classics) and metabolic parameters (insulin, glucose, triglycerides and cholesterol fractions). β-pancreatic cell function (HOMA-β) were also calculated. Volunteers also underwent an oral glucose tolerance test (OGTT). Body composition was evaluated using dual-energy X-ray absorptiometry (DXA).

**RESULTS:** Pre-training blood triglycerides, VLDL-cholesterol, HOMA-β and insulin concentration were higher (p<0.05) in OBR compared to OBS and CON. OBS also had higher mass of visceral adipose tissue compared to OBS and CON (1,785 ± 754, 1,153 ± 431 and 149 ± 80 g, respectively). Both OBS and OBR individuals had increased (p<0.05) percentage of non-classical monocytes (11 ± 5.5 and 12 ± 5.9%, respectively) compared to CON (4 ± 5.9%). The percentage of non-classical monocytes was positively correlated to BMI, fat percentage, HOMA-β and OGTT. After 8 weeks of HIIT, the frequency of non-classical monocytes was reduced (p<0.05) by almost 40% in OBS and OBR (12.1 ± 5.6 and 8.7 ± 3.2%, pre- and post-HIIT, respectively). Although training had no effect on BMI and body fat, HOMA-β was improved (p<0.05) after HIIT (267 ± 166 and 183 ± 109, pre- and post-HIIT, respectively). **CONCLUSION:** HIIT reduces inflammation and improve metabolic parameters in obese insulin sensitive and insulin resistant individuals. Supported by CAPES, CNPq, FAPESP.

**1687**

**May 31 4:00 PM - 4:15 PM**

**Inflammatory Cytokine Production is Elevated in MAIT Cells Following Acute Exercise**

Erik D. Hanson¹, Eli Danson¹, William S. Evans¹, William A. Wood¹, Sammy Saklad², Claudia L. Battaglini, FACSM.¹University of North Carolina, Chapel Hill, Chapel Hill, NC. ²University of Victoria, Melbourne, Australia. (Sponsor: Claudia Battaglini, FACSM) (No relevant relationships reported)

Mucosal associated invariant T (MAIT) cells occupy a unique niche within human immunity yet little is known regarding the effects of exercise on activation or cytokine production. **PURPOSE:** To determine if exercise elevates MAIT cells expression, inflammatory cytokine production and early activation markers after submaximal aerobic exercise. **METHODS:** 16 healthy young males (age 22 ±4, VO2max 51.6 (10.2 mL·kg⁻¹·min⁻¹), %fat 18.0±(5.0)% performed a graded exercise test on a cycle ergometer until volitional exhaustion. Participants cycled for 40 min at 86% of ventilatory threshold following an overnight fast. Peripheral blood mononuclear cells were isolated from blood samples obtained at rest, 0h and 1h after submaximal exercise. Following a 4h stimulation with phorbol 12-myristate 13-acetate and ionomycin, MAIT cells counts and intracellular interferon gamma (IFNγ), tumor necrosis factor alpha (TNFα) and interleukin 17 (IL-17) production were quantified using flow cytometry. Data were analyzed using one-way ANOVA and are expressed as mean (SD).

**RESULTS:** Stimulation resulted in a 1.09 ± 0.42 mL · min⁻¹, 13.2 ± 39.05 μg · ml⁻¹ for absolute IgA concentration, 119.17 ± 0.83 μg · ml⁻¹ for IgA secretion rate and 101.10 ± 0.03 % for relative IgA values. A significant correlation was found between URTI symptoms and relative IgA concentration (R=0.171, P=0.003).

**CONCLUSIONS:** Values for amount of URTI’s and immunological parameters of young elite gymnasts were similar to those of adult sailors (Neville et al., MSSE. 2008; 40: 1229-36), with relative IgA concentrations being associated with the development of URTI symptoms. Thus, young athletes are as prone as adult athletes to develop URTI’s. However, since these athletes exercise indoor in contrast to an outdoor sport as sailing, environment may have an impact on the prevalence of URTI’s.

**1688**

**May 31 4:15 PM - 4:30 PM**

**Environmental Mobilization Of Hematopoetic Stem Cells With Exercise, Compression, And Cooling**


Hematopoetic stem cells (HSC) have recently been studied to improve healing and rehabilitation from musculoskeletal injury. HSC are currently collected using invasive bone marrow aspiration and peripheral harvest after pharmacological mobilization. Animal studies show environmental stresses including heat, hypoxia, and cold mobilize HSC. HSC have also been mobilized to peripheral circulation (PC) with exercise. We hypothesized that the combination of environmental stress and exercise can mobilize HSC to PC. Mechanisms for environmental mobilization will aid in understanding healing and rehabilitation mechanisms and may provide a more convenient method to harvest HSC. **PURPOSE:** To determine if the combination of compression and cooling during exercise can mobilize HSC in PC. **METHODS:** Ten healthy, active males (height 1.78 ± 0.06 m, weight 85.1 ± 13.3 kg, age 30.4 ± 6.4 y) completed a 20-min exercise protocol on the Vasper®️ recumbent cross trainer. The protocol entailed a 5-min warm-up and 15 min of exercise alternating between 30s and 60s in duration with 90s recoveries. Compression cuffs were placed around the upper arms and thighs and inflated to 40 and 65 mmHg, respectively. Subjects sat on a cooling pad and wore a cooling vest to decrease body temperature. Blood samples were collected via forearm vein access prior to exercise and at 20 (T20), 30, 60, 90, 120, 150, 180 A and 240 post-exercise. Cells were processed with different antibodies and flow cytometry was performed on each sample. A linear mixed model analysis was used to evaluate differences in each variable. **RESULTS:** A spike in white blood cell (WBC) count was seen between baseline and T20 (Mₚ₋₅ = 1.740, SE = 0.48, p = .004). The WBC differential revealed a decrease in neutrophils (Mₚ₋₅ = 4.13, SE = 1.52, p = .015) and eosinophils (Mₚ₋₅ = 42, SE = 13, p = .009) and an increase in lymphocytes (Mₚ₋₅ = 4.51, SE = 1.62, p = .004) from baseline to T20, with no change in basophils, monocytes, or immature granulocytes. Flow cytometry indicated an increase in CD34 (+), a cell surface marker for HSC, from baseline to T20 (Mₚ₋₅ = 1.25, SE = .48, p = .028) with no change in the viability of the WBCs. **CONCLUSION:** The Vasper®️ environmentally mobilizes HSC to PC when used to a high level of exertion. Further study is required to determine if these cells can be consistently harvested from PC after mobilization.
antibody and cell-mediated immune responses in young and aged mice. Methods: C57BL/6 male mice, aged 6-8 weeks (n=19) and 27 months (n=16) were randomized into either eccentric exercise (Y-ECC), A-ECC or sedentary (Y-SED, A-SED) groups. For the Y-ECC and A-ECC groups, mice were exercised at 17m/min at -20% grade for 45 min on a treadmill. Y-SED and A-SED mice remained in their home cages. All mice were inoculated in the gastrocnemius with 100μg of OVA and 200 μg aluminum hydroxide (a suboptimal dosage based on titration experiments) immediately after the exercise. Blood was collected prior to, and one, two and four weeks after vaccination. ELISA was performed to analyze anti-OVA IgG. At three weeks post exercise, all mice were injected with 100μg OVA into the dorsal side of the right pinna to determine the delayed-type hypersensitivity (DTH) response. Left pinnae were treated as controls. Ear thickness was measured immediately before and every 24h after intradermal injection. Results: Acute eccentric exercise did not improve primary antibody responses in either young (p=0.06) or aged (p=0.76) mice, compared to their sedentary control groups. We did not find significant differences between Y-ECC and Y-SED in their DTH responses (p=0.25). However, acute eccentric exercise enhanced DTH responses in aged mice, especially at 1 day post intradermal injection (p=0.001). We also documented a significant immunosenescence effect in antibody (p=0.001), but not cell-mediated (p=0.813), immune responses to vaccination. Conclusion: Our results suggest that acute eccentric exercise improved the cell-mediated immune response to OVA vaccination in aged, but not in young mice and failed to affect the anti-OVA antibody response in young or aged mice.

D-42 Free Communication/Slide - Obesity Patterns and Interventions Thursday, May 31, 2018, 3:15 PM - 5:15 PM Room: CC-Mezzanine M100D

1690 Chair: Kathleen Woolf, FACSM, New York University, New York, NY. (No relevant relationships reported)

1691 May 31 3:15 PM - 3:30 PM Association Between Body Composition and Physical Activity Behaviors Pedro J. Benito1, Eliane A. Castro2, Daniel Dos Santos2, Rocio Cupeto1, Ana B. Peinado1. 1Universidad Politécnica de Madrid, Madrid, Spain. 2Universidade de Franca, São Paulo, Brazil. (No relevant relationships reported)

Evidence has shown that replacing sedentary time with equivalent amounts of light-intensity physical activity (LIPA) or moderate-to-vigorous intensity physical activity (MVPA) yielded associated health benefits on body composition. Therefore, because time is finite, to know these associations is relevant for physical activity promotion strategies. PURPOSE: To analyze the effect of the sedentary and active times proportions on body composition in overweight and obese subjects. METHODS: Ninety-six (46 males and 50 females) overweight and obese participants (body mass index 25-34.9 kg/m²), aged 18-50 years, participated in this study. Body composition was assessed by DXA and physical activity was measured by accelerometry. Pearson correlations were performed to evaluate the relationships between independent variables (sedentary time, LIPA, MVPA) and the dependent variables (android fat mass, android fat mass (%) and lean body mass (%)). RESULTS: Significant correlations were found between sedentary time and fat mass (r = 0.36; p < 0.001), android fat mass (r = 0.23; p = 0.03) and lean body mass (r = 0.36; p < 0.001). In the same way, a correlation between MVPA and the percentage of fat mass (r = -0.39; p < 0.001), android fat mass (r = -0.21; p = 0.04 and lean body mass (r = -0.39; p < 0.001). CONCLUSIONS: Our results highlight the importance of reducing sedentary time and promoting MVPA, which may improve body composition in overweight and obese people. LIPA seems to have less impact in the body tissues distribution. Supported by Spanish Government Grant DEP2008-06354-C04-01.

1692 May 31 3:30 PM - 3:45 PM Change in Energy Intake and Health Eating Index in Response to Exercise During Weight Maintenance Lauren T. Ptomey, Anna M. Gorczycza, Amanda N. Szabo, Felicia S. Steger, Ron Krebbl, Matthew S. Mayo, Debra K. Sullivan, Richard A. Washburn, FACSM, Joseph E. Donnelly, FACSM. University of Kansas Medical Center, Kansas City, KS. (No relevant relationships reported)

PURPOSE: It is hypothesized that energy intake increases and diet quality improves in response to increased exercise energy expenditure, thus diminishing the impact of exercise for weight loss and maintenance. The purpose of this analysis was to examine the impact of 3 levels of recommended exercise on energy intake and diet quality during weight maintenance. METHODS: Overweight/obese adults (n=175 age= 43 yrs., BMI=32 kg/m²) who lost ≥ 5% of their initial body weight in response to a 3-mo. weight loss intervention which included energy restriction, increased exercise (100 min•wk⁻¹) and weekly behavioral counseling, completed a 12 mo. weight maintenance intervention. All participants were prescribed a weight maintenance diet (estimated RMR x 1.4), asked to attend biweekly behavioral sessions, and were randomized to one of 3 levels of exercise (150, 225, 300 min•wk⁻¹), with a minimum of 3 exercise sessions•wk⁻¹ completed under supervision. Exercise minutes across 12 mos. were obtained from direct observation or heart rate monitors for supervised and unsupervised sessions, respectively. Energy intake (3-day food records) was assessed at randomization (mo. 0), 6 and 12 mos. Energy intake and diet quality (Healthy Eating Index-2010 (HEI)) were calculated using the Nutrition Data System for Research 2014. RESULTS: Energy intake at mo. 0 was 1337 ± 309, 1284 ± 25, and 1344 ± 317 kcal•day⁻¹, and total HEI scores were 59.0, 57.9, and 60.8 in the 150, 225, and 300 min•wk⁻¹ groups, respectively. Average exercise across 12 mos. was 120, 147, and 170 min•wk⁻¹ in the 150, 225, and 300 min•wk⁻¹ groups, respectively. As expected with a weight maintenance diet, energy intake kcal•day⁻¹ increased from 0-12 mos. in the 150 (319 ± 523), 225 (164 ± 441), and 300 min•wk⁻¹ groups (266 ± 454). However, the between group difference for change in energy intake (0-12 mos.) was not significant (p=0.18). There was no significant difference for change in HEI (0-12 mos.) between the 150 (-0.93), 225 (+2.38), and 300 min•wk⁻¹ groups (-2.60, p=0.29). Exercise min•wk⁻¹ was not associated with energy intake (r=0.03, p=0.94) or HEI (r=0.11, p=0.15). CONCLUSION: There was no impact of the volume of exercise (min•wk⁻¹) on energy intake or HEI in initially overweight/obese adults completing a weight maintenance intervention.

1693 May 31 3:45 PM - 4:00 PM Vo2max Is Associated With Energy Expenditure Measures, Including Diet Induced Thermogenesis, Under Sedentary Conditions Takafumi Ando, Paolo Piaggi, Jonathan Krakoff. National Institute of Diabetes and Digestive and Kidney Diseases, Phoenix, AZ. (No relevant relationships reported)

Low cardioregulatory fitness predicts subsequent weight gain independently of physical activity. However, the physiological mechanisms underlying this relationship have not been fully explained. One hypothesis is that VO2max is related to measures of energy expenditure, in particular diet induced thermogenesis. Results from previous studies exploring these associations have been mixed. However, these studies may have been limited by methodological issues regarding the adjustment for energy expenditure (EE) by confounding factors and small sample size. PURPOSE: To determine the association between VO2max and measures of 24-h thermogenesis under predominantly sedentary conditions and in particular wake fed thermogenesis (AFT) a measure of diet induced thermogenesis. METHODS: Two hundred twenty-nine American Indians from the southwest (132 men, 97 women) who lost ≥ 5% of their initial body weight in response to exercise (100 min•wk⁻¹) and including additional adjustment for energy intake higher AFT (beta = 65.8, n = 181) and 24-h EE (beta = 62.1, standardized beta = 0.125, p = 0.028, n = 229) and including additional adjustment for energy intake higher AFT (beta = 65.8, standardized beta = 0.334, p = 0.012, n = 197). Neither SRM (p = 0.64) nor SPA (p = 0.80) were associated with VO2max. CONCLUSION: VO2max was associated with RMR, AFT, and 24-h EE. In particular, a common mechanism regulating both processes and that the protective effect of higher VO2max on weight change reflect its association with measure of 24-h thermogenesis.
Greater left ventricular mass (LVM) has been associated with incidence of cardiovascular events in cohort studies. LVM has been shown to be associated with larger body mass index (BMI), which may partially explain the association between obesity and cardiovascular disease (CVD). However, despite the importance of cardiorespiratory fitness (CRF) to lower CVD, few studies have examined how CRF contributes to LVM within the context of weight loss. PURPOSE: To examine the change in weight, cardiorespiratory fitness, and LVM in response to a behavioral weight loss intervention, and to examine the association between change in body weight, CRF and LVM in relation to a behavioral weight loss intervention.

METHODS: Data were examined from sedentary adults (N=290): BMI: 32.2±3.8 kg/m² that engaged in a 12-month behavioral weight loss program. All participants received weekly in-person intervention sessions for months 1-6, with combined in-person and telephonic sessions for months 7-12. Participants were prescribed weight loss through diet or diet + physical activity. Diet was prescribed at 1200-1800 kcal/day and physical activity was progressively increased to 150-250 min/wk. Assessment of body weight, CRF expressed as time to termination from a graded exercise test (GXT) and oxygen uptake, along with LVM using cardiac magnetic resonance imaging were assessed at both baseline and 12 months.

RESULTS: There was a significant change in body weight (90.4±13.9 to 80.2±13.5 kg; p<0.001), CRF (22.6±4.5 to 25.6±5.1 ml/kg/min; p<0.001), GXT termination time (7.8±13.0 to 9.7±3.5 min; p<0.001) and LVM (88.5±21.3 to 84.1±20.0; p<0.001). Weight loss was correlated with reduced LVM (r=0.263; p<0.001), but the reduced LVM was not correlated with the increase in CRF (r=0.07; p<0.10) or increase in GXT termination time (r=-0.04; p<0.35).

CONCLUSIONS: LVM may be associated with poor cardiovascular health outcomes. It appears that weight loss reduces LVM, suggesting that a lifestyle intervention for inducing weight loss may be effective in reducing cardiovascular disease risk.

1695 May 31 4:15 PM - 4:30 PM

Attenuation of Excessive Weight Gain One Year Post Pediatric Obesity Treatment Initiation

Kate A. Heelan, FACSM, Holly Bower, Bryce M. Abbey, Roderick T. Bartec. University of Nebraska - Kearney, Kearney, NE.

(No relevant relationships reported)

In the United States, the prevalence of obesity among 6 to 11 year-old children is 18.4% (Hales et al., 2017). Over the past 30 years, family-based pediatric obesity treatment programs have been implemented demonstrating both short-term and long-term results (Epstein et al., 1998). Building Healthy Families (BHF) was adapted from Epstein’s efficacious family-based weight control treatment program and implemented for 6-12 year-olds in a rural mid-western community. Fifty-eight families including 69 obese children (BMI percentile 96.5±3.9%) participated in BHF; a 12-week nutrition, physical activity and lifestyle modification program. Child health outcomes included a clinically and statistically significant reduction in child BMI z-score (-0.27 ± 0.22) at 12-weeks. PURPOSE: To determine long-term weight loss success by assessing body mass and stature one year post BHF initiation and compare to a match control group that participated in yearly health screenings at school.

METHODS: BHF participants (n=69; age: 9.30 ± 1.84 years) and 70 match control groups (n=69; age: 9.30 ± 1.84 years) were assessed at both baseline and 12 months. RESULTS: At one year, BHF participants gained 5.7±2.46 cm and gained 3.48 ± 0.89 kg resulting in a BMI z-score change of -0.22 ± 0.40. In comparison, the BHF participants demonstrated an attenuation in excessive weight gain. A BMI z-score change of -0.22 ± 0.40 in one year presents clinically significant changes that may enhance health. Family based intensive treatment programs are time consuming, expensive, and require family commitment; but appear to have long-term positive influence on growth and maturation among participants.

1696 May 31 4:30 PM - 4:45 PM

Association Between Family Health Behaviors and Obesity Severity: Does Weight Metric Matter?

Karissa L. Peyer¹, Joani Jack², Gregory W. Heath, FACSM³. ¹University of Tennessee at Chattanooga, Chattanooga, TN. ²University of Tennessee College of Medicine Chattanooga and Children's Hospital at Erlanger, Chattanooga, TN.

(No relevant relationships reported)

PURPOSE: Family behaviors regarding physical activity (PA), nutrition and screen time are associated with increased risk for obesity. With increased levels of severe obesity in American youth, the association of these factors with extremely high weight status should be evaluated. The purpose of this study was to examine potential differences in screen, nutrition, and PA activity behaviors among children attending a youth obesity clinic.

METHODS: Subjects included 484 youth (mean age = 11.5) attending their first visit at a Childhood Healthy Eating and Active Living clinic. Height, weight, and age assessed and used to calculate sex- and age-reference Body Mass Index Percentile (BMI%) as well as percent over the 50th (BMI50) and 95th (BMI95) percentiles. Parents completed a behavioral survey including questions about a number of health behaviors including whether their child consumed second helpings (rarely, sometimes, or always), had a TV in the Bedroom (yes/no), or ate with the TV on (yes/no). Parents also reported typical screen (≤ 2 hours, 2-4 hours, 5+ hours) and PA (< 30 minutes, 30- 60 minutes, ≥ 1 hour) behaviors. Analysis of Variance and T-tests were used to examine differences in BMI variables based on reported behaviors. All analyses were performed using SAS Enterprise Guide 7.1 with alpha set at 0.05.

RESULTS: Average BMI% was over 99 while BMI50 and BMI95 median splits were 185% and 137%, respectively. BMI50 and BMI95, but not BMI% were significantly higher in children obtaining ≥ 1 hour of PA compared to those obtaining < 30 minutes per day (p < 0.04). BMI50 and BMI95, but not BMI%, were significantly higher for children who had a TV in the bedroom than for those who did not (p = 0.001 and 0.002). Only BMI50 was significantly lower among Screen Time categories (p = 0.0104). All BMI variables were significantly higher for children who ate with the TV on compared to those who did not (p < 0.001) and for children who always asked for second helpings compared to those who rarely did (p < 0.05).

CONCLUSIONS: Among obese children/youth, commonly targeted health behaviors resulted in differences in weight status, although the extent of these relationships depends on the weight metric being used. Further analysis should examine the influence of interventions to alter these behaviors and the change captured by such weight metrics.
Histology: These data were collected from 214 students enrolled in the fourth grade of four schools. The intervention included programs focused on improving nutritional intake and increasing physical activity. Two schools received a high amount of programming (HP) (>40 programs/year), while two schools received a low amount of programming (LP) (<20 programs/year). Height, body weight and waist circumference were measured at baseline and post-intervention.

RESULTS: At baseline, BMI (± standard deviation [SD]) in HP and LP schools were 18.9 ± 4.7 kg/m² and 19.4 ± 3.6 kg/m² (p=0.319), respectively. Post-intervention BMI for HP and LP schools were 19.3 ± 4.4 kg/m² and 19.4 ± 3.5 kg/m² (p=0.775), respectively. Waist circumference (± SD) at baseline in HP and LP schools were 63.3 ± 4.7 cm and 67.5 ± 10.2 cm (p=0.002), respectively. Post-intervention waist circumference were 64.4 ± 9.8 cm and 66.8 ± 10.0 cm (p=0.081) for the HP and LP schools, respectively.

CONCLUSIONS: The high and low program schools both exhibited increases in BMI after program implementation; though, there were no significant differences between the groups over time. However, BMI alone is not the most effective assessment of adiposity in children; utilizing waist circumference may provide additional information. At baseline, the HP schools had a significantly lower waist circumference compared to the LP schools. Although there was a slight increase in waist circumference in the HP schools and a slight decrease in the LP schools at post-intervention, these were not significantly different. Though the difference in programming did not significantly influence BMI or waist circumference, assessing the changes in anthropometric measures throughout the larger, multi-year intervention may reveal more meaningful impact on the change in adiposity in children. This study was funded by Independence Blue Cross Foundation.
HISTORY: A 16-year-old female with hypermobility experienced a whiplash injury on a flight due to sudden turbulence and immediately developed headache and nausea. She subsequently suffered from persistent headaches, dizziness, motion sickness, nausea, and fatigue for weeks following the incident. A full laboratory workup was within normal limits. The family worried her symptoms were due to a concussion and cervical strain. When evaluated 13 days after the initial injury, symptoms included intermittent headache, pressure in her head, earache and occasional dizziness. She reported good sleep, but still felt tired. He denied cognitive or emotional symptoms. Neck pain and swelling was the most concerning symptom. He endorsed odyphagia but had no difficulty breathing. He denied radicular or neurologic symptoms. He denied fevers. He had one prior concussion 5 months ago. Symptoms included memory problems, difficulty concentrating, and headache. Recovery time was two weeks. PHYSICAL EXAMINATION: Well appearing. Pupils equal and reactive to light. No nystagmus. Normal accommodation. Negative VOMS Cervical spine: Cervical spine ROM normal, painful with side bending and rotation. Paraspinals and sternocleidomastoids are tender to palpation, right worse than the left. Bilateral posterior chain lymphadenopathy noted. Spurling’s negative. Upper extremity strength and sensation are intact. Abdomen: No hepatosplenomegaly. DIFFERENTIAL DIAGNOSIS: Concussion, cervical strain, cervical spine fracture, infection, hematologic malignancy TESTS AND RESULTS: Ultrasound right sternocleidomastoid: No evidence of hematoma or disorganized muscle architecture. There was a large lymph node just posterior to the muscle measuring 2.5 cm in diameter with a mixed echogenic appearance. Labs: WBC 9.7, Hemoglobin 13.7, Hematocrit 40, Platelets 130, Basic Metabolic Panel normal, ALT 148, AST 87, Alkaline Phosphatase 131, albumin 4.0, Bilirubin 0.5, ESR 5, EBV IgM Positive, EBV IgG Positive, FINAL WORKING DIAGNOSIS Infectious Mononucleosis TREATMENT AND OUTCOMES: Patient was held from sports participation for two additional weeks. Symptoms improved over that time period. He was seen by his pediatrician and was cleared to return to contact sports and increase activity level as tolerated.

HISTORY: A 16-year old female soccer player twisted his neck awkwardly while heading a ball. He continued to play despite neck soreness. Six days later he headed the ball several more times during a game and developed worsening pain and swelling. The next morning, he had a headache, dizziness and photophobia. He felt very tired, sleeping more than usual. He was seen by his pediatrician and referred to sports medicine with concern for concussion and cervical strain. When evaluated 13 days after the initial injury, symptoms included intermittent headache, pressure in his head, earache and occasional dizziness. He reported good sleep, but still felt tired. He denied cognitive or emotional symptoms. Neck pain and swelling was the most concerning symptom. He endorsed odyphagia but had no difficulty breathing. He denied radicular or neurologic symptoms. He denied fevers. He had one prior concussion 5 months ago. Symptoms included memory problems, difficulty concentrating, and headache. Recovery time was two weeks. PHYSICAL EXAMINATION: Well appearing. Pupils equal and reactive to light. No nystagmus. Normal accommodation. Negative VOMS Cervical spine: Cervical spine ROM normal, painful with side bending and rotation. Paraspinals and sternocleidomastoids are tender to palpation, right worse than the left. Bilateral posterior chain lymphadenopathy noted. Spurling’s negative. Upper extremity strength and sensation are intact. Abdomen: No hepatosplenomegaly. DIFFERENTIAL DIAGNOSIS: Concussion, cervical strain, cervical spine fracture, infection, hematologic malignancy TESTS AND RESULTS: Ultrasound right sternocleidomastoid: No evidence of hematoma or disorganized muscle architecture. There was a large lymph node just posterior to the muscle measuring 2.5 cm in diameter with a mixed echogenic appearance. Labs: WBC 9.7, Hemoglobin 13.7, Hematocrit 40, Platelets 130, Basic Metabolic Panel normal, ALT 148, AST 87, Alkaline Phosphatase 131, albumin 4.0, Bilirubin 0.5, ESR 5, EBV IgM Positive, EBV IgG Positive, FINAL WORKING DIAGNOSIS Infectious Mononucleosis TREATMENT AND OUTCOMES: Patient was held from sports participation for two additional weeks. Symptoms improved over that time period. He was seen by his pediatrician and was cleared to return to contact sports and increase activity level as tolerated.


TREATMENT AND OUTCOMES: - Surgical correction of strabismus. - Surgical correction of strabismus. - Surgical correction of strabismus. - Surgical correction of strabismus. - Surgical correction of strabismus.

c. Symptoms and performance on clinical examination improved.
d. No esotropia was present during NPC assessment.
e. Assessment for monocular accommodation of the right eye was successful.

HISTORY: 10-year-old female with persistent emotional dysregulation and learning disorder after sustaining a mild head injury in a motor vehicle accident at age 5. She was evaluated in the ED but had no head imaging at the time. In the immediate aftermath of the injury, she developed headache, neck and shoulder pain, and generalized fatigue. These symptoms gradually resolved within several months. However, she also developed depression, irritability, and aggressive behaviors, all of which began within weeks of the accident and represented a drastic change of personality. She developed a regression in counting and language skills, and began struggling with inverting numbers and letters. She exhibited impairments in language processing, working memory, and concentration. In addition to sustained emotional dysregulation and excessive irritability, learning and memory difficulties have persisted for more than four years. PHYSICAL EXAM: 10-year-old girl with mildly restricted affect. Cooperative but with latency of speech. The remainder of the physical and neurological exam, including cranial nerves, gait, coordination, strength, reflexes, and sensation was within normal limits. DIFFERENTIAL DIAGNOSIS: 1. Post-concussive syndrome 2. Post-traumatic stress disorder 3. Specific learning disorder in reading; dyslexia 4. Attention deficit hyperactivity disorder; inattentive type TESTS AND RESULTS: 1. MRI Brain obtained at age 6 - normal for age. 2. Neuropsychological Evaluation - consistent with severe dyslexia as well as ADHD, inattentive type, notable understood as secondary to her learning disability and exacerbated by emotional factors. FINAL WORKING DIAGNOSIS: 1. Traumatic brain injury 2. ADHD, Inattentive Type 3. Dyslexia 4. Dysgraphia (voicing substitution dysgraphia) TREATMENT AND OUTCOMES: 1. IEP implemented with minimal improvement academically. 2. Stimulant trial resulted in mild improvement in attention difficulties, but was discontinued after 5 months due to intolerable side effects. 3. Currently treated with alpha-agonist with moderate improvement in irritability and aggressive behaviors. 4. Patient continues with significant learning disorder including severe dyslexia and dysgraphia, as well as sustained impairments in working memory.
1711 May 31 3:35 PM - 3:55 PM
Anterior Thigh Pain - Shot put/Discus
Casey Muir, Edward Laskowski, FACSM. Mayo Clinic, Rochester, MN.
(No relevant relationships reported)

History: A 17-year-old male who was a first year participant in shot put and discus events presented with gradual onset aching left hip pain for 3 weeks. He denied any precipitating trauma or injury prior to symptom onset. His pain localized primarily to the left proximal anterior thigh. Hip flexion and abduction aggravated the pain. He tried intermittent ice without improvement. He denied radicular pain, weakness, sensory, or mechanical hip symptoms. After 1 physical therapy session, the pain remained at 10/10 intensity, constant throbbing, sharp pain in the proximal anterior thigh. Physical Examination: Antalgic gait with shortened stance phase on the left.

Focal tenderness to palpation at the AIIS, and proximal hip flexor tendons. Range of motion was full and symmetric. Pain was elicited at the extremes of left hip flexion, internal rotation, and external rotation. No weakness with manual muscle testing, but he had pain with resisted hip flexion. Stinchfield elicited hip flexor and AHS pain. FABER and FADIR aggravated left anterior hip pain.


1. Proximal Left Hip Flexor Muscle Strain 2. Traction Apophysitis 3. Labral Tear or other 4. Myositis Ossificans


TEST AND RESULTS: Femur radiographs were negative but contrast MRI of the 5. distal thigh revealed a T2 hyperintensely lobulated mass deep to the vastus lateralis and quadriceps tendon, separate from the suprapatellar recess. CT guided biopsy showed benign fibrovascular tissue consistent with an arteriovenous malformation (AVM).

Final Working Diagnosis: Slow flow arteriovenous malformation. Treatment and Outcomes: The patient underwent percutaneous sclerotherapy with 2cc of absolute alcohol. He reported complete resolution of pain within 1-2 weeks and returned to all previous competitive activity.

1712 May 31 4:15 PM - 4:35 PM
Atypical Leg Pain in a Chi Runner
Jennifer Oberstar. University of Minnesota, Minneapolis, MN.
(Sponsor: Steven Stovitz, FACSM)
(No relevant relationships reported)

General Medicine- Chi Running

History: A 67-year-old white male, using Chi running to treat bilateral calf pain presented with worsening pains over the past month. He exercises for 30 minutes, 3 times/week, and has sharp cramping pain in both calves exacerbated by running. After increasing the intensity of runs, his right leg goes to sleep. Gait modifications have helped reduce pain slightly. The patient’s history included the following: shin splints and chondromalcacia patella since age 30, non-smoker, non-diabetic, no cardiac history, and treatment for hypertension and hyperlipidemia. Family history included coronary artery disease. The patient was sent to Interventional Radiology (IR) for an ankle-brachial index (ABI) and was started on aspirin. No mechanical or structural cause of pain was identified, but moderate peripheral arterial disease (PAD) was discovered in the right leg. CT angiogram of the pelvis and lower extremities was recommended.

Results of the CTA lead to the patient’s direct admission.

Physical Examination:

BMI: 34.91, CONSTITUTIONAL: Healthy, HEENT: normocephalic, LUNGS: clear, CV: RRR, no bruits, GI: soft, NT/ND, SKIN: No rashes, NEURO: intact sensory and motor function of the lower extremities, VASCULAR: No bruits

1. Claudication
2. Abnormal gait
3. PAD

TEST AND RESULTS: Ultrasound ABI Doppler with Exercise-

Right: Resting ABI of 0.84, Positive exercise study Left: Resting ABI of 1.29, Negative exercise study

CT angiogram of the pelvis and bilateral lower extremity-Abdominal aorta Large fusiform infrarenal AAA 8.6 x 7.5 cm. Dilated right and left common iliac arteries 2.4 and 2.8 cm. Focal fusiform aneurysmal dilatation of the mid to distal main trunk of the left internal iliac artery 3.2 cm. Right leg elongated thrombus within the right popliteal artery appearing to attach to the arterial wall proximally resulting in high-grade stenosis

Final Working Diagnosis:

1. Large fusiform infrarenal AAA
2. Left internal and bilateral common iliac aneurysms
3. Popliteal artery embolism

TREATMENT AND OUTCOMES:

1. Evaluation: IR, Vascular surgery, and Cardiology
2. AAA repair: left internal and bilateral common iliac aneurysms and right popliteal embolectomy
3. Walking 3-4 miles with mild pressure but no pain in his calves at 5 weeks postoperatively

HISTORY: 17-year-old male athlete presenting with insidious onset of isolated, painless, unilateral quadriceps weakness and wasting. Physical Examination: Significant unilateral quadriceps atrophy with relative rectus femoris sparing.

Strength was mildly reduced on the affected side, but much less than would be expected given his level of atrophy. There were no other sensory or focal neurologic deficits on examination. Differential Diagnosis: Monomelic Amyotrophy, Amyotrophic Lateral Sclerosis, Cord compression, Nerve root/plexopathy Tests and Results: Nerve conduction studies, EMG, and MRI findings consistent with final diagnosis.

Final Working Diagnosis: Monomelic Amyotrophy (quite rare)

TREATMENT AND OUTCOMES: Observation and long-term follow up, conservative management with physiotherapy. Typically clinical deficit remains stable and isolated, but follow-up is required to ensure it is not a different diagnosis. In this clinical case presentation, we review the natural history, epidemiology, diagnosis, differential considerations, prognosis and management of this rare entity.
HISTORY: A 76-year-old male, with known Parkinson’s disease since 15 years ago, presented due to left posterior thigh pain that started a week prior. He was running and felt a “tug,” sharp pain and weakness. At rest it was a pulling sensation, 5/10 in intensity. Running and prolonged sitting made it worse. He denies any back pain, numbness or tingling. He had been trying to walk/run about 2 miles a day, and strength training. He had a very similar pain on the right side a year ago and with a hamstring strain, given a methylprednisolone dose pack, and physical therapy focusing on his hamstrings. He was able to run pain-free until this injury. He was very distressed that he was unable to run as he believed exercise has been essential in managing his Parkinson’s.

PHYSICAL EXAMINATION: No leg swelling or ecchymosis. Normal hip and knee range of motion. Normal strength. Pain with resisted hamstrings testing. Right-favoring antalgic gait, but takes small steps. Tenderness to palpation of left proximal hamstring. Straight leg test caused mild pain in left hamstring.

DIFFERENTIAL DIAGNOSIS: Hamstring strain Piriformis syndrome Lumbar radiculopathy

TEST AND RESULTS: X-ray of left thigh: Mild pelvic enthesopathy at hamstrings’ tendinous origins along bilateral ischial tuberosities Hips and knees with mild degenerative changes.

FINAL WORKING DIAGNOSIS: Recurrent proximal hamstring strains, in a Parkinson’s disease sufferer intent on running recreationally.

TREATMENT AND OUTCOMES: The challenge is that the patient insists on running, but gait changes caused by Parkinson’s make it difficult.

Physical Therapy initiated special program starting with light stretching and submaximal strengthening, progressing to increased resistance training. Refrained from running initially; after weeks of therapy, was able to walk/run again. Patient made to understand gait effects of Parkinson’s; continues therapy, wants to run in spite of condition.
1720 May 31 3:35 PM - 3:55 PM
**Primum Non Nocere - A Case Of Medication Overuse**

Sahil Shah, Shaun Knox, Andrew Martin. Campbell University School of Osteopathic Medicine, Lillington, NC.

(No relevant relationships reported)

**HISTORY:** 19 year old female college track athlete (100, 200 sprints) with past medical history significant for familial hypercholesterolemia acutely developed right posterior thigh pain during practice, 8 months prior to initial presentation to the clinic. Medications included oral contraceptive pills and simvastatin. She was seen at a different physician office and was diagnosed with a hamstring strain via MRI. Treatment course outlined at that time included rest, acupuncture. This was not completed and she presented to the sports medicine clinic for evaluation and continued treatment due to persistent pain.

**PHYSICAL EXAMINATION:** Stable vital signs and general physical examination, including no rash in the affected area. Musculoskeletal exam revealed full AROM, strength 5/5 and pain at the myostatic junction of the right biceps femoris.


**TEST AND RESULTS:** Vitamin D level - 34.4 Lipid panel (on simvastatin): Total - 206, TG - 110, HDL - 42, VLDL - 22, LDL - 142 Lipid panel (off simvastatin): Total - 215, TG - 93, HDL - 46, VLDL - 19, LDL - 150

**FINAL WORKING DIAGNOSIS:** Right biceps femoris strain

**TREATMENT AND OUTCOMES:**
1. She was taken off her statin medication as this may have been contributing to muscular pain, and was not likely providing benefit for preventing cardiovascular disease at this point. 2. Percutaneous/transcutaneous electric nerve stimulation to the local area. 3. Range of motion exercises, eccentric strengthening of the affected area. 4. Modified practice until able to perform event pain free, then return to full activity.

1721 May 31 4:35 PM - 4:55 PM
**Preparticipation Physical Exam: More Than a Hernia Check.**

Joshua Priddle DO1, Michael Goodlett MD2, Siraj Abdullah DO1, Joseph Edison DO1. 1VCOM-Auburn, Auburn, AL. 2Auburn University, Auburn, AL.

(No relevant relationships reported)

**HISTORY:** A 17 year old male NCAA Div 1 football player presents for his intake physical exam with the complaint of right medial knee pain. He had a recent history of a right MCL sprain two weeks prior. He has a significant past medical history of a 17 year old female college track athlete present for abdominal pain. She was discharged and kept on 50% weight bearing with no ROM restrictions.

**PHYSICAL EXAMINATION:**
- Stable vital signs and neurovascularly intact.
- Medial joint line, and over his MCL. He had no obvious effusions. His right knee was stable to varus stress. He had a stable anterior and posterior drawer and he was neurovascularly intact.

**DIFFERENTIAL DIAGNOSIS:** 1. MCL Sprain, 2. Tibial Bone Bruise, 3. Tibial Fracture, 4. Medial Meniscal Injury.

**TEST AND RESULTS:** X-ray obtained for evaluation of his right knee pain demonstrated a multiloculated cystic bone lesion with sclerotic and thin margins abutting the articular surface of the proximal medial tibia. MRI confirmed a 3.7 X 3.6 X 6.9 cm multiloculated mass in the medial metaphysis of the right tibia extending to the subchondral surface. There was no enhancement of the ACL, PCL, MCL, or LCL.

**SECONDARY DIFFERENTIAL DIAGNOSIS:** 1. Giant Cell Tumor, 2. Aneurysmal Bone Cyst, 3. Chondromyxoidroma, 4. Osteosarcoma

Orthopedic oncology performed an open bone biopsy of the lesion and the patient was subsequently diagnosed with a simple bone cyst.

**FINAL WORKING DIAGNOSIS:** Simple Bone Cyst

**TREATMENT AND OUTCOMES:** Curettage and bone grafting were performed. The patient was discharged and kept on 50% weight bearing with no ROM restrictions with progression off crutches for 6 weeks. At his 6 week post op appointment the patient was observed to be walking and using crutches. He was ambulating without assistance. X-rays obtained at that time showed improvement and new bone growth. At his 3 month follow up he was pain free. X-rays showed bone growth and no interval growth of the lesion. At that time he was cleared for full practice and sport participation.
**D-56 Free Communication/Poster - Fitness Assessment**

**Thursday, May 31, 2018, 1:00 PM - 6:00 PM**

**Room: CC-Hall B**

**1740 Board #1 May 31 2:00 PM - 3:30 PM**

**The Association of Asymmetry in Hopping Tests and Non-contact Injuries in Division I Female Student-athletes**

Meghan Warren\textsuperscript{1}, Monica Lininger\textsuperscript{1}, Craig A. Smith\textsuperscript{2}, Adam Copp\textsuperscript{3}, Nicole J. Chimera\textsuperscript{3}, Northern Arizona University, Flagstaff, AZ; \textsuperscript{2}Smith Performance Center, Tucson, AZ; \textsuperscript{3}Daemen College, Amherst, NY.

(No relevant relationships reported)

**PURPOSE:** Limb differences in hopping for distance tests (single, triple, and crossover) are commonly used for return to play readiness after anterior cruciate ligament (ACL) injury. Females athletes are at high risk of ACL injury and risk factor identification and early prevention is critical. No study has been conducted to assess the ability of these three tests to identify high-risk athletes. To determine the association between asymmetry in hopping tests and non-contact and overuse injuries in Division I female basketball, soccer, and volleyball student-athletes.

**METHODS:** 65 female student-athletes (SA; 19.1 ± 1 y, 171.3±8.7 cm, 68.4± 2.5 kg), recruited over 3 years, injury-free at the time of testing (prior to their respective seasons) were included in the study. Clinical tests were randomized for each SA, and included isometric hip abduction, external rotation, and extension using a handheld dynamometer, as well as hopping and jumping tests. The first non-contact injury that caused the SA to report to the athletic training room was abstracted from the medical record. Contact injuries were excluded. Strength was adjusted for body weight and categorized into tertiles. Logistic regression determined the odds of non-contact or overuse injury with each clinical test. History of previous injury was assessed for confounding.

**RESULTS:** 54 SA were injured during their sport season. No statistically significant association was found between injury and hip abduction (weakest vs. strongest odds ratio: 1.95 (95% confidence interval 0.31-7.50), middle tertile vs. strongest: 0.70 (0.18-3.82), external rotation (weakest vs. strongest odds ratio: 3.87 (95% confidence interval 0.67-22.36), middle tertile vs. strongest: 0.95 (0.24-3.71)), or extension (weakest vs. strongest: 1.15 (0.25-5.23), middle tertile vs. strongest OR = 0.80 (0.18 - 3.62)). **CONCLUSIONS:** None of the strength tests associated with non-contact and overuse injury in this group of Division I female SA. Type II error cannot be ruled out for the findings.

**1742 Board #3 May 31 2:00 PM - 3:30 PM**

**Wearable Contour Sensors to Assess Neuromuscular Control During Repeated Unilateral Partial Squat Task**

Shannon E. Linderman\textsuperscript{1}, Donna Moxley Scarborough\textsuperscript{2}, Eric M. Berksom\textsuperscript{3}, Mary M. Eckert\textsuperscript{1}, Nan-Wei Gong\textsuperscript{1}, Massachusetts General Hospital, Boston, MA; \textsuperscript{2}MGH Institute of Health Professions, Charlestown, MA; \textsuperscript{3}Figur8 Inc, Boston, MA.

**Reported Relationships:** S.E. Linderman: Salary; figur8, Inc.

**PURPOSE:** Improved quantification of muscle balance and symmetry, key facets of neuromuscular control, could aid sports medicine clinicians’ assessment of injury risk and readiness to return-to-sport. This proof-of-concept study evaluates a body contouring sensor network for assessment of neuromuscular control via intra-subject test-retest and intra-limb symmetry testing of peak quadriceps (Quads) and hamstring (HS) muscle contraction during a repeated unilateral partial squat (RUPS) task.

**METHODS:** Wireless contour stretch sensors were placed bilaterally across the Quads and HS muscle bulks of 5 healthy females (23 ± 4.3 years) who exercise regularly (4.6 ± 0.96 times/week). Subjects performed 3 trials of the RUPS activity. Total Quads and HS muscle bulk displacements were collected for 3 squat repetitions during the 3rd RUPS trial. Four subjects performed same day re-testing sessions. Statistical analyses included ICC 2-way mixed effects consistency model evaluation of intra-subject test-retest reliability (n= 4) and paired t-test analysis of limb symmetry (n= 5). **RESULTS:** Both measurements of Quads and HS total muscle displacement displayed excellent correlation during test-retest reliability, ICC = 0.91 (0.18-0.99) and ICC = 0.97 (0.58-0.99). Quad and HS muscle contraction displacement differed significantly between dominant and non-dominant limbs, p = 0.026 and p = 0.041, respectively (Table 1). A significantly greater Quad/HS total displacement ratio was observed for the dominant limb, p = 0.014. **CONCLUSIONS:** The wearable contour-sensor demonstrated consistent Quad and HS peak muscle displacement detection during the RUPS task. We observed differences in muscle ratios and peak muscle displacement between limbs among a small sample of healthy females. These findings demonstrate proof of concept for further investigation of this on-body contour sensor system for assessment of neuromuscular control.
Knee Extension Strength Asymmetry does not affect Peak Power or Fatigue during the Wingate Test
Stuart Best, Reiley Bergin, Scott Royer, Joshua Winters, Kathleen Poploski, Nicholas Heebner, John Abt, FACSM, Scott LePhart, FACSM. University of Kentucky, Lexington, KY. (Sponsor: John Abt, FACSM)

No relevant relationships reported.

PURPOSE: Peak and mean power during the Wingate test is associated with knee extensor strength, however it is unknown if knee extensor asymmetry affects this relationship. We hypothesized that increased muscle symmetry between legs would be associated with decreased peak and mean power during the Wingate test in healthy subjects.

METHODS: 206 highly active male subjects (27.4 ± 4.6 years, 84 ± 9 kg) completed individual limb isokinetic strength testing on a dynamometer (60°·sec⁻¹), as well as a 30 second Wingate anaerobic test in a seated position. Strength testing included maximal knee extension strength (% Body Weight). Knee extension asymmetry ratio between legs (Aext) was calculated as Aext = Emax/Emin, where Emax = strongest leg, Emin = weakest leg. Subjects were later classified as High Symmetry (HS, Aext < 0.85, n=35), Moderate Symmetry (MS, 0.90 ≤ Aext < 0.95, n=60), Moderate Asymmetry (MA, 0.95 ≤ Aext < 1.00, n=32), and High Asymmetry (HA, Aext ≥ 1.00, n=35). Wingate data (W·kg⁻¹) were analyzed for peak (Peak), mean power (PMean), as well as power output at 5 second intervals. RESULTS: There were significant differences in Emax (HS > MA, p<0.012; MS > HA, p<0.001; MS > HA, p<0.044) but not Emean between groups. No significant differences in Pmean (12.89 ± 0.68, 12.74 ± 0.63, 12.71 ± 0.52, 12.87 ± 0.79 W·kg⁻¹), P/Peak (0.26 ± 0.81, 0.95 ± 0.82, 0.95 ± 0.78, 0.92 ± 0.88 W·kg⁻¹) or any other power variables were found between the HS, MS, MA and HA groups respectively (all p>0.055). When all subjects were combined, knee extensor asymmetry (Aext) was not associated with any power variables (all p>0.133). Pmax and P_mean respectively were positively associated with Emax (r=0.414, p<0.001, r=0.464, p<0.001) and Emean (r=0.397, p<0.001, r=0.420, p<0.001). Although all relationships were significant, the associations between strength variables (Emax and Emean respectively) and power decreased from 5 seconds (r=0.490, p<0.001; r=0.490, p<0.001) to 30 seconds (r=0.265, p<0.001; r=0.331, p<0.001). CONCLUSIONS: Greater knee extensor strength imbalance between legs is not associated with decreased power throughout a 30 second Wingate test. These data suggest that for bilateral tasks in which the legs do not move independently, such as cycling, training focused only on improving strength symmetry between legs may not improve peak power production.

Cardiorespiratory Fitness of Otherwise Healthy Obese Women
Vija Bernhardt¹, Dharini M. Bhammar, Tony G. Babb, FACSM¹, ¹Texas A&M University Commerce, Commerce, TX. University of Nevada-Las Vegas, Las Vegas, NV. ²Institute for Exercise and Environmental Medicine, Texas Health Presbyterian Hospital and UT Southwestern Medical Center, Dallas, TX. (Sponsor: Tony G Babb, FACSM)

No relevant relationships reported.

PURPOSE: Cardiorespiratory fitness (CRF) is used as a diagnostic and prognostic health indicator for all-cause and cardiovascular disease mortality (Lee et al, 2010). Thus, properly quantifying and interpreting this data is important for accurate diagnoses. The current EACPR/AHA Scientific Statement includes peak oxygen uptake (VO2peak) both in ml/kg/min and as percent of predicted (Guazzi et al, 2016). We have previously shown, in a small cohort of otherwise healthy obese women (n = 26), that obese adults have normal or slightly reduced CRF (~85% of predicted), depending on the prediction equation used (Bernhardt & Babb, 2012). Here, we wanted to validate our earlier findings in a larger sample of women. METHODS: Obese women underwent hydrostatic weighing to assess body fat percentage, fat mass, and lean body mass. They then completed an incremental cycling test to exhaustion to determine VO2peak. Prediction equations from Riddell et al (R; 1980), Wasserman et al (W; 2005), and Glaser (G; 2010) were used to assess CRF as previously described. Differences between percent predicted VO2peak values derived from the three equations were analyzed using repeated measures ANOVA. RESULTS: Data from 121 women (34 ± 7 years, 62 ± 4 kg/m² BMI, 46 ± 5% body fat, 44 ± 9 kg fat mass, 52 ± 6 kg lean body mass, mean ± SD) were analyzed. VO2peak (ml/min/kg) was low (18.9 ± 3.0 ml/min/kg) and decreased with increasing body mass, severely penalizing heavier individuals. In fact, applying the current ACSM CRF classification, 113 women would be considered “very poor” and 8 as “poor” (all below the 25 percentile). Mean values of % predicted VO2peak were significantly different between equations R and W, and W and G, but not between R and G (R: 92 ± 14%, W: 91 ± 14%, G: 92 ± 14%, p<0.01). Using a cutoff for low CRF of < 84% of predicted VO2peak, only 27-32% of women fell into this category, depending on the equation used. CONCLUSIONS: The commonly used method of evaluating VO2peak based on body weight (ml/kg/min) is not appropriate in obese individuals. VO2peak as percent of predicted is a better alternative when assessing CRF. Similar to our previous data in a small cohort of otherwise healthy obese women, the current data show that the majority of obese women have normal CRF, independent of the prediction equation used.

A Cluster Analysis and Validation of Health-related Fitness Tests in College Students
You Fu¹, Ryan D. Burns², Timothy Brusseau⁴, Nora Constantinn¹. ¹University of Nevada, Reno, Reno, NV. ²University of Utah, Salt Lake City, UT.

No relevant relationships reported.

PURPOSE: Because health-related fitness consists of several domains, understanding clustering of scores from a testing battery can help practitioners derive exercise programs. The purpose of this study was to explore the clustering of health-related fitness test scores in college students and to validate the solution against criterion measures.

METHODS: Participants were college students (Mean age = 19.2 ± 0.6 years; N = 523; 342 females, 181 males) recruited from a university in the southwestern U.S. The health-related fitness assessments consisted of BMI estimated VO2peak from the Astrand-Rhyming cycle ergometer test, and standard push-ups. Criterion measures consisted of DXA-estimated percent body fat (%BF), measured VO2peak from a maximal treadmill test, and a 1-Rep Maximum (1-RM) bench press score. A hierarchical cluster analysis was performed to derive groupings. One-way ANOVA tests were used to explore the differences among the derived cluster groups on each criterion measure.

RESULTS: Six cluster groups were formed representing various fitness “phenotypes” (Pseudo-F = 179.7). The cluster groups differed in %BF (F(5, 517) = 4.46, p < 0.001, eta-squared = 0.31), measured VO2peak (F(5, 517) = 49.7, p < 0.001, eta-squared = 0.33), and 1-RM bench press scores (F(5, 517) = 17.0, p < 0.001, eta-squared = 0.12), providing validation evidence.

CONCLUSIONS: Six cluster groups were formed from a health-related fitness test battery in college students that were validated against criterion measures of health-related fitness. The cluster groups can be used to inform current fitness status and for the derivation of exercise programs.

Work Performed Above The Respiratory Compensation Point Is Not Equivalent To W‘
Jeffrey A. Leo¹, Surendran Sabapathy¹, Michael J. Simmonds³, Troy J. Cross⁴. ¹Griffith University, Gold Coast, Queensland, Australia. ²Mayo Clinic, Rochester, MN.

No relevant relationships reported.

The hyperbolic power-time relationship for severe-intensity cycling exercise is defined by two physiological parameters: (i) the asymptote, critical power (CP); and (ii) the curvature constant, W’. Recently, we reported that the respiratory compensation point (RCP) displays poor measurement agreement with the CP. However, it is unknown whether the amount of supra-RCP mechanical work (RCP) performed during ramp-intensity cycling is similar to that performed above the CP (i.e., W’).

PURPOSE: We sought to determine the measurement agreement between W and RCP obtained during incremental cycling of varying ramp slopes.

METHODS: Twelve male cyclists completed three separate ramp-incremental cycling protocols, where the work rate increment was slow (SR, 15 W·min⁻¹), medium (MR, 30 W·min⁻¹), or fast (FR, 45 W·min⁻¹). Initially, the RCP (adjusted for mean response time) was obtained using the ventilatory equivalent for CO₂ method. To assess RCP, we calculated the power-time integral between the RCP and the instantaneous power output observed at exercise termination for each ramp-incremental test, separately. W’ was determined via Morton’s model for ramp-intensity exercise. The assumption that W and RCP occur at equivalent kilojoule (kJ) values was assessed by one-way ANOVA and evaluating the concordance correlation coefficient (CCC) and typical error (root-mean-square error [RMSE]) for each ramp-incremental test, separately.

RESULTS: RCP increased with decreases in the ramp-incremental slope (p < 0.05). RCP in SR (21.5 ± 6.5 kJ), MR (16.8 ± 5.6 kJ) and FR (13.3 ± 4.3 kJ) were not
different from $W^*$ (15.7 ± 6.9 kJ). The degree to which the relationship between $W^*$ and $RC^*$ approximated the line of identity was poor for SR (CCC = −0.09 and RMSE = 11.32 kJ), MR (CCC = 0.23 and RMSE = 7.5 kJ) and FR (CCC = 0.37 and RMSE = 6.5 kJ).

CONCLUSION: Our data demonstrate that $RC^*$ is lower when the ramp-incremental slope is increased. Furthermore, despite occurring at similar kJ values, we observed poor measurement agreement between $W^*$ and $RC^*$, as evidenced by the low CCC and the large RMSE values, irrespective of the ramp-incremental protocol. Together, these findings indicate that $RC^*$ obtained during ramp-incremental cycling is not equivalent to $W^*$.

1747 Board #8
May 31 2:00 PM - 3:30 PM
Effectiveness of Preseason Conditioning on $V_{O_2}^\text{max}$ in College Athletes Assessed via Ift and Gxt
Kallie LaValle, Jordan Nieuwmsa, Joseph D. Ostrem. Concordia University - St. Paul, St. Paul, MN.
(No relevant relationships reported)

Developing a greater aerobic capacity is essential for successful performance in college athletics (Helgerud, Engen, Wisloff & Hof, 2001). Specifically, the preseason training program can be utilized for aerobic capacity improvement to optimize performance throughout the competitive season (Castagna, et al. 2013). Moreover, accurately assessing aerobic capacity is important to quantify the effectiveness of an aerobic training program.

PURPOSE: The purpose of the study was to determine the aerobic capacity changes via Intermittent Fitness Testing (IFT) and Graded Exercise Testing (GXT) in Division II collegiate athletes following a preseason conditioning program.

METHODS: Fourteen college athletes (male = 7; age = 19±1.1 yrs) participated in the study. Subjects performed the 30-15 IFT (Buchheit, 2007), an interval assessment with progressively increasing speed until maximal effort is reached, and a modified Balke GXT assessment on a treadmill to failure. Aerobic fitness was assessed before and after an 8-week preseason interval training program. Pairwise t-tests evaluated mean differences within IFT and GXT assessments for pre- and post-training variables. Independent t-tests compared the IFT and GXT assessments between genders. Correlations between IFT and GXT assessment were reported via Pearson’s correlation coefficients.

RESULTS: The measured $V_{O_2}^\text{max}$ via GXT (45.1 ± 11.9 ml/kg/min, P < 0.001) and estimated 30-15 IFT $V_{O_2}^\text{max}$ (46.7 ± 12.3 ml/kg/min, P < 0.001) both significantly increased over the 8-week preseason training period. Heart rate (HR) at 2 min post-GXT was significantly lower (150±14bpm vs. 141±14bpm, P = 0.019) following preseason training. GXT measured $V_{O_2}^\text{max}$ and 30-15 IFT estimate $V_{O_2}^\text{max}$ displayed a strong correlation before and after preseason interval training (r = 0.84, P < 0.001 vs. r = 0.77, P < 0.001). Weight was significantly lower in post testing (1.5±0.2 kg, P = 0.019).

CONCLUSIONS: Preseason interval training produced positive aerobic capacity improvements and were similarly detected with IFT and GXT. Further studies could investigate the relationship between in-season athletic performance and preseason aerobic capacity changes.

1748 Board #9
May 31 2:00 PM - 3:30 PM
Comparison of Non-Maximal Tests for Exercise Prescription and Outcome Assessment
Recem A. Alajmi, Carl Foster, FACSM, John P. Porcari, FACSM, Kim Radtke, Scott T. Dobberstein. University of Wisconsin-La Crosse, La Crosse, WI.
(No relevant relationships reported)

Introduction Although maximal incremental exercise tests (GXT) are the gold standard for outcome assessment and exercise prescription, they are not widely available in either fitness or clinical exercise programs. Standardized tests for outcome assessment and exercise prescription, they are not widely available in either fitness or clinical exercise programs.

PURPOSE: The purpose of the study was to determine the aerobic capacity changes via Intermittent Fitness Testing (IFT) and Graded Exercise Testing (GXT) in Division II collegiate athletes following a preseason conditioning program.

METHODS: Fourteen college athletes (male = 7; age = 19±1.1 yrs) participated in the study. Subjects performed the 30-15 IFT (Buchheit, 2007), an interval assessment with progressively increasing speed until maximal effort is reached, and a modified Balke GXT assessment on a treadmill to failure. Aerobic fitness was assessed before and after an 8-week preseason interval training program. Pairwise t-tests evaluated mean differences within IFT and GXT assessments for pre- and post-training variables. Independent t-tests compared the IFT and GXT assessments between genders. Correlations between IFT and GXT assessment were reported via Pearson’s correlation coefficients.

RESULTS: The measured $V_{O_2}^\text{max}$ via GXT (45.1 ± 11.9 ml/kg/min, P < 0.001) and estimated 30-15 IFT $V_{O_2}^\text{max}$ (46.7 ± 12.3 ml/kg/min, P < 0.001) both significantly increased over the 8-week preseason training period. Heart rate (HR) at 2 min post-GXT was significantly lower (150±14bpm vs. 141±14bpm, P = 0.019) following preseason training. GXT measured $V_{O_2}^\text{max}$ and 30-15 IFT estimate $V_{O_2}^\text{max}$ displayed a strong correlation before and after preseason interval training (r = 0.84, P < 0.001 vs. r = 0.77, P < 0.001). Weight was significantly lower in post testing (1.5±0.2 kg, P = 0.019).

CONCLUSIONS: Preseason interval training produced positive aerobic capacity improvements and were similarly detected with IFT and GXT. Further studies could investigate the relationship between in-season athletic performance and preseason aerobic capacity changes.

1749 Board #10
May 31 2:00 PM - 3:30 PM
Normative Benchmark Workout Scores ForCrossFit® Athletes
Gerald T. Mangine, Brant Cebulla, Yuri Feito, FACSM, Kennesaw State University; Kennesaw, GA. *University of California at Berkeley, Berkeley, CA. (Sponsor: Yuri Feito, FACSM)
(No relevant relationships reported)

PURPOSE: To provide normative reference values for the five most common benchmark workouts for male (M) and female (F) CrossFit® athletes competing in the teen (T), individual (I), and masters (MS) divisions The CrossFit Games®.

METHODS: Five-hundred-uniform resource locators were searched from a publicly-available online database and yielded 133,857 user profiles that contained self-reported anthropometric and performance data. Profiles were sorted by sex and age (i.e., T, I, or MS) and then screened for errors. Profiles were eliminated from the analysis if they: 1) contained data points that exceeded four standard deviations (i.e., < 0.001% of all values) from their respective mean; or 2) did not contain more than one completed benchmark workout (i.e., Fran, Grace, Helen, Filthy-Fifty, and Fight-Gone-Bad).

RESULTS: Separate norms were calculated for each sex and age category for Fran (M: 346 ± 143.5 sec; F: 452 ± 231.4 sec; I: 468 ± 196.4 sec; MS: 493 ± 239.3 sec), Grace (M: 228 ± 146.2 sec; F: 343 ± 187.9 sec; I: 286 ± 194.5 sec; MS: 363 ± 152.9 sec), Helen (M: 209 ± 196.4 sec; F: 300 ± 178.9 sec; I: 264 ± 175.6 sec), and Fight-Gone-Bad (M: 157 ± 150 sec; F: 201 ± 193.5 sec; I: 186 ± 175.4 sec; MS: 195 ± 175.6 sec).

CONCLUSION: This study presents norms for the five most common benchmark workouts for male and female athletes participating in The CrossFit Games® across the three major divisions. The norms can be used to assess competency in these sport-specific challenges within these populations.
medication-related changes in physical fitness among community-dwelling elderly individuals, such as single leg balance, which could lead to restriction in activities of daily living and an increased risk of falling.

RESULTS: There was a significant relationship between BMI and plank time \((r=-0.66, p=0.004)\), but not between plank time and SEBT performance \((r=0.39, p=0.12)\) or BMI and SEBT \((r=0.19, p=0.46)\). Mean plank time was significantly higher \((p<0.001)\) in normal \((56.8\pm10.8\ s)\) compared to the overweight \((53.2\pm12.6\ s)\) and obese \((51.1\pm11.2\ s)\) subjects. The reach distance for all SEBT angles were lower in the obese subjects compared to the normal and overweight groups, although these differences were not statistically significant \((p>0.05)\). CONCLUSIONS: There is a significant relationship between BMI and core strength. Additionally, plank time is significantly lower in obese subjects indicating reduced core strength. There are also small, but non-significant, differences in balance among BMI groups. These findings suggest that obesity is associated with core strength and balance deficits that should be addressed in a fitness program.

1754 Board #15 May 31 2:00 PM - 3:30 PM Inertial Load Influences Power Measures during the Wingate Test

John Eric W. Smith¹, David D. Pascoe, FACSM², Benjamin M. Kriens³, Matthew J. Allister¹, Junfeng Ma², Mississippi State University, Mississippi State, MS. Auburn University, Auburn, AL. (Sponsor: David D. Pascoe, FACSM)

The Wingate Test is a commonly used assessment of anaerobic capacity and power during cycling. Wingate Protocol involves participants reaching maximal pedal cadence prior to resistance being added to the cycling flywheel. PURPOSE: The purpose of this study was to create a method to correct power measures to account for the influence of inertial load during a Wingate Test. METHODS: This study was performed using a Velotron ergometer and the Velotron Wingate Software. Ergometers were pedaled up to three different cadences \((130, 150, \text{ and } 170 \text{ revolutions per minute})\) at five different loads \((3.75, 5.25, 6.75, 8.25, \text{ and } 9.75 \text{ kp})\). Pedaling force was measured immediately before resistance was added to the flywheel. Data were collected for a full 30-seCONDS as utilized in a standard Wingate Test. RESULTS: Peak power resulting from inertial load ranged from 482-1615 W. Average power resulting from inertial load over the first portion of the test varied between 282-735 W based on flywheel resistance and initial cadence while no work was performed. Statistical modeling allowed the development of a regression curve \((r^2 = 0.986)\) accounting for second predictions of the influence of inertial load on power output readings. CONCLUSION: The Wingate Test can be valuable tool in a participant’s work assessment. However, caution needs to be taken in the interpretation and application of power output as this study has demonstrated.

1755 Board #16 May 31 4:00 PM - 5:30 PM Monitoring of Cardiorespiratory Performance in Healthy Subjects Using a 3-Minute Step Test

David D. Pascoe, FACSM, Junfeng Ma, Matthew J. Allister, Matthew J. Allister, Junfeng Ma, David D. Pascoe, FACSM, Mississippi State University, Mississippi State, MS. Auburn University, Auburn, AL. (Sponsor: David D. Pascoe, FACSM)

PURPOSE: The purpose of this study was to develop a method to correct power measures to account for the influence of inertial load during a Wingate Test.

METHODS: This study was performed using a Velotron ergometer and the Velotron Wingate Software. Ergometers were pedaled up to three different cadences \((130, 150, \text{ and } 170 \text{ revolutions per minute})\) at five different loads \((3.75, 5.25, 6.75, 8.25, \text{ and } 9.75 \text{ kp})\). Pedaling force was measured immediately before resistance was added to the flywheel. Data were collected for a full 30-seCONDS as utilized in a standard Wingate Test. RESULTS: Peak power resulting from inertial load ranged from 482-1615 W. Average power resulting from inertial load over the first portion of the test varied between 282-735 W based on flywheel resistance and initial cadence while no work was performed. Statistical modeling allowed the development of a regression curve \((r^2 = 0.986)\) accounting for second predictions of the influence of inertial load on power output readings. CONCLUSION: The Wingate Test can be valuable tool in a participant’s work assessment. However, caution needs to be taken in the interpretation and application of power output as this study has demonstrated.
Muscular power is a skill-related component of physical fitness and is most often associated with athletic performance. A simple and effective way to measure lower body muscular power is the vertical jump test. PURPOSE: To compare 3 different vertical jump measurement devices and to determine the reliability of the 3 devices.

METHODS: A convenience sample of 30 college students (16 males and 14 females; mean age 20.7 ± 3.3 years), volunteered to participate in this study. The vertical jump heights were determined by the 3 devices (Jump™ mat, Vertec™, and the Vert™ device) simultaneously. The Just Jump™ mat was placed on the ground next to the Vertec™, and the subject wore the Vert™ device, clipped to their waist, while jumping. The subjects completed a brief, dynamic warm-up prior to performing the counter movement vertical jumps. Each subject was allowed 2 maximal effort jump trials prior to performing 5 maximum effort vertical jumps. After each jump, the 3 measurements were recorded. Each subject completed a 2nd series of 5 jumps 2-3 days after the first testing session. The protocol for the 2nd day was exactly the same as the first day. An ANOVA was used to determine differences between vertical jump heights between the 3 measurement devices and a paired t-test was used to compare vertical jump measurements between the 2 testing days on each device. Significance was defined as p < .05 for all statistical calculations.

RESULTS: There was no significant difference in vertical jump heights measured between the 3 devices on either day (Day 1 - Just Jump™ mat: 21.2 ± 6.2 in.; Vertec™: 21.0 ± 6.2 in.; Vert™: 20.1 ± 4.9 in.; p = .227; Day 2 - Just Jump™ mat: 21.2 ± 6.0 in.; Vertec™: 21.1 ± 6.2 in.; Vert™: 20.2 ± 4.9 in.; p = .233). In addition, there were no significant differences between the vertical jumps between the 2 days for any of the devices (Just Jump™ mat: p = .616; Vertec™: p = .141; Vert™: p = .897).

CONCLUSION: The results of this study indicated that the Vert™ device recorded values approximately 1 inch lower than the Vertec™ and the Just Jump™ mat, however, the difference was not statistically significant. In addition, all 3 devices recorded similar measurements on both days of testing. Based on these results, any one of the 3 devices would be adequate to provide consistent and reliable vertical jump results in a field setting.

Electromagnetically braked cycle ergometers (CE) have been the standard modality for maximal anaerobic power (AP) testing in applied research settings; however, modern non-motorized treadmill (NMT) ergometers may prove a viable alternative for testing. PURPOSE: To compare performance markers derived from a 30-s maximal sprint on CE and NMT under optimized loads.

METHODS: Recreationally active men (n = 5; 24.8 ± 4.4 yrs) and women (n = 6; 21.3 ± 3.4 yrs) volunteered for the study. First visit consisted of a force-velocity-power test on the CE and NMT to determine optimal resistance for peak power production. Remaining two visits were performed in a randomized crossover order, consisting of a single 30-s maximal AP test on the CE or NMT. Peak power (PP), mean power (MP), minimal power (Pmin), and fatigue index (FI) were averaged over three revolutions on the CE and three strides on the NMT. Rating of perceived exertion (RPE), maximal heart rate (HRmax) and blood lactate concentration (BLa) were collected as a measure of intensity. All markers were analyzed using paired samples t-tests and Pearson product correlation coefficients.

RESULTS: PP, MP, and Pmin were higher (p < 0.001) on NMT (924.4 ± 279.72 W, 636.9 ± 309.55 W and 364.34 ± 123.20 W, respectively) than CE (501.90 ± 154.20 W, 309.55 ± 115.28 W and 178.11 ± 58.93 W, respectively). Significant correlation was found between CE and NMT under optimized loads (r = 0.779, p = 0.05). HRmax was higher on the NMT than CE (184.1 ± 11.0 bpm and 177.7 ± 11.0 bpm, respectively). BLa (NMT = 11.6 ± 2.5 mmol/L; CE = 10.4 ± 2.4 mmol/L) and RPE (NMT = 17.6; CE = 17.1), (p > 0.05), were not significantly different between the devices. There was no statistically significant difference on the NMT as compared to the CE. Significant correlation was found between CE and NMT under optimized loads (r = 0.779, p = 0.05). FI was not significantly different on the NMT (r = 0.859, p = 0.001), relative MP (r = 0.721, p = 0.012), Pmin (r = 0.824, p = 0.02) was found between PP (r = 0.938, p < 0.001), relative PP (r = 0.871, p < 0.001), MP

CONCLUSION: There is a strong relationship between CE and NMT in assessing AP at optimized loads, however higher power output and maximal heart rates were observed on a NMT. Further research is necessary to clarify FI relationship.

Bilateral deficit (BLD) is an occurrence where the unilateral sum in force output is higher than the bilateral force output in the upper or lower limbs. Maximal bilateral and unilateral lifts can be used to determine if a BLD is present. BLD can often have negative effects on performance and daily activity due to an uneven force output per limb in bilateral movements. This is important for health and fitness professionals because it can help them to recognize and reduce the occurrence of BLD. PURPOSE: To determine if there is a difference between a combined maximal unilateral lift (cMUL) and a maximal bilateral lift (MBL) for vertical shoulder press (VSP) and to determinie if BLD was present in recreationally trained participants. It was hypothesized that the cMUL will be significantly greater than the MBL.

METHODS: Thirty participants (19 male, 11 female) were recruited for this study. Participants engaged in three separate visits which were each 72 hours apart. The first visit consisted of a movement screening that assessed biomechanical functionality and movement patterns.

RESULTS: Participants were then randomly assigned for visit 2 to either a MUL or MBL testing condition and completed the other condition during visit 3. In each testing condition, participants performed 6 to 8 repetitions at 50% 1RM. Participants then proceeded to lift one repetition at 70% 1RM, which was increased by 10% after a successful lift. This pattern was followed until volitional fatigue was present. Unilateral values for the left and right limbs were combined (cMUL). A paired samples t-test was used to determine if there was a difference between cMUL and MBL (p < 0.05).

CONCLUSION: Participants were 22.96 ± 3.72 years old, 170.1 ± 9.3 cm tall, and weighed 73.7 ± 11.50 kg. Although 15 participants presented a BLD, a significant difference was not observed between the MBL (99.0 ± 36.4 lbs) and cMUL (98.3 ± 32.3 lbs).

CONCLUSIONS: The results did not support the hypothesis that the cMUL will be greater than the MBL. This could be due to the training status of the participants. Future studies are needed to assess training programs and their effect on the occurrence of BLD.
Does a Push-Up Using the Spyder 360 ™ Elicit More Muscle Activation Compared with a Standard Push-up?

Kent D. Johnson, FACSM, William Vantrease. Lipscomb University, Nashville, TN.

The conventional push-up is a common method for assessing a person’s muscular endurance or as an exercise to improve muscle performance in the upper extremities or trunk. Many organizations encourage using the push-up as a test to assess muscular endurance (including the American College of Sports Medicine). A relatively new device called the Spyder 360 ™ is being promoted as a method to maximize muscle activation during a push-up due to its unstable platform on wheels. PURPOSE: To compare muscle activation in select muscle groups during a standard push-up activity with and without the Spyder 360 ™. METHODOLOGY: Twelve healthy male subjects volunteered for the study (age=26.6±7.5yrs; WT=85.8±9.4kg; HT=182.4±16.04cm; Percent Fat=13.7±8.5%; BMI=25.87±3.28). Volunteers reported to the laboratory and were randomly assigned to test first using either stable push-up handles (PUH) or Spyder 360 ™ (PU360). EMG electrodes were placed over the following muscles to determine muscle activation: 1) clavicular fibers of the pectoralis major (PM); 2) middle triceps (TR); 3) middle latissimus dorsi (LD); 4) middle portion of the rectus abdominus (RA); and 5) anterior deltoid (AD). Subjects were asked to perform 5 push-ups each using the PUH and PU360. The maximal one push-up EMG data was used for comparison between the two interventions (PUH or PU360).

RESULTS: Results indicate that the PU360 elicits significantly more muscle activation during a push-up activity in the pectoralis major (29%; p=0.001); triceps brachii (42%; p=0.006); latissimus dorsi (26%; p=0.017); and rectus abdominus (32%; p=0.005). There was no significant difference in the anterior deltoid (8%; p=0.1653).

CONCLUSION: These results demonstrate that the PU360 elicits more muscle activation in the PM, TR, LD and RA compared with PUH for the subjects in this study.

Lifespan Physical Fitness Analysis In A University-Sponsored, Guided Exercise Program

Chris Dondzila, Amy Campbell, Vanessa DeLeo. Grand Valley State University, Allendale, MI. (Sponsor: Stephen Glass, FACSM)

BACKGROUND: Professional guidance is integral to assist individuals adopting an active lifestyle to enhance physical fitness, yet there is clarity lacking regarding which aspects of exercise programming (aerobic and resistance training) should be targeted across the lifespan. PURPOSE: To provide a lifespan, descriptive analysis of aerobic and muscular fitness in individuals seeking guidance in initiating an exercise program through a University program. METHODS: Upon registering in a University sponsored, guided exercise program, participants (N=991) received a comprehensive health analysis, measuring variables largely influenced by aerobic training (predicted VO2max from the YMCA cycle test and skinfold body fat percentage) and resistance training (hand grip strength and push ups). One sample t-tests were used to compare mean data with 50th percentile ranking/good ranking (ACSM), stratified by the following age groups: 20-29 years (n=615), 30-39 years (n=178), 40-49 years (n=62), 50-59 years (n=98), ≥60 years (n=38). RESULTS:

Regarding outcomes largely influenced by aerobic exercise, VO2max values were lower in the male 20s (40.0±12.8 ml/kg/min) and 30s groups (33.7±11.5 ml/kg/min) and the female 20s group (33.8±9.7 ml/kg/min, all p>0.005), yet higher in the female 50s group (28.8±5.3 ml/kg/min; p<0.05); body fat percentage was higher in the female 20s (27.0±6.6%); 30s (28.0±8.9%); and 40s groups (34.4±8.9%, all p=0.000). For outcomes largely influenced by resistance training, grip strength was significantly lower in the male 20s (86.8±24.4 lbs) and 30s (66.0±30.2 lbs, both p<0.000), whereas the 60s female group was significantly higher (57.6±12.0 lbs, p<0.05); for pushups men performed significantly worse in the 30s (14.0±10.9 repetitions) and 40s (11.2±4.6 repetitions, both p<0.05) groups, whereas women performed better in the 20s (19.8±10.9 repetitions), 40s (18.5±10.6 repetitions), and 50s (13.3±8.1 repetitions, all p=0.000) groups.

CONCLUSION: Aerobic fitness was markedly lower in the early lifespan for men and women. Specific to genders, muscular fitness was low in men through the 30s and body fat percentage high in women through the 40s. Focus should be placed on enhancing all physical fitness values early in the lifespan to more effectively raise and maintain throughout older adulthood.

Chinese Collegiate Fitness Index Report Based on the Supporting Active Lifestyle Perspective

Yi Liu1, Xiaolei Liu2, Mingxi Guan3, Hao Guo4, Yan Peng5, Ming Yang6, Jingdong Chang1. Southwest University, chongqing, China. 1High School Affiliated to Southwest University, chongqing, China. 2Chongqing Business Vocational College, chongqing, China. 3Chongqing College of Humanities,Science & Technology, chongqing, China. 4Sichuan Aerospace Vocational College, Chengdu, China.

The purpose of this study was to assess the status of Chinese collegiate fitness and to develop a promotion strategy from the supporting active lifestyle perspective.

METHODS: Drawing on National Academy of Kinesiology released the National Collegiate Fitness Index Report 2015 (NCFI) to develop Chinese collegiate fitness index (CCFI). The advisory committee members used the Delphi method to rate the importance of the fitness factors of CCFI. Finally, three domain was included in the CCFI and named transportation, exercise facilities, and physical education policies and services. A total of 789colleges and universities were surveyed, 386 were recovered, and 245 were valid questionnaires. The missing data that schools with incomplete responses were filled with the mean by SPSS24.0. The domain score was calculated by the rank of each group.

RESULTS: Finally, 245 colleges and universities came from 29 Provinces, Municipalities, Autonomous Regions and Hong Kong Special Administrative Region joining in the survey. Three groups were identified according to the difference of the attributes, the difference between public and private, as well as the different institutions and vocational institutions. Among the 245 colleges and universities, 48 were recognized as the subordinate universities, 152 were determined as the provincial universities, and 45 were defined as the public vocational or private colleges. The top three of universities are (1) Tsinghua University (74.7); (2) Beijing Normal University (72.1); (3) South China University of Technology (72.0).

CONCLUSIONS: There are obvious regional differences in the fitness index of Chinese collegiate (p<0.0005); The fitness index of the subordinate universities was significantly higher than other two group universities (p<0.0005).

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

Unsupervised Home-based Intermittent Walking Effectively Improves Physiological and Psychological Health

Carrie Ferguson, Rosalind E. Lancaster, Shauna Burke, Gemma K. Lyall, Karen M. Birch, FACSM. University of Leeds, Leeds, United Kingdom.

PURPOSE: To investigate whether unsupervised home-based IE walking presents an achievable, but sufficient, physiological stimulus to reduce perceived barriers to exercise, CVD risk and, as a consequence, increase HRQoL in an overweight, but otherwise healthy population.

METHODS: 25 participants (45 ± 10 yr; 32 ± 3.8 kg/m²; 10 m, 15 f) undertook 12 weeks of home-based IE walking, completing 3 sessions/week and 32 min/session of IE (IE = 78 ± 24 vs. 58 ± 36 %; p < 0.05). This was largely driven by reductions in IE 1 (2.7 ± 3.7; IE = 78 ± 24 vs. 58 ± 36 %; p < 0.05), this was largely driven by reductions in IE 1 (2.7 ± 3.7; IE = 78 ± 24 vs. 58 ± 36 %; p < 0.05), this was largely driven by reductions in IE 1 (2.7 ± 3.7; IE = 78 ± 24 vs. 58 ± 36 %; p < 0.05), this was largely driven by reductions in IE 1 (2.7 ± 3.7; IE = 78 ± 24 vs. 58 ± 36 %; p < 0.05), this was largely driven by reductions in IE 1 (2.7 ± 3.7; IE = 78 ± 24 vs. 58 ± 36 %; p < 0.05), this was largely driven by reductions in IE 1 (2.7 ± 3.7; IE = 78 ± 24 vs. 58 ± 36 %; p < 0.05), this was largely driven by reductions in IE 1 (2.7 ± 3.7; IE = 78 ± 24 vs. 58 ± 36 %; p < 0.05), this was largely driven by reductions in IE 1 (2.7 ± 3.7; IE = 78 ± 24 vs. 58 ± 36 %; p < 0.05), this was largely driven by reductions in IE 1 (2.7 ± 3.7; IE = 78 ± 24 vs. 58 ± 36 %; p < 0.05), this was largely driven by reductions in IE 1 (2.7 ± 3.7; IE = 78 ± 24 vs. 58 ± 36 %; p < 0.05).

ACKNOWLEDGMENTS: There are obvious regional differences in the fitness index of Chinese collegiate (p<0.0005); The fitness index of the subordinate universities was significantly higher than other two group universities (p<0.0005).

ACKNOWLEDGEMENT: Supported by NPPGS Grant 15CTY011, and Fundamental Research Funds for the Central Universities SWU1709240.
and psychological markers of health in an overweight, but otherwise healthy population. IF_{low} may be more effective than IF_{high} for reducing barriers to exercise, CVD risk and increasing HRQoL. Support: Heart Research UK RG2631

1763 Board #24 May 31 2:00 PM - 3:30 PM
Examination of the Relationship between Handgrip Strength and Upper Body Muscular Endurance in College-age Females
Cassandra E. Forsythe1, Matthew Orange1, James W. Krieger2. 1CCSU, New Britain, CT. 2Weightology LLC, Issaquah, WA. (Sponsor: Scanan Walsh PhD, FACSM) (No relevant relationships reported)

Knowledge regarding upper body muscular endurance and strength measures in college-age females is limited due to a relative lack of investigation. Since the implementation of Title IX, a large number of females regularly participate in strength and muscular endurance activities, and as such, more observational, descriptive fitness data on this population is needed. PURPOSE: While push-ups are traditionally a measure of muscular endurance, many females lack the upper body strength to perform a single standard push-up. This study seeks to determine the correlation between performance of push-ups from the standard position and a standard measure of upper extremity isometric strength, handgrip. METHODS: Healthy, non-pregnant females were recruited from the student population at CCSU. Subjects were excluded if they had uncontrolled asthma or any other medical condition that would prevent them from participating in strenuous physical activity. Following a short warm-up, subjects completed standard push-ups to exhaustion and completed a right-left maximum handgrip assessment using a dynamometer. RESULTS: Our 60 subjects had a mean age of 20.6 years (SD ± 2.5, range 18-27), and performed an average of 11.7 push-ups (SEM ± 1.30, range 0-47). Their average right and left handgrip was 35.1 kg (SEM ± 0.63) and 32.8 kg (SEM ± 0.62), respectively. Both Spearman rank and Kendall’s TII correlations showed no significant relationship between push-up performance and handgrip strength for either hand (Left hand: r = 0.17, p = 0.27; Right hand: r = -0.04, p = 0.78). CONCLUSIONS: Our results demonstrate that college-age females are capable of performing standard push-ups to exhaustion, but that upper extremity isometric strength is a poor predictor of push-up performance in this population.

1764 Board #25 May 31 2:00 PM - 3:30 PM
Effects Of A 12-minute Daily Physical Activity Intervention On Health Measures Of Office Workers
Maria Konstantaki, Georgina Colgate. Buckinghamshire New University, High Wycombe, United Kingdom. (No relevant relationships reported)

Office workers are known to sit for 65-75% of their working hours. Prolonged sedentary behaviour is linked to chronic disease. Physical activity programmes offered at the worksite tend to be generally attended only by the fitter or highly motivated office workers and are still unsuccessful in the long-term. PURPOSE: To investigate the effects of a six-week ‘bite size’ physical activity intervention (3 x 4 minutes daily) on health measures and exercise adherence of office workers. METHODS: Forty office workers employed in administrative positions (age range 24 to 59 yrs) performed a series of physiological measurements including body mass (BM; kg), body fat (BF; %), blood pressure (BP; mmHg), resting heart rate (HR; bpm), waist to hip ratio (WHR), upper and lower body endurance test (number of push-ups and timed wall squat), and core endurance (timed plank; s) at baseline and at the end of the study. For the bite size intervention, participants worked in small groups and completed nine stretch and strengthening exercises in approximately 4 min, three times a day, for 6-weeks. Participants also completed a Wellness questionnaire pre- and post-intervention and recorded their adherence to sessions in a self-administered log. RESULTS: The bite size intervention significantly improved muscular endurance of the upper body (pre: 11.6 ± 3.5 v post: 20.1 ± 2.6 push ups), lower body (8.36 ± 4.2 s v 22.7 ± 5.6 s; p<0.001) and core (43.2 ± 6.1 v 33.8 ± 4.8 s; p=0.005). No significant differences in BP, BF or HR were observed (all p>0.05). Wellness questionnaire results showed improved mood, sleep quality and reduction in stress levels and fatigue post-intervention. Adherence rate was 67.5%, as only 13 participants completed the intervention. CONCLUSIONS: The improvements in upper/lower and core endurance shown in this study could be beneficial in improving posture and alleviating low back pain often experienced by office workers due to prolonged sitting. Bite size exercise in just four minutes 3x a day might be a time saving and effective alternative to previous methods aiming to improve the health and well being of office workers.

1765 Board #26 May 31 2:00 PM - 3:30 PM
Bone Strength Differences According to Peak Power Norm Table Categories
Rebeckkah J. Reichert, Maria G. Alvarez, Andrew Denys, Kimberly D. Espartero, Priscilla Franson, Arianna M. Mazzarini, Vanessa R. Yingling, FACSM. California State University, East Bay, Hayward, CA. (Sponsor: Vanessa R. Yingling, FACSM) (No relevant relationships reported)

Purpose: To determine if a commonly used peak power (PP) norm table (Patterson & Peterson, 2004) discerns differences in bone strength between PP categories. Fractures become more prevalent with age due to bone strength losses. Bone strength is a predictive factor of fracture risk (Clark et al., 2006; Schuit et al., 2004) and previous research has shown muscle strength is significantly correlated to bone strength variables (Frost, 2003; Yingling, 2017). An accessible field measure of PP that detects differences in bone strength may be an important step in optimizing bone strength, thus preventing fracture later in life. METHODS: 114 participants, 62 F and 52 M (age yrs 21.1±3.3) performed a maximal vertical jump test. PP was calculated from vertical jump height (Sayers, 1999) and categorized into the following groups: Well Above Average, Average, and Well Below Average. Moment of Inertia (I), Cortical Area (Ct. Ar), cortical Bone Mineral Density (cBMD), and Strength-Strain Index (SSI) were measured using peripheral Quantitative Computed Tomography (pQCT) to quantify bone strength at the 50% tibia site. A one-way ANOVA and a Tukey post hoc test assessed differences between PP categories at a significance level of p<0.05 (GraphPad Prism). RESULTS: Bone strength variables were significantly different between PP norm table categories, except cBMD in males. Females: SSI (p=0.0001), I (p=0.001), CLR (p=0.001), cBMD (p=0.0063). Males: SSI (p=0.0457), CLR (p=0.0101), CLR (p=0.0226). Post hoc testing revealed a significant difference between the Well Above Average and Well Below Average groups for both genders. Conclusion: Current PP norm table categories show a significant difference between Well Above Average and Well Below Average. This indicates that those in the Well Below Average category for PP could benefit from exercise prescription targeted for bone strength optimization.

1766 Board #27 May 31 2:00 PM - 3:30 PM
Aerobic And Anaerobic Parameters Of A Three-minute All-out Test Are Associated With Rowing Performance
Gabrielle A. Mori, Emily M. Casper, Alec R. Dickson, Kyle L. Sunderland. High Point University, High Point, NC. (No relevant relationships reported)

Critical power can be estimated utilizing a three-minute all-out exercise test. The 2000m rowing test is utilized by US rowing as a standard test for all of their rowers. Critical power has been reported to predict 2000m rowing performance, however the three-minute all-out test has not been used to predict 2000m rowing performance. PURPOSE: The purpose of this study was to examine the relationship between 2000m rowing performance and the parameters of a three-minute all-out rowing test in collegiate club rowers. METHODS: Ten (F=6, M=4) collegiate rowers (mean ± SD; age 19.3 ± 1.2 y; height 176.7 ± 10.0 cm; weight 75.6 ± 19.5 kg) completed a peak power test to determine peak power output (PO) and a one-minute all-out test, a three-minute all-out test to determine end-power (EP) and work done above end-power (WEP), and a 2000m time trial on a rowing ergometer. Testing days were separated by 72 hours and began with a five-minute warm-up on the rowing ergometer. The peak power, one-minute, and three-minute tests were all completed on a damper setting 10 whereas the 2000m time trial was completed at a self-selected damper setting. Repeated measures ANOVA was used to compare PO for all the tests and Pearson’s product moment correlations were conducted to measure the relationships between 2000m time and the parameters of the all-out rowing tests.

RESULTS: The three-minute relationship with 2000m time was average power for the 3-minute test (r = -0.968, p<0.001). Additionally, 2000m time was significantly correlated with EP (r = -0.933, p<0.001), average power during 1-minute test (r = -0.784, p<0.01), and PO (r = -0.762, p=0.01). Work above end-power (WEP) was significantly related to PP of all the tests. There were significant differences between PP for all tests (p<0.01).

CONCLUSIONS: These results suggest that a single 3-minute all-out rowing test can predict both peak power output and 2000m time, therefore rowing coaches could use this test to more efficiently assess rowers.

Abstracts were prepared by the authors and printed as submitted.
BACKGROUND: Exercise is commonly prescribed using various heart rate (HR) methods (e.g., %HRreserve, %HRmax). Exercise can also be described using the Counting Talk Test (CTT). Studies analyzing the correlation between exercise HR and CTT are limited, as well as data supporting the validity of the CTT as a method of exercise prescription. PURPOSE: To investigate whether CTT results are associated with exercise HRs and can therefore be used as a valid method of exercise prescription. METHODS: This study included 26 women with a mean age of 20.5 ± 6 years. Subjects performed exercise testing on a Stages ergometer once a week for three consecutive weeks. Data was collected at rest, during five stages of self-selected exercise intensities corresponding to RPE values of 8, 10, 12, 14 and 16 based on the Borg 6-20 scale, and during recovery. Data collected included measurements of Heart Rate, CTT Number, CTT Duration, average watts, and average RPM. Calculations were performed after testing to determine the subjects’ CTT using the equation (exercise CTT/ resting CTT) x 100. Pearson Correlation Coefficients were calculated to analyze the relationship between Heart Rate and CTT Number, Heart Rate and CTT Duration, as well as between %HRmax and %CTT. RESULTS: A statistically significant inverse correlation was found between HR and CTT number (r = -0.4188, p < 0.05) as well as between HR and CTT Duration (r = -0.5675, p < 0.05). A statistically significant inverse relationship was also found between %HRmax and %CTT (r = -0.5211, p < 0.05). A statistically significant positive correlation was found between CTT number and CTT duration (r = 0.4686, p < 0.05). CONCLUSION: Heart Rate was inversely associated with both CTT number and CTT duration. There was also an inverse relationship between %HRmax and %CTT. This supports the idea that CTT is a possible alternative method of exercise prescription. Using CTT as exercise intensity prescription may improve patient adherence, making the monitoring of exercise intensity more accessible to the general population. More research is needed to ensure proper exercise prescription using the CTT in practice.
Firefighting is a physically demanding profession with high requirements for aerobic capacity ($VO_{2\text{max}}$). However, this population has a high rate of obesity, consistent with the general population. Previous research in general populations has identified a relationship between $VO_{2\text{max}}$ and anthropometrics, specifically the impact of body weight and lean body mass. Moreover, research suggests an association between decreased percent body fat (%BF) and decreased aerobic and strength measures in similar tactical populations such as military. However, this relationship has not been thoroughly examined in firefighters. PURPOSE: To determine the association between anthropometric characteristics and $VO_{2\text{peak}}$ of firefighters. METHODS: Eighteen healthy firefighters (Age= 39.9 ± 11.0 years; Body Mass Index (BMI)= 28.0 ± 3.4 kg/m²; %BF= 27.1 ± 8.7%; Waist to Hip Ratio (WHR)= 0.88 ± 0.04; VO2max = 41.2 ± 7.5 ml/kg/min) completed measurements of anthropometry, height, weight, bioelectrical impedance analysis, waist and hip circumferences) and a treadmill graded exercise test (GXT) to determine $VO_{2\text{max}}$ utilizing open circuit spirometry. Normality was assessed, and Pearson correlation and Spearman coefficients were used when appropriate to determine the associations between $VO_{2\text{max}}$ and anthropometric characteristics (BMI, %BF, WHR). RESULTS: Results revealed a significant moderate correlation ($r= -0.636$; $p= 0.005$) between %BF and $VO_{2\text{max}}$, indicating that higher levels of body composition are related to lower $VO_{2\text{max}}$. No relationship was found between BMI and $VO_{2\text{max}}$ ($r= 0.05$; $p= 0.845$), and the association between WHR and $VO_{2\text{max}}$ approached significance ($r= -0.462$; $p= 0.053$). CONCLUSION: Results of the current investigation suggest %BF may be associated with maximal aerobic capacity. Additionally, data revealed no significant relationship between BMI and $VO_{2\text{max}}$, suggesting that total body weight may not have a significant impact on aerobic capacity. Future research should continue to investigate the effects that maintaining an ideal body composition may have on work performance and injury risk, including the negative effects of obesity on thermoregulation in job specific tasks for firefighters.

Validity of Hit & Turn Tennis Test in Estimating Aerobic Capacity with Amateur Players

Bo Li, Jianrong Zhong, Xinxin Wang, Xiaotian Li, Lu Jin, Yuchao Cao, Lv Miao, Yongming Li. Shanghai University of Sport, Shanghai, China.

Validity of Hit & Turn Tennis Test (H&TTT) in Estimating Aerobic Capacity with Amateur Players

The Hit & Turn Tennis Test (H&TTT) is an acoustically controlled on-court test designed for evaluating tennis-specific endurance. Performance levels achieved during this test has been proposed to estimate the peak oxygen uptake ($VO_{2\text{peak}}$), but the validity of the regression equations warrant further investigation. Purpose: To evaluate the validity of H&TTT in estimating $VO_{2\text{peak}}$.

Methods: Sixteen collegiate tennis players (age: 22.2 ± 1.7 yrs; height: 175 ± 5 cm; mass: 69.2 ± 6.1 kg; tennis training experience: 2.3 ± 0.8 yrs) volunteered to perform H&TTT on an indoor synthetic court. A portable spirometric system (K4b², Cosmed, Italy) was utilized to measure the ventilatory activities to calculate $VO_{2\text{peak}}$ during the test. $VO_{2\text{max}}$ was also estimated with a H&TTT regression equation ($VO_{2\text{max}}$=[Level*2+30]ml/min/kg). Additionally, for the directly measured ventilatory activities two smoothing methods (5 vs. 3 successive points) were utilized to process $VO_{2}$ data, and five different methods (the highest consecutive 5 points vs 5s vs 10s vs 15s) were utilized to calculate $VO_{2\text{peak}}$.

Result: The levels subjects achieved in H&TTT were 14.6 ± 3.4. The estimated $VO_{2\text{peak}}$ was 59.3 ± 6.7ml/min/kg using the regression equation. The calculated $VO_{2\text{max}}$ using different smoothing methods and criterion ranged between 53.5 ± 5.1 and 57.7 ± 6.0 ml/min/kg. No significant correlation was found between estimated and calculated $VO_{2\text{max}}$ ($r < 0.3, p > 0.05$). Significant differences were found for calculated $VO_{2\text{peak}}$ using different smoothing methods and criterion ($p<0.01$).

Conclusion: Inconsistent with the literature, the validity of H&TTT in estimating $VO_{2\text{peak}}$ was not supported by this study. Caution should be paid when this test is utilized. In addition, a fixed method of data processing is recommended when calculating $VO_{2}$ from direct measurements.

Preservation of explosive force in long-term strength trained elders is determined by neural adaptations

Lucas B. R. Orsatto¹, Matheus J. Wiest¹, Bruno M. Moura², David F. Collins¹, Fernando Diefenhauser¹.¹Universidade Federal de Santa Catarina, Florianópolis, Brazil. ²Toronto Rehabilitation Institute, Toronto, ON, Canada. ³University of Alberta, Edmonton, AB, Canada.

PURPOSE: To understand the effects of long-term strength training in the neural and contractile properties of explosive force in young adults and elders. METHODS: 54 healthy males were divided in four groups: untrained young control (YC - n=14; 26 ± 4 yrs), untrained elder control (EC - n=14; 66 ± 3 yrs), strength trained young (YT - n=14; 27 ± 3 yrs), and strength trained elder (ET - n=12; 64 ± 4 yrs). Knee extension isometric torque was recorded during: 1) maximum voluntary isometric contractions (MVIC; peak torque); 2) explosive voluntary contractions (rate of torque development – RTD at 0 -50 and -150 ms); and 3) supramaximally-evoked octets (8 pulses at 300 Hz; torque at 50 and 75 ms). Surface electromyography (sEMG; 0-50, 50-100 ms) of the quadriceps muscle was recorded during explosive contractions and was normalized to the MVIC sEMG root mean square (RMS) data. The skeletal muscle index (SMI) was estimated using DXA. One-way ANOVA (Tukey post hoc) was used to compare groups. RESULTS: Displayed in table 1.

Table 1. SMI, MVIC and octets torque, RTD and sEMG (mean ± SD).
### S344 Vol. 49 No. 5 Supplement

**MEDICINE & SCIENCE IN SPORTS & EXERCISE®

#### Variables

<table>
<thead>
<tr>
<th></th>
<th>EC</th>
<th>ET</th>
<th>YC</th>
<th>YT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMH (kg/height^2)</td>
<td>8.9 ± 1.6</td>
<td>10.0 ± 1.3</td>
<td>9.3 ± 0.94</td>
<td>11.5 ± 0.7</td>
</tr>
<tr>
<td>MVIC peak torque (N·m)</td>
<td>212 ± 39</td>
<td>245 ± 50</td>
<td>290 ± 55</td>
<td>358 ± 67</td>
</tr>
<tr>
<td>RTD (N·m·s^-1)</td>
<td>0.50 ms</td>
<td>981 ± 210</td>
<td>1340 ± 252</td>
<td>1396 ± 483</td>
</tr>
<tr>
<td>Octet torque (N·m)</td>
<td>50 ms</td>
<td>52 ± 18</td>
<td>62 ± 12</td>
<td>77 ± 13</td>
</tr>
<tr>
<td>sEMG (% RMS)</td>
<td>0-50 ms</td>
<td>75 ms</td>
<td>72 ± 29</td>
<td>85 ± 17</td>
</tr>
</tbody>
</table>

**CONCLUSIONS:**

Unstable surface training has been popular in physical rehabilitation settings for decades. A more recent training technique in strength and conditioning is to create instability by using a suspended weight during resistance training exercises. Suspended weights could create a greater challenge for the core and potentially improve balance. **PURPOSE:** To determine if a 6 week training program using suspended weights during squats will lead to improvements in balance. METHODS: As part of their 6 week off-season strength and conditioning program 38 collegiate baseball players were randomly assigned to one of two groups. A group that completed the squats in the traditional fashion and a group that completed the squats while weights were suspended below the barbell. The subjects were tested pre and post for balance using a four direction Star Excursion Balance Test (SEBT). The results for each subject were normalized to a percent of their individual leg length. Difference scores were calculated between the percent of leg length scores pre-test and post-test. An independent samples t-test was conducted between these difference scores. Finally, a paired samples pre and post t-test was conducted within groups to see if there were any significant improvements within each group. RESULTS: The mean percent change of both the control (2.13±4.42%) and treatment (0.60±6.37%) groups improved slightly from pre-test to post-test but there were no significant differences (t = 0.79, p = 0.44) between the two groups. The paired samples t-test were not significant for the traditional squat (pre mean = 99.80 ± 8.30%, post mean = 101.93 ± 7.11%, t = 1.92, p = 0.074) or the suspended loaded squat (pre mean = 99.70 ± 6.86%, post mean = 100.30 ± 7.94%, t = 3.75, p = 0.017), indicating that neither technique significantly improved balance. **CONCLUSION:** The results of this study indicate that completing traditional or suspended loaded squats as part of an overall 6-week strength and conditioning program will not lead to significant improvements in balance in highly trained college athletes.

### 1775 Board #36 May 31 2:00 PM - 3:30 PM

**Suspended Weight Training During Squats: Does It Improve Balance More Than Traditional Squats?**

Bryan K. Christensen, Samuel P. Thielen, Kyle J. Hackney, Jeremiah T. Moen, North Dakota State University, Fargo, ND; Sanford Power Center, Fargo, ND; Mayville State University, Mayville, ND.

No relevant relationships reported.

**RESULTS:** While CRT on lower limbs was more effective in improving BMD of the femur region in postmenopausal females, VRT showed a more significant improvement at both spine and femur regions. Therefore, VRT may be a more effective intervention for promoting core strength and balance ability, as a result for reducing fall frequency of postmenopausal females. The effectiveness of a combined CRT and VRT program was determined using faster and slower training speeds. The results for each subject were normalized to a percent of their individual leg length. Difference scores were calculated between the percent of leg length scores pre-test and post-test. An independent samples t-test was conducted between these difference scores. Finally, a paired samples pre and post t-test was conducted within groups to see if there were any significant improvements within each group. RESULTS: The mean percent change of both the control (2.13±4.42%) and treatment (0.60±6.37%) groups improved slightly from pre-test to post-test but there were no significant differences (t = 0.79, p = 0.44) between the two groups. The paired samples t-test were not significant for the traditional squat (pre mean = 99.80 ± 8.30%, post mean = 101.93 ± 7.11%, t = 1.92, p = 0.074) or the suspended loaded squat (pre mean = 99.70 ± 6.86%, post mean = 100.30 ± 7.94%, t = 3.75, p = 0.017), indicating that neither technique significantly improved balance. **CONCLUSION:** The results of this study indicate that completing traditional or suspended loaded squats as part of an overall 6-week strength and conditioning program will not lead to significant improvements in balance in highly trained college athletes.

### 1777 Board #38 May 31 2:00 PM - 3:30 PM

**Effects of Vibration Resistance Training on Bone Mineral Density of Postmenopausal Females**

Li Peng, 1 weimo Zhu, FACSM, 2 College of Physical Education, South-West University, Chongqing, China; 2 University of Illinois at Urbana-Champaign, Urbana, IL. (Sponsor: weimo Zhu, FACSM)

No relevant relationships reported.

**RESULTS:** While CRT on lower limbs was more effective in improving BMD of the femur region in postmenopausal females, VRT showed a more significant improvement at both spine and femur regions. Therefore, VRT may be a more effective intervention for promoting core strength and balance ability, as a result for reducing fall frequency of postmenopausal females. The effectiveness of a combined CRT and VRT program was determined using faster and slower training speeds. The results for each subject were normalized to a percent of their individual leg length. Difference scores were calculated between the percent of leg length scores pre-test and post-test. An independent samples t-test was conducted between these difference scores. Finally, a paired samples pre and post t-test was conducted within groups to see if there were any significant improvements within each group. RESULTS: The mean percent change of both the control (2.13±4.42%) and treatment (0.60±6.37%) groups improved slightly from pre-test to post-test but there were no significant differences (t = 0.79, p = 0.44) between the two groups. The paired samples t-test were not significant for the traditional squat (pre mean = 99.80 ± 8.30%, post mean = 101.93 ± 7.11%, t = 1.92, p = 0.074) or the suspended loaded squat (pre mean = 99.70 ± 6.86%, post mean = 100.30 ± 7.94%, t = 3.75, p = 0.017), indicating that neither technique significantly improved balance. **CONCLUSION:** The results of this study indicate that completing traditional or suspended loaded squats as part of an overall 6-week strength and conditioning program will not lead to significant improvements in balance in highly trained college athletes.

---

**ACSM May 29 – June 2, 2018 Minneapolis, Minnesota**
of the UPS, the lysosomal system (autophagy), and the calcium-dependent calpain system. PURPOSE: To define the impact a restricted breathing mask (RBM) has on serum cortisol and proteolytic genes during exercise resistance. METHODS: In a counterbalanced crossover design, ten resistance trained male participants (20.3 ± 1.3 years) performed two separate testing sessions, RBM and No Mask, consisting of squat, leg press, and leg extension. Muscle samples were obtained at baseline, 3hr, 6hr, and 24hr post-exercise. Blood samples were obtained at baseline, 30min, 3hr, 6hr, and 24hr post-exercise. From each muscle sample, glucocorticoid-DNA (GR-DNA) binding and mRNA expression of Atrogin-1, FOXO1, MuRF1, MAFbx, Myostatin, and REDD1 were determined. Two-way repeated-measures analyses of variance (ANOVA) were performed with condition and time as main effects (p ≤ 0.05). RESULTS: No significant interactions between session and time for Atrogin-1, FOXO1, MuRF1, MAFbx, Myostatin, and REDD1. There was no main effect for session for serum cortisol. There was a significant interaction between session and time for GR-DNA binding. For the RBM session, compared to baseline GR-DNA binding was significantly elevated at 3-hr (p < 0.007), 6-hr (p < 0.001), and 24-hr (p < 0.002) post-exercise. CONCLUSION: The use of a RBM failed to affect serum cortisol or alter the mRNA expression of proteolytic genes. However, there was an increase in delta charge GR-DNA binding during the RBM compared to the no mask session.

PURPOSE: To compare physiological, performance and perceptual responses to the squat exercise mode (conventional barbell), to those using an exoskeleton (Institute of Human and Machine Cognition; Pensacola FL) designed for use during manned space flight. METHODS: Subjects (n = 15) made four laboratory visits, which began with two familiarization sessions on the exoskeleton, followed by two squat workouts in which the exercise mode (exoskeleton, barbell) was administered in a randomized sequence. Per workout they performed four repetitions each against progressively heavier (23, 34, 45.5 and 57 kg) loads separated by 90-second rests. A series of physiological, performance and perceptual data from the final two laboratory visits were collected before, during and after workouts. Per workout, we collected the same dependent variables. Z-scores were used to identify outliers, which along with its paired value from the other workout, were eliminated from further analyses. To assess data validity, dependent physiological, performance and perceptual variables from each workout were compared with paired t-tests and Cohen’s d. RESULTS: All subjects completed each workout (100% compliance). Z-scores results show less than 0.5% of our total data were deemed outliers. Average t-test and Cohen’s d values were 0.68 and 0.25 respectively. CONCLUSIONS: Prior research suggests t-test and Cohen’s d values less than 1.0 and 0.25 are very close to the null hypothesis and represent degrees of data similarity. Based upon these guidelines, current results denote an acceptable degree of data similarity derived from exoskeleton squats. We conclude exoskeleton squats yield physiological, performance and perceptual responses like those done with a barbell, and warrant continued inquiry involving microgravity simulation in human subjects.

Measuring average concentric velocity (ACV) during barbell exercises can be used for autoregulation of training loads; however, research is needed to clarify the load-velocity relationships for different barbell exercises. Training age, frequency, limb length, and relative strength are known to influence the load-velocity relationship. PURPOSE: To compare the ACV of the squat and deadlift over a spectrum of relative intensities and to determine the influence of training age, frequency, and relative strength on speed-power relationships. METHODS: Ten subjects (8 male, 2 left hand dominant) completed twelve training visits of the non-dominant elbow flexors across four weeks. The training protocol required the subjects to complete five sets of five, five-second isometric contractions at 80% of their MVIC force. Strength asymmetry of the dominant and non-dominant limbs were determined at baseline and following the training intervention with the following equation: dominant- non-dominant arm x 100. The resulting score reflects the magnitude of strength asymmetry and its direction (i.e., negative values favor the non-dominant limb). A paired samples t-test was used to compare the mean strength asymmetry scores before and after the training intervention. RESULTS: There was a significant difference in the direction of strength asymmetry post-training (mean ± SD: -2.21 ± 5.83%, range: -9.8 - 4.5%) compared to baseline (mean ± SD: 2.12 ± 5.34%, range: -5.9 - 9.7%). However, the magnitude of asymmetry was unchanged (P = 0.875). CONCLUSIONS: The mean strength asymmetries were relatively small.
before and after training. Nevertheless, the mean strength asymmetry shifted from the dominant limb at baseline to the trained, non-dominant limb following the training intervention. However, the individual responses were highly variable, as the magnitude of strength asymmetry decreased (40%), increased, (40%), or was relatively unchanged (20%). Collectively, these data show that unilateral non-dominant limb training reversed the direction of muscle strength asymmetry yet maintained its magnitude.

PURPOSE: The purpose of the present study was to investigate physiological and cognitive changes following a 6-week lower-body resistance training protocol. METHODS: Eight healthy men volunteered to participate in a 6-week resistance training protocol using the back squat (BS) and conventional deadlift (DL). Each participant went through a 1-week pre-testing period consisting of anthropometric measurements, vertical jump performance, 1-repetition maximum (1RM) testing of BS and DL, maximal aerobic capacity (VO\textsubscript{max}), cognitive performance, and total mood disturbance (TMD). Participants were then randomly placed into one of two experimental groups. The two groups were 90-seconds (90s) rest between sets (n= 4) and 3-minutes (3m) rest between sets (n= 3). Each group came into the lab for testing sessions twice per week, separated by at least forty-eight hours. In each session, the participants performed 3 sets of 5 repetitions using eighty-five percent of the previously determined 1RM for DL and BS. RESULTS: Analysis of variance (ANOVA) revealed a main effect of time for BS (p < 0.026), and main effect for group of vertical jump (p < 0.001). The 90m group increased BS performance (p < 0.020), while the 90m group improved vertical jump (p < 0.031). Group by time interactions were observed for two measures of cognitive performance: Interference score (p < 0.048) and Word-Color score (p < 0.050). Additionally, a group by time interaction was also observed for TMD (p < 0.004). Despite the trending increase of executive function in the 90s group, a worsened TMD score post-intervention was observed (p < 0.008). CONCLUSION: Minimal rest improved power within the 90s group while the 3m group significantly improved lower body strength. Cognitive function only appeared to improve in the 3m group. Despite no increase in strength for the 90s group, it appears minimal rest is advantageous for athletes looking to enhance power performance, although further research is necessary.

When designing training protocols, safety and effectiveness are the ultimate goals, with safety being a prerequisite of effectiveness (a protocol cannot be effective if not safe first). However, in January 2017, three Pacific-12 Conference football athletes were hospitalized with rhabdomyolysis. The affected players were supervised by a strength and conditioning coach (SCC), certified by the U.S. Track and Field and Cross Country Coaches Association (USTFCCCA). The National Collegiate Athletic Association (NCAA) only requires a nationally-accredited strength and conditioning certification program and USTFCCCA is one of them. This revised the debate about the effectiveness of several SCC certifications. Among them, the Collegiate Strength and Conditioning Coaches association (CSCCa), the only SCC certifying organization that includes a two-part practical in their exam, claim they are the only ones devoted to meeting the unique needs of the collegiate SCC. We used 2016-17 NCAA DI-III championship data to determine coaching effectiveness. PURPOSE: To investigate retrospectively the relationship between NCAA national championship data and CSCCa-certified SCCs. METHODS: Championship data was retrieved from NCAA archives. All SCCs, who won national championships in any sport within the past year/season, were recruited via email/phone in order to acquire information. All SCCs, who won national championships in any sport within the past year/season, were recruited via email/phone in order to acquire information. The regulation of the strength and conditioning championship teams and for 15.5% of championship teams. The z-score is 5.9979. The (one-tailed hypothesis, significance level at 0.05), we tested for statistical significance. RESULTS: Last season/year, CSCCa-certified coaches worked for 2.7% of NCAA non-championship teams and for 15.5% of championship teams. The z-score is 5.9979. The p-value is 0.0001. The result is significant at p<0.05. Conclusion: The SCC credential is essential for most NCAA teams. The regulation of the strength and conditioning world is crucial to prevent future incidents of unsafe and therefore, ineffective exercise prescription. Without accounting for other factors, the process of obtaining a CSCCa certification could be a potential solution to increase the effectiveness of SCCs.

It has been demonstrated that increasing caloric expenditure through exercise participation is one mechanism by which to modify caloric balance in favor of weight loss. While chronic resistance training (RT) has been demonstrated to elevate resting metabolic rate (RMR) due to increased lean mass, there has been less research on the acute effects of a single bout of resistance training on RMR. PURPOSE: To determine the effects of an acute bout of resistance training on the 24 h RMR of college-aged males. METHODS: Ten healthy men aged 18-24yr performed 8 exercises (2 sets, 10 repetitions, 2 min recovery, 70% IRM & 8RM) following ACSM Guidelines for RT. Subjects reported for testing following a 12 h fast and engaged in 7, 30 min RMR measurements over the next 24 h. Subjects completed both an experimental (RT) and control (no exercise) day separated by 1 week. RESULTS: RMR (kcal) data was analyzed using a 1-way ANOVA with repeated measures on 2 factors (group and time). Statistical analysis revealed that there was no significant main effect for group (F[1, 17] = 2179.58; p = 0.001). Despite the trending increase of executive function in the 3m group, a worsened TMD score post-intervention was observed (p < 0.008). CONCLUSION: We conclude that an acute bout of RT, following ACSM guidelines, did not significantly impact RMR in RT males 24 hrs post-exercise.

<table>
<thead>
<tr>
<th>Table 1. Mean 24-hour RMR Values by Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>RMR Measurement</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Experimental (kcal)</td>
</tr>
<tr>
<td>1922.76 ± 118.57</td>
</tr>
<tr>
<td>2199.89 ± 118.57</td>
</tr>
<tr>
<td>2426.10 ± 118.57</td>
</tr>
<tr>
<td>2066.59 ± 118.57</td>
</tr>
<tr>
<td>2427.42 ± 118.57</td>
</tr>
<tr>
<td>2205.77 ± 118.57</td>
</tr>
<tr>
<td>2008.55 ± 118.57</td>
</tr>
<tr>
<td>Control (kcal)</td>
</tr>
<tr>
<td>1783.70 ± 118.57</td>
</tr>
<tr>
<td>2336.24 ± 118.57</td>
</tr>
<tr>
<td>2189.38 ± 118.57</td>
</tr>
<tr>
<td>2010.28 ± 118.57</td>
</tr>
<tr>
<td>2392.67 ± 118.57</td>
</tr>
<tr>
<td>2180.48 ± 118.57</td>
</tr>
<tr>
<td>2109.41 ± 118.57</td>
</tr>
</tbody>
</table>

Note: Values are means ± standard error.

<table>
<thead>
<tr>
<th>Table 2. Mean RMR Values across Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>RMR Measurement</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>kcal</td>
</tr>
<tr>
<td>1855.23 ± (83.85)</td>
</tr>
<tr>
<td>2268.07 ±* (83.85)</td>
</tr>
<tr>
<td>2307.74 ±* (83.85)</td>
</tr>
<tr>
<td>2038.43 ±* (83.85)</td>
</tr>
<tr>
<td>2410.04 ±* (83.85)</td>
</tr>
<tr>
<td>2193.13 ±* (83.85)</td>
</tr>
<tr>
<td>2058.98 ±* (83.85)</td>
</tr>
</tbody>
</table>

Note: Values are means ± standard error. = Significant difference vs. Measure 1;  = Significant difference vs. measure 4

Cluster sets (CLU), a training method in which a brief rest is inserted between a group of repetitions, attenuates the loss in power typically observed in traditional set (TRD) configurations during resistance training. Training studies report greater gains in strength and power when using CLU at lower intensities. However, few data exist on the kinetics and kinematics of CLU at higher intensities (~80%). PURPOSE: To compare the kinetics and kinematics during TRD and CLU at a high intensity. METHODS: Eight resistance trained men (23 ± 3.3; 177 ± 7.2 cm; 82.7 ± 11.0 kg; 11.9 ± 3.5% body fat) had body composition and one-repetition maximum (IRM) back squat assessed. After at least 48 hours, in a randomized crossover, participants completed 4 sets 6 repetitions (TRD) with 180 seconds inter-set rest or 4 sets 2 clusters
of 3 (x [2 x 3]) (CLU) with 30 seconds intra-set rest and 150 seconds inter-set rest, both configurations at 80% 1 RM separated by 72 hours. Data were collected using a bilateral force plate and motion capture system, and smoothed using a 4th order Butterworth filter (12 Hz cutoff). Data were analyzed by a repeated measures ANOVA (p ≤ 0.05). RESULTS: A significant CONDITION x SET interaction was observed, with lower power outputs during TRD for SET 2 (p = 0.008), 3 (p = 0.019) and 4 (p = 0.002) compared to SET 1. Only SET 4 was significantly lower than SET 1 (p = 0.006) in the traditional CONVENTIONAL interaction (p < 0.001). The pattern observed in the CONVENTIONAL interaction was also observed. Compared to REP 1, significantly lower power outputs were observed for every subsequent repetition during TRD. In contrast, reduced power output was not observed until later in the set when performing CLU. The greater mean power was attributed to velocity, as no main effect or interactions were observed for mean force (p ≤ 0.05). A CONDITION x REP interaction approached significance (p = 0.069) for velocity, while the CONDITION x SET interaction effect was significant (p < 0.001), mirroring the pattern observed in mean power. CONCLUSION: These data demonstrate that the greater power observed during resistance exercise at lower intensities is also observed at higher intensities, and is attributed to higher velocities. Long-term training studies at higher intensities are warranted to determine the adaptations resulting from consistent CLU training.

1789 Board #50 May 31 2:00 PM - 3:30 PM One Set to Failure per week Increases Strength More Effectively than Traditional Resistance Training  

P. Gage Murphy, Danny Domínguez, Murat Karakulut,  
University of Texas at Rio Grande Valley, Brownsville, TX.  
(No relevant relationships reported)

PURPOSE: To determine the efficacy of the current recommendations for increasing strength compared to other, less time consuming programs in untrained sedentary and recreationally active females. METHODS: Forty-six female subjects (age = 22.7 ± 4.1 yrs) were randomly assigned to one of four groups that determined the resistance training program they would follow for 6 weeks. All resistance training programs utilized the same two exercises on the same equipment: leg extension and leg curl. The four training groups included: a traditional group (HIGH), two blood flow restriction (BFR) groups (BFR-1 and BFR-2), and a minimalist group (MIN). HIGH group followed ACSM guidelines for increasing strength, which comprised of 3 sets of 10 repetitions 3xw/k at 50% of 1RM. BFR-1 program consisted of 4 sets of 10, 15, 15 reps 1xw/k at 20% of 1RM. BFR-2 program consisted of 4 sets of 30, 15, 15, 15 reps 2xw/k at 20% of 1RM. MIN program consisted of 1 set to failure 1xw/k at 75% of 1RM. Weight was added each week if each subject completed the previous weeks program with proper form. Prior to and following 6 week training period subjects were tested for 1RM strength on leg extension and leg curl exercises. All subjects were at least 8 hours fasted as well as hydrated (determined using clinical urine refractometer) for pre- and post-testing. RESULTS: One-way ANOVA found no between-group differences in any of the outcome measures of interest at baseline. Repeated measures ANOVA found a significant time main effect for 1RM (p < 0.01) with all groups improving in strength for leg extension and leg curl. There was also a significant condition difference (p < 0.01) for the MIN group in the 1RM for the leg extension, representing that increases in leg extension 1RM by MIN group was significantly greater than all other conditions. CONCLUSION: All training programs were effective at increasing 1RM strength for the leg extension and leg curl. Strength increases by the MIN group for the leg extension were significantly greater than all other groups. These results indicate that a less frequent, more time efficient program is more effective than the current recommendations for increasing strength and it may be an alternative training approach for those who want to maximize the time spent for training but still maximize benefits.

Previous studies demonstrated the importance of analyzing movement propulsive velocity (MPV) loss during resistance training as an estimate of intensity of effort. However, these studies involved sets performed with maximal intended velocity and used special devices, which is not usual for most people practicing resistance training. PURPOSE: The purpose of the present study is to evaluate the changes in MPV during resistance training with different loads while the trainees are attempting to move the load at a pre-determined repetition duration. METHODS: Twenty-one resistance-trained men (age: 25.7 ± 5 years; height: 177.0 ± 7.2 cm; mass: 85.4 ± 13.56 kg) participated in the study. Participants performed two tests sessions. The first to determine 1 repetition maximum (1RM) load, and the second to evaluate MPV loss during a set to momentary muscle failure (MF) performed at 75% and 50% of 1RM using a 2 second concentric and 2 second eccentric repetition duration controlled by a mobile app metronome. RESULTS: Mean one-repetition maximum 1RM load was 98±21.6 Kgs, with a relative strength of 1.15±0.2, obtained by ratio of the load of 1RM relative to body mass. The average number of repetitions performed at 75% of 1RM was 7.5±1.7 and 13.7±2.8 for 50% of 1RM. With 75% of 1RM there was a significant difference among repetitions MPV. Post hoc analysis revealed that MPV in the last repetition was lower than in the preceding three. Similarly, MPV during the penultimate repetition was lower than during the antepenultimate and the 4th from last. However, there was no difference in MPV between the 4th last and the antepenultimate repetition. Velocity loss from

THURSDAY, MAY 31, 2018

Abstracts were prepared by the authors and printed as submitted.
Regarding resistance training objectives, muscle hypertrophy and strength are primary goals. The movement velocity appears to be important to improve muscle mass and strength. Eccentric exercises have been attributed to greater gains in muscle cross-sectional area, mainly because of a greater time under tension, inducing more stress to muscle fibers and greater adaptation. Therefore, manipulation of the eccentric phase tempo may have different implications to results in resistance training. PURPOSE: Evaluate the effects of two different velocities of eccentric phase in isotonic contractions on muscle hypertrophy and strength of the quadriceps femoris in healthy adults.

METHODS: Ten healthy adults underwent in a training program consisting of knee extensions unilaterally, where each leg was allocated in a different pattern of movement. These consisted of two groups Isotonic contractions of one second in concentric phase, 0 seconds in a transition phase and 2 seconds in eccentric phase (G2S); Isotonic contractions of 1 second in concentric phase, 0 seconds in a transition phase and 4 seconds in eccentric phase (G4S). Each protocol consisted of 5 series of exercise until volitional failure, with 70% of 1 maximal repetition and 3 minutes of rest between series, 2 times a week. RESULTS: We observed muscle hypertrophy response over time for all muscles (Rectus Femoris (RF), P = 0.00; Vastus Lateralis (VL), P =0.00 and Vastus Medialis (VM), P =0.00; the difference between treatments was observed only for VM (P =0.02). The effect size was: RF, 0.78 and 0.82; VL, 1.05 and 0.98; VM, 0.59 and 1.08, for G2S and G4S, respectively. Both groups improved strength over time (P =0.00), with the effect size for G2S of 0.63 and G4S 0.53, with Hedge’s g approach; however, there was no difference (P=0.05) between treatments. Time Under Tension (TUT) was different between groups (G2S=1300±635 and G4S=2535±654).

CONCLUSIONS: Our results suggest that the different eccentric phase tempo is not able to produce differences in strength and muscle hypertrophy for knee extenders, except for the Vastus Medialis, although the time under tension was greater in G4S.

The antepenultimate to the penultimate repetition was 5.33%, from the last to the penultimate was 22.11% and the accumulated loss from the last to the 4th last was 25.4%. ANOVA for MPV values obtained at 50% 1RM load showed no significant effects, which suggested the same predetermined velocity pattern was maintained until reaching MP.

CONCLUSIONS: Accessing MPV loss during resistance training using simple methods can be an important tool for standardize the intensity of effort employed during maximal training with high loads, but not with light loads. This can be specially useful in clinical conditions where maximum exertions are contraindicated.
lactate (p<0.001) and pulse rate (p=0.040). The variables that predicted significant increase in pH were mean arterial blood pressure (p<0.001), temperature (p=0.010), and pregnancy status (p=0.026). Sex (p=0.316), age (p=0.714), obesity (p=0.195), and blood alcohol content (p=0.624) were not statistically significant. Injury severity score was a trending predictor (p=0.057). CONCLUSIONS: The strong association between lactate and pH may indicate a need to re-examine components of the lactate/pH framework. The associations between blood pressure, pulse, and pH implicate the kidney; further work needs to be done in delineating renal function and its role in modulation of pH and cardiovascular function.

1795 Board #56
May 31 3:30 PM - 5:00 PM
Home-based Exercise Improves Heart Contractility Determined by 2D Speckle Tracking Strain in Renal Transplant Recipients
Laura Stefani,1 Riggs Klika, FACSM,2 Gianni Pedriozetti,2 Chiara Ingletto,1 Benedetta Tosi,2 Stefano Pedri,2 Giorgio Galanti1 (1University of Florence, Firenze, Italy; 2University of Trieste, Trieste, Italy). (Sponsor: Riggs J. Klika, FACSM)

(Purpose: Renal transplant recipients (RTR) are at high risk for adverse cardiovascular events due to potential cardiotoxic effects of multiple drug therapies and often sedentary behavior. Moderate intensity exercise has been shown to decrease the risk of these potential events. The purpose of this study was to evaluate the changes in myocardial function using global longitudinal strain (GLS), mean strain (Lo) and ejection fraction (EF) determined from 2D speckle tracking strain (STS) before and after participation in a home-based aerobic and strength training program in RTR and to determine if there was a sex difference in the response.

METHODS: A group of 30 RTR’s (12 females and 18 males, aged 47.9 ± 12.3 y, BMI: 24.4 ± 3.3, average age at transplant 38.6 ± 13.1) participated in an exercise program for 12 months. Individualized exercise programs were created based on the results of a cycle ergometer test, hand grip dynamometry, bioelectrical impedance and skinfold analysis with the goal of achieving 150 minutes*wk -1 of activity at moderate intensity (minimal levels were set at 3×week -1 with a goal of at least 30 minutes*session -1 . Subjects completed 2D echocardiographic examination at T 0, T 6, and T 12 months. Repeated measure ANOVA and a two-way mixed ANOVA with Tukey post-hoc analysis were used to detect differences across time and sex differences.

RESULTS: GLS and Lo increased significantly from T 0 to T 12 and remained high at T 2 (GLS: -17.9 ± 3.3 vs -20.4 ± 3.2 and -20.5 ± 3.8 and Lo: -18.3 ± 3.8 vs -20.4 ± 3.3 and -20.4 ± 3.0) with no changes in EF over time (EF % 60.4 ± 5.3 vs 61.8 ± 6.9 and 64.3 ± 6.2). Men were significantly older at time of transplant (33.8 ± 12.6 vs 45.7 ± 11.4, p < 0.05) with lower cardiac function at T 0 (-17.1 ± 3.7 vs -19.2 ± 2.2), p < 0.05 than women and accounted for a majority of the improvement in cardiac function in this sample. CONCLUSIONS: A moderately intense exercise program was well tolerated by RTR’s and significantly improved heart function in men during the initial 6 months of the program. More work is needed to determine if these improvements are maintained with long-term training adaptations. Future studies should investigate the potential role of GLS in the assessment of cardiac function following unsupervised exercise training.

Dehydration, exertional hyperthermia, and muscle damage commonly occur in athletic, military, and occupational settings, yet, their combined effects on biomarkers of acute kidney injury are not well understood. PURPOSE: Investigate the combination of dehydration, muscle damage, and exercise in the heat on biomarkers of renal stress.

METHODS: Six male participants (age 24±5 y, body mass 74±6.3 kg, body fat 14.3±4.1%) completed two trials, one euhydric (EU; fluid replacement ≤2% body mass loss) and one dehydrated (HY; fluid replacement ≤2% body mass loss) with 12 days in between trials (at least 72h without exercise), separated by ≥72 h. Trials consisted of muscle damaging unilateral eccentric knee flexion, 60 minutes of treadmill running (~60% VO max) in the heat (33 °C, 54% RH), and 30 minutes of passive recovery. Participants were provided a rehydration protocol in both trials and returned 72 h later for a follow-up visit.

RESULTS: Urine osmolality when HY was greater pre- (HY: 1045±102, EU: 612±142 mOsm/kg; p<0.01) and post-hydration (HY: 771±185, EU: 503±205 mOsm/kg; p<0.01), but not 24-h post (HY: 545±310, EU: 545±404 mOsm/kg; p = 0.98). Serum osmolality was also different pre-trial (HY 301±5, EU 290±5 mOsm/kg; p = 0.02), but was similar 24-h post (HY 295±4, EU 293±3 mOsm/kg; P = 0.29). Isometric strength was reduced regardless of condition immediately after eccentric exercise (grand mean Δ = -33.6±27.9 N.m, p = 0.03). Rectal temperature increased to a greater degree when HY (2.1±0.6 °C) compared to EU (1.6±0.4 °C; P = 0.01). Plasma neutrophil gelatinase-associated lipocalin (pNGAL) increased independent of condition (grand means: pre- 59.0±7.3, post-exercise 77.6±12.0 ng/mL, p<0.01), but was not different between trials (P = 0.84). However, percent changes from baseline in pNGAL were greater, regardless of time, when HY compared to EU (1.7±5.5% vs 1.0±1.1%, p = 0.03, P < 0.01). CONCLUSION: Exercise in the heat with muscle damage increased renal strain when HY and resulted in greater changes in pNGAL, a biomarker of acute kidney injury. These preliminary findings suggest that improper fluid consumption prior to and during exercise may augment renal stress, yet the long-term consequences of these detriments require further investigation.

*Supported by funding from Central States ACSM Student Grant Award

Purpose: Early-stage chronic kidney disease (CKD) is prevalent in pre-diabetics. A healthy lifestyle is promoted in those at high risk of developing type 2 diabetes (T2DM) yet any relationships between physical activity and nutritional intake on kidney function in these individuals is unknown. This study aimed to quantify the independent associations that may exist between changes in physical activity, dietary fats and fibre, and estimated kidney function in individuals with pre-diabetic stage 2 CKD. METHODS: The study analysed data from a subset of adults at high risk of T2DM recruited to a lifestyle education programme (Yates et al. Diabet Med. 34:698-707, 2017). At baseline and 24 months, 126 (84 male) pre-diabetic CKD stage 2 (mean(SD) baseline estimated glomerular filtration rate (eGFR) 76.7(8.0) ml/min/1.73 m 2 , age 66(6) years, BMI 31.6(5.1) kg/m 2 ) provided dietary data via the Dietary Instrument for Nutrition Education food frequency questionnaire and physical activity and steps by 7-day accelerometry. Linear regression examined the independent associations of baseline and change at 24 month in eGFR and average number of steps, moderate to vigorous physical activity (MVPA), total fat and unsaturated fat, and dietary fibre against 95% level of significance (p<0.05). RESULTS: Between baseline and 24 months eGFR decreased by -3.04(9.4) ml/min/1.73 m 2 . There were no changes in MVPA, steps, fat and fibre intake but responses were highly variable between individuals. Baseline and change in eGFR at 24 months were positively associated with baseline MVPA (Pearson correlation, r=0.182, p=0.02 and r=0.160, p=0.04 for baseline eGFR and change in eGFR respectively). MVPA was not change in eGFR. There was a positive association between change in eGFR and average number of steps at baseline (r=0.40, p=0.059). However, after adjustment for known confounders (including age, sex, BMI, smoking status, ethnicity), these associations disappeared. There were no associations between eGFR and dietary fats (total and unsaturated), and fibre. Conclusions: Higher MVPA and average number of steps were associated with (but not predictive of) higher eGFR in a group of adults with pre-diabetic stage 2 CKD. Therefore, a healthy active lifestyle should be encouraged in pre-diabetes to prevent decline in kidney function.
4. Derived Activity Categories vs. Accel Variables

Results from Five Random Forest Models to Predict Mechanical Load.

<table>
<thead>
<tr>
<th>Model</th>
<th>R²</th>
<th>Median Absolute Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Known Activity Categories</td>
<td>0.44</td>
<td>0.43</td>
</tr>
<tr>
<td>2. Accel Variables</td>
<td>0.65</td>
<td>0.27</td>
</tr>
<tr>
<td>3. Known Activity Categories + Accel Variables</td>
<td>0.78</td>
<td>0.20</td>
</tr>
<tr>
<td>4. Derived Activity Categories</td>
<td>0.32</td>
<td>0.49</td>
</tr>
<tr>
<td>5. Derived Activity Categories + Accel Variables</td>
<td>0.66</td>
<td>0.23</td>
</tr>
</tbody>
</table>

**CONCLUSION:** Models containing the accel variables performed better than those containing only activity categories. The accel data can be used to predict categories and GRF. Accels provide valuable objective information when evaluating mechanical loading on bone and should be used when examining bone-strengthening physical activity in free-living situations.

**URINARY INCONTINENCE IN POST-PARTUM WOMEN**

Urinary incontinence is often considered a disorder by pelvic floor dysfunction in post-partum women. Thus we think a lack of care during the puerperal period also influences instability of the pelvic girdle as well as pelvic floor dysfunction. A lumbar X-ray examination was performed as diagnostic imaging for low back pain, and alignment abnormality in the pelvic girdle was often found. At our clinic, diagnostic imaging with a simple load as one leg standing was performed in addition to the above cases to emphasize abnormality in pelvic girdle.

**PURPOSE:** To investigate alignment abnormality of pelvic girdles, in particular symphysiolysis, in one leg standing X-ray of the pelvic girdle in post-partum women, and to examine the relationship with alignment abnormality in pelvic girdles and the cross-sectional areas (CSA) of the psoas major.

**METHODS:** Participants were 30 parous women (61.5±14.5yr, 154.6±6.7cm) who consulted us with low back pain at our clinic. Lumbar X-ray, one leg standing X-ray, and a lumbar MRI were conducted. The difference in the height between right and left superiors pubis rami (the malalignment of pelvic) was measured from one leg standing X-ray. The CSA of the psoas major was measured from a lumbar MRI at L4-L5, and the difference between right and left CSA was calculated. Analysis of the relationship between the malalignment in pelvic and the CSA of the psoas major was performed using Spearman’s rank correlation coefficient.

**RESULTS:** The malalignment in pelvic measured from a one leg standing was 1.64±1.39 mm (mean ± SD). These malalignment in pelvic varied between right leg standing and left leg standing. The amount of variation between right leg standing and left leg standing was 1.41±0.894. The CSA of psoas major was 711.5±146.6 mm². The difference in CSA between right and left was 13.0±7.31 %. The relationship between the malalignment in pelvic and the CSA of psoas major was not statistically significant (r = 0.213, p>0.05), but the relationship became significant by increasing number of experiments (power analysis; n = 77).

**CONCLUSIONS:** The alignment abnormality in pelvic girdles could be estimated by a one leg standing X-ray examination. These results suggest that lack of care during the puerperal period influences alignment abnormality in pelvic girdle, and may lead to a future orthopedic disease.
Achilles tendinopathy is a common overuse condition in runners, and if degenerative organization), increased ipsilateral composite dorsiflexion was found. Lower PSFR has been linked to degraded mechanical properties of tendons. Although Achilles tendon stiffness is not the sole factor affecting ankle ROM, findings from this study depict the relationship between the two variables. Where PSFR was at or below the low end of previously-established healthy ranges (1.8-2.4), lower BMI was found with lower PSFR.

1802 Board #63 May 31 3:30 PM - 5:00 PM Measurement Of Nitrate And Nitrite In Biopsy-Sized Muscle Samples Andrew R. Coggan, FACSM, Ashley D. Troutman, Mary Beth Brown, FACSM. Indiana University Purdue University Indianapolis, Indianapolis, IN. (No relevant relationships reported)

Studies of rats have demonstrated that skeletal muscle plays a central role in whole-body nitrate (NO)/nitrite (NO2)/nitric oxide (NO) metabolism. The small size of human muscle biopsy samples, however, presents an analytical challenge in this context. Indeed, a recent study by Nyakairu et al. (J Appl Physiol 2017: 123:637-644) reported that NO2 was below the limit of detection (LOD) using the “gold standard” chemiluminescent method even when assaying 40 mg of tissue. PURPOSE: To develop a method to precisely and accurately quantify the NO2 and NO3 content of biopsy-sized muscle samples. METHODS: NO2 and NO3 were extracted from rat soleus muscle samples using methanol combined with mechanical homogenization + ultrasound, bead beating, pulverization, or pulverization + 0.5% Triton X100. After centrifugation to remove precipitated proteins, NO2 and NO3 were measured using a dedicated high performance liquid chromatography analyzer with a LOD of <0.5 pmol. RESULTS: Mechanical homogenization + ultrasound resulted in the lowest NO2 content (62.16±16 pmol/mg), with high variability (CV>50%) across samples from the same muscle. NO2 content (1.00±0.18 pmol/mg) was also elevated, suggestive of NO2 reduction during tissue processing. Bead beating or pulverization yielded higher NO2 and lower NO3 levels, but reproducibility was still poor. Pulverization + 0.5% Triton X100 provided the highest NO2 (97.15±10 pmol/mg) and lowest NO3 (0.59±0.16 pmol/mg) contents, with the least variability (CV<15%). These values are consistent with literature data from larger rat muscle samples analyzed using the chemiluminescent method. CONCLUSIONS: We have developed a method capable of measuring NO2 and NO3 in muscle samples as small as 10 mg. The theoretical limit is even lower, i.e., 1 mg for both NO2 and NO3 and 5 ng for NO2 alone. This method should prove highly useful in investigating the role of skeletal muscle NO2/NO3 metabolism in both healthy and diseased subject populations, in response to exercise and dietary interventions, etc.

1803 Board #64 May 31 3:30 PM - 5:00 PM 2D Ultrasound-Based Characterization of Achilles Tendon Micromorphology in Runners Using Spatial Frequency Parameters Ari L. Baquet1, Kai-Yu Ho2, Yu-Jen Chang2, Abbigail Fietzer2, Michelle Evers1, Caleb Strassberg3, Greg Bashford4, Kornelia Kulig5. 1University of Southern California, Los Angeles, CA. 2University of Nevada, Las Vegas, Las Vegas, NV. 3West Virginia University, Morgantown, WV. 4University of Nebraska-Lincoln, Lincoln, NE. (No relevant relationships reported)

Achilles tendinopathy is a common overuse condition in runners, and if degenerative can be a precursor to rupture even in absence of symptoms. Ultrasoundography and spatial frequency analysis are capable of detecting impaired collagenous organization and tensile strength in Achilles tendons, often not plainly visible. These tools, along with basic clinical tests and athletic history, may help characterize the traits and risk factors for sub-clinical Achilles tendinopathy. PURPOSE: To characterize athletic history, waist-to-hip ratio, BMI, ultrasoundography findings, heel raise endurance, and composite dorsiflexion associated with symptomatic and asymptomatic Achilles tendons in runners. METHODS: 48 self-identified runners (16 F, 32 M; 18 ± 9 years) with symmetrical 7.6 years of running experience were examined. Heel raise endurance and knee-to-wall composite dorsiflexion were assessed. Height, weight, and waist and hip circumferences were taken, and participants filled out a VISA-A and activity questionnaire. Achilles ultrasound images were analyzed for peak spatial frequency radius (PSFR), P6 width (an indirect measure of collagen bundle size), and Q6 (ratio of PSFR to P6) with MATLAB code developed for prior tendon research. Data were sorted by PSFR into 4 ascending groups (1.50-1.69, 1.70-1.89, 1.90-2.09), 2.10-2.29) and 1-way ANOVA with post-hoc analyses was used to detect and compare between-group differences. RESULTS: One-way ANOVA revealed statistically significant differences for knee-to-wall (p=0.043) and BMI (p=0.038). Post-hoc analyses showed that knee-to-wall was higher at PSFR of 1.50-1.69 when compared to PSFR of 1.90-2.09 (p=0.032). Decreased BMI was found at PSFR of 1.50-1.69 versus 1.70-1.89 (p=0.001).

CONCLUSIONS: In tendons with decreased PSFR (impaired collagenous organization), increased ipsilateral composite dorsiflexion was found. Lower PSFR has been linked to degraded mechanical properties of tendons. Although Achilles tendon stiffness is not the sole factor affecting ankle ROM, findings from this study depict the relationship between the two variables. Where PSFR was at or below the low end of previously-established healthy ranges (1.8-2.4), lower BMI was found with lower PSFR.

1804 Board #65 May 31 3:30 PM - 5:00 PM Test-Retest Reliability of Muscle Cross Sectional Area and Echo Intensity in Upper Extremity Muscles Brett Pexa1, Joseph B. Myers2, Hayden Gianuli3, Eric D. Ryan1. 1University of North Carolina at Chapel Hill, Chapel Hill, NC. 2Tampa Bay Rays Baseball Organization, St. Petersburg, FL. (Sponsor: Brian Pietrosimone, FACSM) (No relevant relationships reported)

Ultrasoundography has become a popular tool to simultaneously examine muscle size and quality due to their important role in muscle function. These variables demonstrate excellent reliability in the lower extremity but have yet to be assessed in upper extremity. PURPOSE: To determine the test-retest reliability of US-derived cross sectional area (CSA) and echo intensity (EI) in the infraspinatus, supraspinatus, and flexor carpi ulnaris. METHODS: Twenty two shoulders and forearms were scanned with a brightness mode US one week apart (n=11, age: 19.9 ± 0.94 years, height: 180 ± 6.73cm, mass: 78.37±12.17kg). Shoulder muscles were panoramically assessed at 1/3 the distance from the root of the spine of the scapula and the acromial angle. The flexor carpi ulnaris was assessed 4 cm distal to the medial epicondyle. Images were reduced in ImageJ to assess CSA and EI in each muscle. Relative and absolute consistency were assessed with intraclass correlation coefficients (ICC) and standard error of measurement (SEM), respectively. Minimal detectable change (MDC) scores were determined to identify a difference or change that can be considered real. RESULTS: Infraspinatus CSA (ICC 2,1=.960) and EI (ICC 2,1=.850) demonstrated the highest relative consistency among the three muscles (supraspinatus CSA: ICC 2,1=.717, EI: ICC 2,1=.762; flexor carpi ulnaris CSA: ICC 2,1=.954, EI: ICC 2,1=.676). Infraspinatus CSA and EI (CSA: SEM=3.28%; MDC=9.09%; EI: SEM=9.40%, MDC=26.05%) also demonstrated the lowest SEM and MDC, expressed as a percentage of the mean values (supraspinatus CSA: SEM=15.83%, MDC=43.89%; EI: SEM=12.99%, MDC=36.01%; flexor carpi ulnaris CSA: SEM=13.56%, MDC=37.61%; EI: SEM=9.90%, MDC=27.45%). CONCLUSIONS: Of the upper extremity muscles examined, the infraspinatus muscle had the highest relative consistency, and the lowest absolute consistency and MDC scores for CSA and EI. Furthermore, as the primary stabilizer of the glenohumeral joint, future studies may consider examining infraspinatus CSA and EI to assess upper extremity muscle morphology following an intervention, treatment, and/or condition.

1805 Board #66 May 31 3:30 PM - 5:00 PM Assessment of Muscle Injury Using Diffusion Kurtosis MRI and H MRS Richard M. Lovering, Shanna R. Iyer, Jiachen Zhuo, Steven Roys, Wenjun Zhu, Su Xu. University of Maryland School of Medicine, Baltimore, MD. (Sponsor: E.G. McFarland, FACSM) (No relevant relationships reported)

Muscle strain injuries are typically diagnosed based on physical exam and patient history, although muscle strain injuries can be detected by T2-weighted magnetic resonance imaging (MRI) and Diffusion Tense Image (DTI). Proton MR spectroscopy (‘H MRS) enables the study of metabolic changes in vivo, such as fat content stored inside fibers as droplets (intra-myocellular lipids, IMCL) or in adipocytes between myofibers (extra-myocellular lipids, EMCL). Diffusion kurtosis imaging (DKI) is a novel technique that allows in-vivo characterization of diffusion of water in muscle. PURPOSE: To determine the effects of injury on IMCL and EMCL in vivo, and if variables calculated from DKI would serve as an earlier and more sensitive marker of damage after muscle strain injury in rats. METHODS: The tibialis anterior muscles (TA) of anesthetized Sprague-Dawley rats (N=3, 300 ± 5 g) were injured by 50% lengthening contractions. DTI and DKI were acquired over the same region as axial T2 images. A Point-RESolved Spectroscopy pulse sequence was used for MRS data acquisition from TA muscle. LCMedal package (Provencher 2001, Version 6.3) was used for quantification of the MRS data. TA imaging was compared to functional
changes, and BODIPY 495/503 staining of TA cross-section sections was used to identify lipid depositions. RESULTS: Injury was confirmed by a significant loss of isometric torque (70 +/- 2% loss). There was a significant lactate accumulation (>= 68 mM) with corresponding reductions of EMCL and total creatine (Cr) at 4 hours post injury. The complicated metabolic patterns were expected during muscle regeneration, remodeling, and maturation. BODIPY staining confirmed the changes quantified by the 'H MRS findings. For DTI, mean diffusion (MD) and fractional anisotropy (FA) values were little and returned to normal by the time of functional recovery (day 21). Mean kurtosis (MK), however, was significantly different at all time points and remained high, even after recovery. CONCLUSIONS: These data suggest that DKI may be a useful indicator of overall muscle health. Furthermore, EMCL and IMCL levels, determined from 'H MRS, can be used as biomarkers of metabolic alterations following muscle injury and subsequent recovery.

1806 Board #67 May 31 3:30 PM - 5:00 PM Near-Infrared Spectroscopy Derived Total Heme vs. Assay Derived Total Heme Kaylin D. Didier, Shane M. Hammer, Kelsey J. Phelps, John M. Gonzalez, Thomas J. Barstow, FACSM. Kansas State University, Manhattan, KS. (No relevant relationships reported)

PURPOSE: The primary aim of this study was to compare frequency-domain multi-distance (FDMD) Near-Infrared Spectroscopy (NIRS) derived total heme concentration in the triceps brachii (myoglobin) to the assay derived total heme concentration. METHODS: Five swine were transported to the Kansas State University Meats Laboratory for harvest under federal inspection. Carcass measurements were taken on the same day as harvest. Immediately post draining of the carcass the NIRS probe was placed along the belly of the deltoideus (DT), triceps brachiti lateral head (TLH), tensor fasciae latae (TFL), longissimus dorsi (LD), biceps femoris (BF), and semitendinosus (ST) muscles and a measurement was taken for 1 min. The position of the probe was marked to accurately assess the same region of exposed muscle after processing. After the carcass was processed the muscles were exposed (removal of the skin and adipose tissue layer). The NIRS probe was placed on the exposed muscle and data was collected for 1 min. The muscles were then excised for chemical analysis.

RESULTS: The NIRS total heme signal with the skin intact was significantly less than the assay derived total hem (p<0.05). The NIRS total heme signal during the direct muscle condition was not significantly different from the assay derived total heme for BF, DT, ST, TFL, and TL (p>0.05), but was significantly less than the assay derived total heme for the LL muscle group (p<0.012). The NIRS total heme signal directly on the muscle was significantly correlated with the assay derived total heme concentration (r=0.56, p<0.0001). The NIRS total heme signal was significantly less for the intact skin compared to direct muscle conditions for BF, DT, ST, TFL, and TL (p<0.05), but not for the LL (p=0.922).

CONCLUSIONS: The similar total heme derived between the assay and the FDMD NIRS (during direct muscle measurements) indicates that the NIRS provides an accurate quantification of the total heme in the muscles, including myoglobin. However, when skin and adipose tissue are intact the signal is attenuated and should be taken into consideration.

1807 Board #68 May 31 3:30 PM - 5:00 PM Comparison between Dual X-ray Absorptiometry and Magnetic Resonance Imaging for Visceral Fat Assessment in Athletes Hiroko MURATA1, Tomoyoshi YAGI1, Taishi MIDORIKAWA2, Suguru TORII1, Eri TAKAI1, Motoko TAGUCHI1, Waseda University, Tokorozawa, Japan; ‘Obirin University, Machida, Japan. (No relevant relationships reported)

PURPOSE: Heavyweight athletes, e.g., linemen reportedly have excess body fat mass, increased cardiometabolic risk, and insulin resistance, compared to non-heavyweight athletes. Visceral fat is related to cardiometabolic risk. Visceral adipose tissue (VAT) mass is usually assessed with magnetic resonance imaging (MRI). However, this method is labor- and time-intensive. VAT measurement using dual X-ray absorptiometry (DXA) takes less time to scan and analyze findings than MRI. Moreover, DXA can accurately measure abdominal VAT in average-weight individuals. However, this method has not been validated in athletes with a wide range of body habitus. This study compared VAT volume measured by DXA (DXA-VAT) and MRI (MRI-VAT).

METHODS: The study included 30 male collegiate athletes (height 173.3±6.7 cm, weight 90.4±21.3 kg, body mass index 29.9±6.0 kg/m², waist circumference 90.9±16.4 cm) from the following sports: judo, American football, sumo, skiing, and weight lifting. Paired measurement of VAT was performed using MRI and DXA. MRI-VAT volume was calculated by integrating six 65-mm single MRI slices corresponding to the level of DXA-VAT volume measurement. Data were compared using a paired t-test and a Bland-Altman plot was used to assess systematic error.

RESULTS: DXA and MRI-VAT volume differed significantly (p<0.01). Regression analysis showed a linear relationship between DXA and MRI-VAT volume (r=0.90). The fit line for the relationship between MRI and DXA-VAT volume was calculated as follows: DXA-VAT volume = MRI-VAT volume + 97 (cm³). Bland-Altman analysis showed DXA-VAT volume overestimation by 94.5±5 cm³ compared with MRI-VAT volume, with no systematic error (p=0.203). Less subcutaneous abdominal fat in athletes than in nonathletes may cause overestimation of DXA-VAT volume.

CONCLUSIONS: DXA-VAT volume was overestimated compared with MRI-VAT volume, with strong correlations for a wide range of values. A new equation may be needed to assess DXA-VAT in athletes.

1808 Board #69 May 31 3:30 PM - 5:00 PM Utilizing Ultrasonic Imaging to Evaluate Acute Doppler Flow Adoptions of the Medial Elbow Arie J. van Duijn, Shawn D. Felton, Kevin P. Lynch, Mitchell L. Cordova, FACSM. Florida Gulf Coast University, Fort Myers, FL. (Sponsor: Mitchell L Cordova, FACSM) (No relevant relationships reported)

The use of musculoskeletal ultrasound quantification (MSKU) has been rapidly gaining use in the orthopedic clinical setting. An emerging feature of MSKU is Doppler imaging quantification (PDQI) that can be used to quantify circulation in MSK and provide a measure of tissue perfusion and/or inflammation.

PURPOSE: To examine the use of PDQI for evaluation of tissue perfusion of the ulnar collateral ligament (UCL) following an in-game performance in collegiate pitchers.

METHODS: Ten Division I collegiate baseball pitchers (mean age 20.4 ± 1.4 yrs and mean body fat percentage 18.6 ± 3.9%). With no history of significant upper extremity injuries participated. MSKU imaging was obtained with a GE LOGIQe ultrasound unit for each athlete prior to and immediately following (< 15 minutes) the pitching performance during his first game of the season. Post-imaging PDQI ratios were calculated to assess the maximum level of tissue perfusion of the UCL in the throwing arm.

RESULTS: Differences in maximum UCL PDQI ratios pre and post the first pitching outing of the season were analyzed through paired sample t-tests. There was no post significant difference (t(9) = 1.37, p<0.05) between the PDQI ratios before (mean max ratio: 0.02 ± 0.06) and after pitching (mean max ratio: 0.22 ± 0.29). Assessment of the following control variables: pitch count (F1,9 = 0.73, p> 0.42) and innings pitched (F1,9 = 0.37, p> 0.56) indicated no significant effect on the PDQI ratios.

CONCLUSIONS: No statistically significant difference in perfusion of the UCL, as expressed by PDQI ratios was found after a single pitching outing. However, a numerical increase in the mean PDQI ratio post pitching was seen. Upon further exploration of the data, it was noted that there was significant variability in ratio changes among the subjects, which may be improved upon by increasing the sample size and number of pitching outings. Further research is needed to evaluate the clinical significance of immediate perfusion changes during throwing.
software (OASys 1.0, Optasia Medical, Chaddie, UK). Pain and physical function were evaluated using the respective Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) subscales. RESULTS: Despite the non-weight-bearing nature of the DEXA scan, greater medial JSW narrowing of the involved knee was significantly correlated with greater WOMAC pain scores (Spearman correlation; R = 0.815; P=0.002). There were no significant correlations with lateral JSW of the involved knee, medial or lateral JSW of the uninvolved knee, and WOMAC subscales (p<0.05). There was strong test-retest reliability, for involved lateral compartment, and ICC> 0.95; standard error of the measurement (SEM)= 0.22 mm and medial (ICC= 0.99; SEM= 0.15 mm) DEXA-derived JSW using the semi-automatic software. CONCLUSIONS: The strong relationship between WOMAC pain and DEXA-derived JSW suggests potential use of DEXA as a practical tool for tracking severity and pain associated with KOA. Semi-automatic knee analysis software designed to evaluate radiographic images can reliably evaluate JSW from a DEXA-produced image. Further validation of DEXA-derived images of the knee for KOA diagnosis is warranted. Supported by: NIAMS (1R21AR067560-01) and the Rehabilitation Research Resource to Enhance Clinical Trials (1P2CHD086851-01).

1810 Board #71 May 31 3:30 PM - 5:00 PM Evaluating Near Infrared Spectroscopy Signals From Skeletal Muscle

ADEOLA A. SANNI, Kevin K. McCully. UNIVERSITY OF GEORGIA, Athens, GA.

(No relevant relationships reported)

Near Infrared Spectroscopy (NIRS) uses the relative absorption of light at 850 and 760nm to determine skeletal muscle oxygen saturation. There are currently disagreements in the literature over how to report oxygen saturation and the relative contributions of hemoglobin and myoglobin. PURPOSE: 1) Compare the separate 850nm (HBO2) and 760nm (HHb) signals during rest, ischemia, and reperfusion, and 2) test whether electrical stimulation to increase metabolic rate changes oxygen saturation values during 5-6 minutes of complete ischemia. Method: Ten participants ages 20-29 years were measured. NIRS measurements were made in the forearm flexor muscles at rest, after 30 seconds of 6 Hz electrical stimulation, during and after 5-6 minutes of complete ischemia produced by arterial occlusion preceded by 30 seconds of 6 Hz electrical stimulation. After 5-6 minutes of ischemia 30 seconds of 6 Hz electrical stimulation was performed. RESULTS: Six Hz stimulation for 30 s increased metabolic rate for HBO2 and HHb; 6.2 ± 3.1 and 5.5 ± 2.7 fold over rest, respectively. Six Hz stimulation during cuff ischemia did not change either the HHb or HBO2 values (p<0.05). There was significantly greater (p=0.05) pulsatility associated with heart rate in the HBO2 (0.78 ± 0.41% range) compared to HHb (0.16 ± 0.09% range). Pulse size increased during reperfusion; HBO2 (2.37 ± 0.38% range) compared to HHb (0.96 ± 0.32% range). Conclusions: The difference in the magnitude of pulsatility between HBO2 and HHb signals suggests different anatomical locations for these signals, further suggesting that using various ratios of HBO2 and HHb signals should be performed with caution. Increasing metabolic rate with electrical stimulation during complete ischemia did not further change the NIRS signals, suggesting complete ischemia is obtained with 5-6 minutes of complete cuff occlusion.

Keywords: Skeletal Muscle, Near Infrared Spectroscopy (NIRS), Oxygen consumption, Hemoglobin, Myoglobin

Word Count: Lines

1811 Board #72 May 31 3:30 PM - 5:00 PM Measuring Thigh Cross-sectional Areas From CT Scans: Validation Of NIH Image J And SliceOmatic Methods

Richard A. Dennis1, Alejandro G. Villasante Tezanos2, Reid D. Landes3, James N. Wise4, Priscilla Franson, Arianna M. Mazzarini, Rebekkah J. Reichert, Vanessa R. Yingling, 49501, FACSM. California State University, East Bay, Hayward, CA. (Sponsor: Vanessa R Yingling, FACSM)

(No relevant relationships reported)

PURPOSE: Muscle and fat areas in thigh CT scans are important outcomes in aging and exercise research. NIH Image J and SliceOmatic software programs are often used to quantify these areas but three methodological issues commonly exist between references: the tissue density range used to define muscle and fat varies between studies, areas of intermediate density are omitted, and the handling of areas of matching density (i.e. skin and bone marrow) is unreported. Thus, the purpose of this analysis was to validate methods for using these programs while assessing the effects of these three issues on the results. METHODS: CT scans of the mid-thigh were analyzed for two cohorts based on gender (57F, 65-86 yrs v. 44M, 64-91 yrs) and the effects of resistance exercise training (12 wks, 26M, 62-77 yrs) and detraining (26 wks, subset 16M, 62-75 yrs). The total thigh was segmented into seven regions based on Hounsfield Units range: fat of normal (NDF) and high-density (HDF); muscle of low (LDM), normal (NDM), high (HDM), and very high density (VHDM); and bone. RESULTS (mean, SD, cm²): In the first cohort, male thigh total area was (207 ± 27 v 223 ± 42, P=0.02) and contained less NDF (54 ± 19 v 118 ± 38, P<0.0001) but more muscle of all densities (e.g. NDM 108 ± 19 v 69 ± 14, P=0.0001) than female thigh. These results were from Image J and the effect of skin was not considered. However, the results were strongly correlated (R²=0.99) with those from SliceOmatic even if skin was included as subcutaneous fat. In the second cohort, resistance training (pre v post) increased thigh size (220 ± 32 v 229 ± 30, P=0.0001) and muscle content of all densities (e.g. NDM 107 ± 20 v 111 ± 22, P=0.02) except VHDM. Detraining (trained v detrained) decreased thigh size (230 ± 34 v 222 ± 39, P<0.0007) and content of NDM (115 ± 24 v 106 ± 21, P=0.001) and HDM (2.5 ± 1.8 v 1.8 ± 1.6). These results were from SliceOmatic and were not affected by skin fat and bone marrow. CONCLUSIONS: Image J and SliceOmatic generate similar results for measurement of muscle and fat of all densities in the thigh. SliceOmatic is the more capable program but Image J is sufficient if areas with density similar to muscle and fat are consistent and do not affect the results. Funding: VA RR&D Merit RX001203 (RAD) and NIH NIA R01 AG064920 (CAP and MMB).

THURSDAY, MAY 31, 2018
1813 Board #74 May 31 3:30 PM - 5:00 PM
Difference in Attentional Involvement and Respiratory Complexity During Static Balance Between Older and Young Adults
John P. Manning1, Luis Hernandez1, Shuqi Zhang1, Paul Wright1, David Benney1, Li Li, FACSM1, 2Northern Illinois University, DeKalb, IL, Georgia Southern University, Statesboro, GA.
(No relevant relationships reported)
Balance system requires multiple bodily systems working in tandem. Sample entropy (SE), indicator of attentional involvement in balance, measures time series complexity, high values indicating high complexity. In older adults (OA), balance is documented as deteriorating as aging progresses. As such we hypothesized attentional investment on balance is higher among OA, leading to lower SE. **Purpose:** Investigate 1) effects of group and breathing conditions on attentional involvement (AI) in balance (2) group effect on respiratory complexity (RC) and AI in balance during OA and YA.

**Methods:** Participants were recruited and placed into 2 groups, OA (n=6) and YA (n=6). Participants were asked to stand on force plate for 2 minutes (Accuway, AMTI, Watertown, MA) with feet apart at 15° one foot apart at heels. Balance tests conducted under 3 breathing conditions, neutral breathing (NB), chest breathing (CB), abdominal breathing (AB). Raw data of CoP were filtered by 4th order low-pass Butterworth filter with cutoff-frequency 10Hz in R software (R Software, The R Foundation, Austria). SE of CoP was calculated in mediolateral-direction (SEx), anteroposterior-direction (SEy), chest RC (SEcx), abdominal RC (SEcy), in R. Factorial MANOVA test was used to determine the relationship between cognition and respiratory complexity (RC) (Wilks’ < 0.001). ANOVA showed significant interactions in SEx and SEy (p<0.001). Post-hoc tests showed YA AB (p = 0.013; 0.034) was significantly higher than all conditions and OA AB (0.006; 0.002) was significantly higher than YA CB (0.010; 0.003) with respect to SEx. (p<0.05); YA NB (0.011; 0.005) and YA CB were significantly higher than OA NB (0.006; 0.001), OA CB (0.006; 0.001), OA AB, and YA AB with respect to SEcx. **Conclusion:** Breathing condition significantly affected attention on balance with significant group effect between RC and AI, OA and YA. YA group exhibited highest combined complexity for both SEx and SEy.

Results: MANOVA showed significant difference in group and breathing condition (Wilks’<0.001). Older adults exhibited higher means (p<0.05) in SE (OA:0.149±0.052; YA:0.108±0.040) and SE (OA:0.271±0.106; YA:0.142±0.062). A significant interaction was observed between groups and breathing conditions (Wilks’<0.001). ANOVA showed significant interactions in SEx and SEy (p<0.001). Post-hoc tests showed YA AB (0.013±0.040) was significantly higher than all conditions and OA AB (0.006±0.002) was significantly higher than YA CB (0.010±0.003) with respect to SEx. (p<0.05); YA NB (0.011±0.005) and YA CB were significantly higher than OA NB (0.006±0.001), OA CB (0.006±0.001), OA AB, and YA AB with respect to SEcx.

**Conclusion:** Breathing condition significantly affected attention on balance with significant group effect between RC and AI, OA and YA. YA group exhibited highest combined complexity for both SEx and SEy.

1814 Board #75 May 31 3:30 PM - 5:00 PM
Mobility And Balance Performance Is Associated With Health-related Quality Of Life In Community-dwelling Older Adults
Lauren Graham1, Allison M. O’Halloran1, Trishia T. Yada2, Jane E. Freund3, Chitra Lakshmi K. Balasubramanian4, Srikan Vallabhapurolu3, E’lon University, Elon, NC; 2University of North Florida, Jacksonville, FL; 3University of North Florida, Jacksonville, FL (Sponsor: Stephen Bailey, FACSM)
(No relevant relationships reported)
Safe and successful mobility may be essential to maintain quality of life in independently living community-dwelling older adults. These are high functioning individuals who may encounter precarious situations during their community ambulation increased risk for falling and loss of mobility. Loss of mobility in these individuals may have a dramatic impact on their quality of life. Though there are many ways to measure balance and fall-risk in older adults, the Community Balance and Mobility (CB&M) assessment is shown to alleviate the ceiling effects in older adults with a higher CB&M score attained higher scores on the SF-36 subscales, suggesting that, greater mobility and balance ability is associated with a higher quality of life in independently-living community-dwelling older adults. If dynamic balance can be improved or maintained in older adults, they are more likely to sustain a better health-related quality of life.

Analysis was performed between SF-36 and CB&M scores. **Results:** The physical function subscale (r = 0.572; p = 0.008) and general health subscale (r = 0.520; p = 0.019) showed significant moderate positive correlations with mobility and balance performance, as assessed by the CB&M. **Conclusions:** Community-dwelling older adults with a higher CB&M score attained higher scores on the SF-36 subscales, suggesting that, greater mobility and balance ability is associated with a higher quality of life in independently-living community-dwelling older adults. If dynamic balance can be improved or maintained in older adults, they are more likely to sustain a better health-related quality of life.

1815 Board #76 May 31 3:30 PM - 5:00 PM
Relationship between Cognition and Exercise Capability in Community-dwelling Older Adults
Chunnmei Cao1, Yu Liu2, Jingmin Liu3, Weimo Zhu, FACSM1, Weimo Zhu, FACSM3, Tsinghua University, Beijing, China. 2Peking University, Beijing, China. 3University of Illinois at Urbana-Champaign, Urbana, IL. (Sponsor: Weimo Zhu, FACSM)
(No relevant relationships reported)
Several studies found that both cognition and exercise capability (EC) were risk factors related to older adults’ falls. However, there is limited information about the performance of cognition and EC in old adults.

**Purpose:** To investigate the relationship between components of cognition and EC in older adults.

**Methods:** Sixty-six old adults (aged 65-80 yr, 31 males and 35 female) volunteered performing a battery of four physical test (Hand force, 30’s chair-stand test, Eyes closed standing and The timed “Up & Go”) evaluating EC. Four psychological tasks (Stroop task, N-back task, More_oddshifting task and working memory) were used to assess EF, and 2-Choice Reaction Time (CRT) to processing speed, dual task walking to attention. Person correlation coefficient (r) was used to determine the relationship between cognition and EC.

**Result:** Some low-to-moderate correlations were found between cognition and EC, which are summarized in the table below:

<table>
<thead>
<tr>
<th></th>
<th>Hand force</th>
<th>N-back task</th>
<th>More_oddshifting task</th>
<th>Working memory</th>
<th>CRT</th>
<th>Dual task</th>
</tr>
</thead>
<tbody>
<tr>
<td>30’s chair-stand test</td>
<td>.20</td>
<td>.18</td>
<td>.12</td>
<td>-.15</td>
<td>.40</td>
<td>.25</td>
</tr>
<tr>
<td>Eyes closed standing</td>
<td>.22</td>
<td>.19</td>
<td>.12</td>
<td>-.15</td>
<td>.40</td>
<td>.25</td>
</tr>
<tr>
<td>The timed “Up &amp; Go”</td>
<td>-.27</td>
<td>.21</td>
<td>-.31</td>
<td>.25</td>
<td>.39</td>
<td>.24</td>
</tr>
</tbody>
</table>

**Note:** *p<.05, **p<.01.

**Conclusion:** The cognition does have low-to-moderate relationship with some EC, which means that we may promote one through training another one.

1816 Board #77 May 31 3:30 PM - 5:00 PM
Greater Stance Time Variability is Associated with Lower Step Activity in Older Adults
Trishia T. Yada1, Lauren E. Graham1, Allison M. O’Halloran1, Jane E. Freund3, Chitra Lakshmi K. Balasubramanian4, Srikan Vallabhapurolu3, E’lon University, Elon, NC; 3University of North Florida, Jacksonville, FL (Sponsor: Stephen Bailey, FACSM)
(No relevant relationships reported)
Previous research has shown that older adults with greater gait variability are at a higher risk for falling. Falls increase fear of falling and may subsequently result in mobility disabilitymanifesting as decreased physical activity. Physical activity is commonly gauged from continuous step activity monitoring. While decreased step activity has been associated with impaired gait, the associations between gait variability and step activity are not understood. **Purpose:** To examine the relationship between gait variability and step activity in older adults. **Methods:** Spatiotemporal gait parameters were recorded for 19 healthy older adults (mean age 74.5 ± 6.3 years; 9 males/10 females) walking at a normal walking speed across a GAITRite walkway for 5 trials. Step activity (steps) of participants was collected using a research-grade step activity monitor for 7 consecutive days. Average number of steps for the 7 days was used. Coefficient of variation (defined as % of SD over mean) of gait speed, stride length, step width, swing time, stance time and double support time were calculated. Pearson’s and Spearman’s correlation coefficients were used based on normality to determine the relationship between gait variability and step activity. **Results:** Stance time variability showed significant moderate inverse correlation with step activity (r = -0.482, p = 0.036). Swing time variability showed moderate inverse correlation with step activity with a trend towards significance (r = -0.451, p = 0.052). Variability of gait speed (r = -0.349, p = 0.143), stride length (r =
-0.3, p < 0.212), step width (rho = 0.088, p = 0.721), and double support time (rho = -0.249, p < 0.304) showed weak inverse but not significant correlation with step activity. CONCLUSION: In general, gait variability seems to be inversely related to step activity in older adults meaning those with greater gait variability showed lower step activity. In particular, stance time variability has earlier shown to be critical in identifying older adults with mobility disability and those older adults at risk for future disability. Our finding of decreased step activity in those older adults with increased stance time variability suggests that step activity monitoring could provide surrogate and complimentary measures to identify mobility disability in older adults.

1817 Board #78  May 31 3:30 PM - 5:00 PM  Elevated Bmi Impairs Balance Among Older Adults With Vestibular Disorders
Alexis C. King1, J Mark VanNess1, Toni J. Oliver2, Courtney D. Jensen1. 1University of the Pacific, Stockton, CA. 2San Luis Sports Therapy, Templeton, CA.
(No relevant relationships reported)
Each year, more than 2.5 million geriatric patients are admitted to emergency departments for fall-related injuries. Identifying variables that predict fall risk may help manage this problem. Physical activity and body composition are potential predictors. The average elderly fall risk patient walks <200 steps per day and is commonly advised to minimize physical activity owing to elevated risk of injury. Limiting exposure can be effective in the short term but the chronic anthropometric consequences may exacerbate risk in the future.
PURPOSE: To evaluate the effect of body mass index (BMI) on balance in geriatric patients who are at risk of falling.
METHODS: We enrolled 24 patients (12 men, 12 women) with a diagnosed vestibular disorder who were >65 years of age. Patients were excluded if they had a history of injury precluding participation or currently participated in an exercise program. We collected demographic, anthropometric, and balance data at baseline. Balance was assessed using a CSIM HUMAC System Balance Board. After baseline testing, subjects were randomized to either a fatigue intervention (modified Bruce treadmill protocol) or a mild walking intervention (2 mph, 0% incline, 4 minutes). Following exercise, patients repeated the balance assessment. Linear regression tested the effects of age, sex, obesity, and group assignment on the change in balance score.
RESULTS: The regression model explained 78% of the variance in the change in balance score (p < 0.001). Holding all other predictors constant, performing the fatigue protocol associated with a greater loss of balance (3.9 percentage points; p = 0.044); for each 1-point increase in BMI, patients experienced an additional loss of 0.7 percentage points. When evaluating obesity as a binary variable, being classified as obese associated with a loss in balance of 5.0 percentage points (p = 0.011).
CONCLUSIONS: The relationship between fall risk and level of activity is complex. In our sample, obesity associated with a greater deterioration of balance following physical activity. When patients who are at risk of falling are advised to avoid physical activity, that advice may result in chronic compromise of balance, elevating the risk of future falls. Conversely, exercise performed in a safe, controlled environment may have therapeutic potential.

1818 Board #79  May 31 3:30 PM - 5:00 PM  The Effect of Mental Fatigue on Postural Stability in Young and Older Women
Amanda J. Morris, Garrett Lindsey, Anita D. Christie. University of Oregon, Eugene, OR. (Sponsor: David Gabriel, FACSM)
(No relevant relationships reported)
Allocation of attentional resources is required for maintaining postural stability. Fewer attentional resources are available for balance control when individuals perform a dual task paradigm involving concurrent performance of a cognitive task. However, these effects have not been studied under conditions of mental fatigue. PURPOSE: To determine if mental fatigue influences postural stability and if there are age differences in stability in response to mental fatigue. METHODs: Center of pressure (COP) displacement during the steady standing platform perturbations was performed at the beginning and end of 20 minutes of the psychomotor vigilance task (PVT; mental fatigue condition) and 20 minutes of watching a nature video (control condition) in 16 young (22.4 ± 3.72 years) and 16 older females (72.6 ± 6.50 years). The PVT is a sustained attention task that induces mental fatigue, as indicated by increases in reaction time (RT) to visual stimuli. RESULTS: Older adults had a significantly longer RT (325.17 ± 30.90 ms) than young (287.95 ± 29.53 ms) baseline (p < 0.002). Both groups had significantly longer RTs by the end of the PVT task (young 11% increase, p < 0.002; older 7% increase, p < 0.03), indicating the presence of mental fatigue in the mental fatigue condition. Older adults had a significantly larger anterior-posterior (AP) COP displacement baseline (5.77% vs. 6.67 cm) than young (7.37% vs. 8.12 cm baseline (p < 0.001). Nine young and 8 old adults had increases of 0.7-54% in AP COP displacement after the mental fatigue condition. However, there was no significant main effect of condition (p = 0.12) nor an interaction of age and condition (p = 0.85) for the percent change in AP COP from the beginning to the end of the session.

CONCLUSION: These results indicate that although postural control and reaction time performance was worse in older than young at baseline, there was no significant effect of mental fatigue on postural stability in either group.

1819 Board #80  May 31 3:30 PM - 5:00 PM  Electrical Nerve Stimulation Elicits Intensity-Dependent Changes in Force Steadiness in Young and Older Adults
Diba Mani, Daniel F. Feeney, Roger M. Enoka. University of Colorado, Boulder, CO. (Sponsor: Robert Mazzeo, FACSM)
(No relevant relationships reported)
When individuals attempt to match a submaximal target force by performing a steady isometric contraction, the fluctuations in force are often quantified as force steadiness (coefficient of variation [CV] for force) to provide an index of the neural drive to muscle. PURPOSE: To compare force steadiness of the wrist extensors during evoked and voluntary submaximal contractions in young and older adults. METHODs: Thirteen young (mean ± SD age = 25 ± 4 years) and 12 older (mean ± SD age = 78 ± 5 years) adults participated in a 1-hr protocol that included maximal voluntary contractions (MVCs) and voluntary and evoked isometric contractions to match a 10% MVC target force. Force steadiness during the voluntary contraction was compared with that evoked by wide, high-frequency (1 ms pulses at 100 Hz) and narrow, low-frequency (0.2 ms pulses at 50 Hz) neuromuscular electrical stimulation (NMES), and a voluntary contraction with superimposed submotor transcutaneous electrical stimulation (TENS). CV for force was compared between age groups with unpaired t-tests and within age groups by paired t-tests. RESULTS: CV for force was less for young adults (1.82 ± 0.43%) than older adults (2.80 ± 1.08%) during the voluntary contraction with the wrist extenders (p < 0.03) than during the voluntary contraction by itself (1.82 ± 0.43%). CONCLUSION: The improvement in force steadiness for older adults during the NMES-evoked contractions indicates that the age-associated decline in force steadiness is attributable to changes in the neural drive to muscle, rather than the mechanical properties of muscle. In contrast, the decline in force steadiness for young adults during concurrent TENS suggests that heightened sensory feedback compromised the neural drive to muscle during the steady contraction.

1820 Board #81  May 31 3:30 PM - 5:00 PM  Effects Of Resistance Training On Maximal Motor Unit Firing Rates In Young And Older Males
Phuong L. Ha1, Garrett M. Hester2, Ryan J. Colquhoun1, Mitchell A. Magrini1, Zachary K. Pope3, Alejandro Barrera-Curiel2, Carlos A. Estrada1, Jason M. DeFerranti4, Phuong L. Ha1. 1Kennesaw State University, Kennesaw, GA, 2Oklahoma State University, Stillwater, OK.
(No relevant relationships reported)
It is unknown if resistance training (RT) has differential effects on maximal firing rates (MAXFR) of motor units (MUs) across the recruitment threshold (RECFR), and whether or not age has an influence. PURPOSE: To examine the effects of short-term RT on MAXFR of MUs in young and older males. METHODs: Thirteen young and seventeen older males were randomly assigned to either a training (young group [YTG]: n = 8; age = 21 ± 1.6 yrs; old group [OTG]: n = 10; age = 64.1 ± 7.4 yrs) or control (young [YCG]: n = 5; age = 22 ± 3.1 yrs; old group [OCG]: n = 7; age = 64 ± 9.3 yrs) group. RT involved knee extensions for 4 sets of 10 repetitions for 2 weeks. Before (PRE) and after (POST) RT subjects performed 2 maximum isometric ramp contractions (MVCs) of the knee extensors while 4 surface electromyography (sEMG) signals were recorded from the vastus lateralis. The raw sEMG signals were then decomposed into their constituent MU action potential trains. RECFR, defined as the relative force level (%MVC) when the MU began firing, and MAXFR were calculated for each MU. The highest 500 ms average for torque was considered the peak torque (PT). Linear regression was used on the pooled and individual data for the groups separately, to examine the relationship between RECFR and MAXFR. Two-way (group [young vs. old] × time [PRE vs. POST]) repeated measures analyses of variance were used to compare individual slope coefficients (SLP) and PT across time. RESULTS: A total of 1,403 (PRE = 713; POST = 690) MUs were detected. SLP, PT (p = 0.136) and PT (p = 0.781) remained unaltered in the control groups at POST. No significant group × time interactions were observed for SLP (p = 0.678) or PT (p = 0.100), but a main effect for time was demonstrated for SLP (-44.1%; p = 0.001) and PT (+12.5%; p < 0.001). CONCLUSION: These findings, in addition to a qualitative, visual inspection of the pooled regression lines (figure below), indicate RT induced a slightly more negative relationship between pooled RECFR and MAXFR and this effect was not influenced by age.

Abstracts were prepared by the authors and printed as submitted.
Thurs, May 31, 2018

1821 Board #82 May 31 3:30 PM - 5:00 PM
Dynamic Balance Changes in Older Adults Following 12-Weeks of a Self-Managed Exercise Program
Michele Nofal, Saad Alhammad, Lisa MK Chin, Jeffrey E. Herrick, Clinton J. Watske, George Mason University, Fairfax, VA. (Sponsor: Randall E. Keyser, FACSM)
(No relevant relationships reported)

INTRODUCTION: Static and dynamic balance declines with age. A training program including aerobic (AT), resistance (RT) or balance training (BT) may improve dynamic and static balance in older adults. PURPOSE: To determine the influence of a 12-week self-managed exercise program combining AT, RT, and BT on static and dynamic balance measures in unimpaired older adults. METHODS: 17 participants attended three educational seminars on AT, RT, and BT prior to beginning exercise, consulting with their physician, and selecting exercises including AT, RT, or BT. Based on activities chosen, participants were organized into three groups; G1 (AT only): n=8, age: 73.0±2.8 yrs, BMI: 26.1±3.5 kg/m²; G2 (AT+RT): n=5, age: 68.2±3.1 yrs, BMI: 25.5±6.0 kg/m²; and G3 (AT+RT+BT): n=4, age: 70.0±1.4 yrs, BMI: 27.8±6.8 kg/m². Exercises were based on National Institute of Aging guidelines. Assessments were conducted prior to the start (PRE) and completion (POST) of the program. The ANOVA was used to analyze dynamic (Timed Up and Go, TUG; Four Square Step Test, 4S) and static (Sway area: 95% confidence ellipse during 30 seconds of standing balance with eyes open, SA) measures of balance between groups. T-tests were used to analyze within-group differences and Cohen’s d was used to analyze effect size within groups. RESULTS: No differences were found between groups in the TUG, 4S, or SA following the program at POST. T-tests showed improved TUG scores (all participants p=0.0019, G1: p=0.0049, G2 p=0.413, G3: p=0.0242) and 4S times (all participants p=0.0365, G1, p=0.0224, G2 p=0.522, G3 p=0.0172) from PRE to POST. Cohen’s d values for the TUG (all participants=0.832, G1=9.17, G2=14.5, G3=1.75) and the 4S (all participants=0.383, G1=5.17, G2=0.37, G3=5.05) suggest a large effect for the TUG for all participants, G1, and G3. A small effect was found for all participants for the 4S and a medium effect was found for G1 and G3. CONCLUSION: The exercise mode did not influence dynamic or static balance between groups of older adults after a 12-week self-managed exercise program. However, measures of dynamic balance improved in the TUG and 4S for all participants as well as some individual groups. Additional investigation is necessary to identify community-based exercises that improved in the TUG and 4S for all participants as well as some individual groups. Measures of dynamic balance in unimpaired older adults.

1822 Board #83 May 31 3:30 PM - 5:00 PM
An Analysis of Squat Mechanics Between Individuals With High and Low Strength Levels
Kevin H. Choé1, Pablo B. Costa2, Jared W. Coburn, FACSM3, Derek N. Pamukoff. University of Nevada, Las Vegas, Las Vegas, NV; 2California State University, Fullerton, Fullerton, CA.
(No relevant relationships reported)

Individuals with weak hip musculature may have compensatory hip and knee motion during common strengthening exercises, such as the back squat (BS), that elevate frontal plane joint loading. PURPOSE: The purpose of this study was to compare frontal plane squat mechanic.0s between strong and weak individuals during the BS. METHODS: Twenty-eight individuals (17 males and 11 females, 23.42±3.34 yrs., 1.72±0.09 m, 75.20±11.41 kg) who consistently performed the BS were recruited for this study, and were categorized into strong (n=14, 23.00±0.08yrs, 1.69±0.09m, 71.97±11.80kg) and weak (n=14, 23.86±3.86yrs, 1.76±0.08m, 74.43±11.2kg) groups using a median split of BS 1-repetition-maximum (1RM) normalized to body mass. This study required two visits, with the first being 1RM testing and the second consisting of a 3-dimensional assessment of squatting mechanics. During the second visit, participants performed 2 sets of 3 repetitions of the BS at 70% and 85% 1RM in a random order. The average of the second repetitions of each set was used for analysis. Dependent variables included the peak knee abduction angle and external moment, and peak hip adduction angle and external moment. 2 (group) x 2 (load) mixed model ANOVA was used to compare peak external knee abduction moments and angles, and peak external hip adduction moments and angles at 70% and 85% 1RM. RESULTS: Group x load interactions were not significant for peak knee abduction angles (F1,9=1.05, p=0.31) and moments (F1,9=0.61, p=0.44), or for peak hip adduction angles (F1,9=0.87, p=0.61) and moments (F1,9=1.11, p=0.79). There were also no main effects of load or group on any dependent variable. CONCLUSIONS: Results suggest that strong and weak individuals have similar frontal plane hip and knee mechanics during the BS at 70% and 85% 1RM. However, these loads were relatively similar, and loads greater than 85% 1RM are frequently used in exercise programs. Differences may also become evident during repetitions closer to failure. Future research should examine if compensatory frontal plane actions are found with greater resistance. Furthermore, all participants were trained regardless of group, and training status may influence the magnitude of frontal plane hip and knee motion during the BS.

1823 Board #84 May 31 3:30 PM - 5:00 PM
Improving Posterior Chain Engagement and Forward Trunk Lean During The Front Squat
Scott Wilson, William Goodman, Christopher Casillas, Linnea Zavala, James Becker. Montana State University, Bozeman, MT.
(No relevant relationships reported)

Front squats are a commonly used squat variation as they place less load on the lumbar spine. However, when done incorrectly, front squats may have inefficient posterior-chain activation and reduced trunk stability, thus negating any potential benefits. Various techniques have been proposed to mitigate such consequences but, to date, few have been quantified. PURPOSE: This study examined the effects of an intervention designed to increase posterior chain engagement on kinematics and muscle activity during the front squat. METHODS: 7 physically active adults (4 male, 3 female; ages 25 +/- 4 years) performed front squats under two conditions: baseline and after instruction in a specific front squat technique emphasizing foot alignment and using EMG biofeedback to help engage the glutes. All squats were performed at 70% of a tested 1 rep max. Whole-body kinematics were recorded with a 12-camera motion capture system while ground reaction forces were measured using two force plates. Peak hip extensor moments, pelvic tilt and forward torso lean were calculated on each repetition. Activity of the erector spinae (ES) and gluteus maximus (GM) muscles was analyzed by calculating average root mean square (RMS) amplitude across the squat. Differences from pre to post intervention were evaluated using paired t-tests and effect sizes. RESULTS: Peak pelvic tilt, forward trunk lean, and hip extensor moments were all not statistically different after the intervention and showed small effect sizes (Table 1). While mean ES activity decreased after the intervention the effect size was small (Table 1). In contrast, while mean GM activity was not significantly different post-intervention, there was a moderate effect size (Table 1). CONCLUSION: The intervention technique changed activation of some posterior muscle groups, but not kinematics or kinetics. Whether this was due to the intervention itself or participants requiring more training time requires further investigation.

Table 1. Means (± standard deviations) pre and post intervention

<table>
<thead>
<tr>
<th>Measure</th>
<th>Pre</th>
<th>Post</th>
<th>t</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak pelvic tilt (°)</td>
<td>30.1±10.2</td>
<td>28.1±14.2</td>
<td>2.441</td>
<td>0.134</td>
</tr>
<tr>
<td>Forward trunk lean (°)</td>
<td>38.9±9.6</td>
<td>39.9±9.9</td>
<td>0.311</td>
<td>0.157</td>
</tr>
<tr>
<td>Peak hip extensor maximum (Nm)</td>
<td>58.6±65.9</td>
<td>55.8±63.3</td>
<td>0.312</td>
<td>0.027</td>
</tr>
<tr>
<td>Mean erector spinae RMS (mV)</td>
<td>6.0±3.2</td>
<td>5.1±3.0</td>
<td>0.034</td>
<td>0.148</td>
</tr>
<tr>
<td>Mean gluteus maximus RMS (mV)</td>
<td>11.7±0.7</td>
<td>11.2±0.6</td>
<td>0.066</td>
<td>0.472</td>
</tr>
</tbody>
</table>
technique on LE kinetics is warranted. Purpose: This study compared hip and knee frontal plane kinetics during body-weight squats with varying depths and stance widths. Methods: Eleven healthy, college-aged participants (6 female, 5 male, height = 1.68 ± 0.08 m, mass = 67.4 ± 10.7 kg) performed 5 body squats at 100%, 150% and 200% of shoulder width for each of the following knee flexion angles: 55°, 90° and 125°. Trials were randomized and data were collected using Vicon Nexus and AMTI force plates. Frontal plane kinetics were processed using Visual 3D. Results: At the hip, abduction moments significantly increased as the width increased (100% = 0.301 ± 0.02, 150% = 0.539 ± 0.04 and 200% = 0.736 ± 0.04; p < 0.001) and depth (55° = 0.306 ± 0.03 Nm/kg, 90° = 0.540 ± 0.04 Nm/kg and 125° = 0.725 ± 0.05 Nm/kg; p < 0.001) increased. At the knee, adduction moments significantly increased with wider stances (100% = 0.116 ± 0.02 Nm/kg, 150% = 0.178 ± 0.01 Nm/kg and 200% = 0.221 ± 0.01 Nm/kg; p < 0.001) while greater knee abduction moments were observed as depth of the squat increased (55° = 0.066 ± 0.04 Nm/kg, 90° = 0.147 ± 0.04 Nm/kg and 125° = 0.465 ± 0.05 Nm/kg; p < 0.001). Conclusion: Depth and larger stance widths may place greater demand on the hip and knee joints as evidenced by increased frontal plane moments. These data may benefit rehabilitation and strength training programs. For example, clinicians using squats as a rehabilitative exercise might decrease stance width when aiming to avoid LE frontal plane joint loading. Further, athletes who repeatedly stress the frontal plane stabilizing structures of the LE during dynamic movements may benefit from deeper and wider squats in training that would prepare these structures for their sport specific movements. Further research is needed to investigate other means of altering joint loading in the LE during exercise.

Board #86
May 31 3:30 PM - 5:00 PM
Influence of Attentional Focus on a Weighted Barbell Back Squat Among Experienced Performers
Blake Loxtercamp1, Marcus Moore1, Scott Austen1, Greg DeNunzio2, Lesley M. Seiboral1. 1University of St. Thomas, St. Paul, MN. 2Northwestern Health Sciences University, Bloomington, MN.

Previous research suggests that adopting an external attentional focus (i.e. an object) rather than an internal focus (i.e. a body part) improves motor skill performance such as jump height, and increases peak force during isometric elbow flexion. However, little is known about the impact of attentional focus during a barbell back squat (BBS). PURPOSE: To determine the influence of attentional focus on ground reaction force (GRF), peak power (PP), and peak moment (PM) in the sagittal, frontal, and transverse planes at the knee, hip, and ankle joints in weight-lifters performing a BBS. METHODS: Male weight-lifters (age 23.1 ±2.4; >3 years strength training experience) performed 8 BBS repetitions at 50% of their 1RM. Repetitions were performed under 3 conditions: Control (CON) followed by counterbalanced internal (INT; putting pressure on the heels and lateral aspect of the feet) and external (EXT; pushing the ground away from the body) focus conditions. PP (W) and PM (Nm) were measured using the software Motion Monitor; GRF (N) was measured using Bertec force plates. Participants also completed an attentional focus adherence questionnaire. RESULTS: For inversion PP at the ankle (i.e., negative power in the frontal plane), the absolute value for EXT (−59.5 W ±6.6; 0.021, 0.016) was significantly greater than CON (−42.3 W ±4.8). For valgus PP at the knee (i.e. negative power in the frontal plane), the absolute values for EXT (−231.8 W ±18.8; 0.016) and INT (−227.3 W ±23.0; 0.033) were significantly greater than CON (−187.4 W ±15.9). For abduction ankle PM (i.e positive moment in the transverse plane), the EXT (39.4 Nm ±4.6; 0.016) was significantly greater than INT (30.7 Nm ±3.7). With an EXT focus, participants focused on pushing the ground away in significantly more repetitions (6.3 ±0.72; 0.03) than the INT focus (5.2 ±1.9). Focus conditions elicited no significant differences in the other variables. CONCLUSION: Results indicate attentional focus has little influence on hip, knee, and ankle joint kinetics during a BBS among experienced weightlifters. Instructing experienced weightlifters to shift their attentional focus may have little effect on BBS performance. Future studies should investigate the impact of attentional focus on novice weightlifters performing lower body multi-joint movements.

Board #87
May 31 3:30 PM - 5:00 PM
Load-dependent Relational Muscular Effort of the Knee Extensor Muscles During Back and Front Squats
John Krzyszowski, Kristof Kipp, Sandra Dahling, Jordi Heeneman. Marquette University, Milwaukee, WI. (Sponsor: Paula Papanek, FACSAM)

Introduction: The back squat (BS) and the front squat (FS) are mainstay exercises of strength training programs. However, not much is known about joint-specific kinematic and kinetic changes during the execution these two exercises as the external load is varied. In addition, the Relational Muscular Effort (RME), which quantifies a muscle groups operating level with respect to its maximum capacity, of the knee extensor muscle group during both exercises is not well characterized.

Purpose: To investigate load-dependent RME of the knee extensor muscles during the BS and FS.

Methods: Seven collegiate athletes (4 male, 3 female) participate in this study. Each athlete completed motion analysis and isometric muscle strength testing. During motion analysis testing each athlete performed, in counterbalanced order, both the BS and FS at loads of 40, 60, and 80% of their FS one-repetition maximum (1-RM). Kinematic and kinetic data were captured from markers placed on anatomical landmarks (Plug-in Gait marker set) and from two force plates underneath the athletes’ feet. These data were used to calculate the net joint moments (NJM) during each exercise and at each load. During the isometric strength testing sessions each athlete performed maximal voluntary isometric contractions (MVIC) at 30, 60, and 90 degrees of knee flexion. A moment-angle curve was fitted to the MVIC data and used to calculate the theoretical peak NM during the squats, which was then compared against the actual NM during the execution of the BS and FS to calculate the RME. A 2x3 ANOVA ([Exercise: Front, Back] x [Load: 40, 60, 80]) was used to determine the effects of exercise and load on RME.

Results: The interaction (p = 0.025) and load main effect were significant (p = 0.004). Post-hoc testing, however, indicated that only the exercise-pooled RME differed across loads (40% RME: 51.6±0.05, 60% RME: 61.3±0.06, 80% RME: 69.3±0.06). Specifically, the RME differed significantly between 40% and 60% (p = 0.049), 40% and 80% (p = 0.015), and 60% and 80% (p = 0.008). Conclusions: RME did not differ between BS and FS at any load, but increased linearly from 40% through to 80% of FS 1-RM. These results suggest that at the same absolute load both exercises impose similar demands upon the knee extensor muscle groups, and that greater loads increase that demand.

The ability to assess, prescribe, and modify exercises based on biomechanical characteristics of the movement is an essential skill that personal trainers, strength and conditioning coaches, physical therapists or other fitness/exercise practitioners must possess. Currently no tool exists that assesses this overall perceptual-cognitive skill.

Purpose: To gain item level feedback and begin to evaluate an efficient instrument to accurately and reliably assess strength training technique expertise.

Methods: Fifty, five exercise science students (Mean age: 22.6 ± 2.4 SD; 27% with B.S.) and 15 experienced academics in the strength training field (Mean age: 42.2 ± 10.7 SD; 67% with Ph.D.) completed a 26-item test with various questions eliciting knowledge of exercises, optimizing muscle activation, selecting exercises, and identifying poor technique) were also characterized. Item level metrics such as discrimination and difficulty were calculated. Results: Overall, academics performed better than students with a medium to large effect size (d = 0.78, p = 0.041). Four items displayed poor discrimination (item-total correlation <0.1) and two items were relatively easy (overall percent answered correctly >85%). Qualitative item level feedback was helpful to further modify/refine wording of questions. Almost all individuals (95%) indicated they wanted to learn more about techniques to assess strength training exercises.

Conclusions: Initial evidence indicates this tool demonstrates sufficient difficulty and discriminability to characterize strength training technique expertise. In addition, individuals perceive this evaluative skill of strength training technical performance as very important for practical application and desire further training/education to improve this skill (even in high level academic individuals). Larger sample - factor analytic, reliability, and predictive/discriminant validity evidence should be gathered to further assess and refine this assessment tool.
2018 Board #89 May 31 3:30 PM - 5:00 PM
Dynamic Resistance Training Promotes Better Neuromuscular Benefits And Reduces Oxidative Stress In Healthy Wistar Rats
Michel Souza, Rodrigo Neves, Thiago Rosa, Alexandre Oliveira, Gustavo Gomes, Rafael Costa, Bernardo Brixi, Luiz Souza, Rafael Olber, Lyseline Deus, Milton Moraes
1Universidade Católica de Brasília, São Paulo, Brazil. 2Universidade Católica de Brasília, Brasilia, Brazil.

**PURPOSE:** Resistance training (RT) is used as a non-pharmacological tool in the prevention and treatment of various diseases. However, few studies have evaluated the different neuromuscular adaptations promoted by dynamic (DRT) and isometric (IRT), and their impact on redox status. This study aimed to compare the different adaptations on muscle strength and oxidative stress in healthy Wistar male rats.

**METHODS:** Fifteen male Wistar rats at 12 weeks of age were randomized into 3 groups: control group (CTL; n = 5), DRT (n = 5) and IRT (n = 5). All animals were adapted for 2 weeks on the vertical ladder. After the animals were submitted to dynamic strength muscle (DSM) (test performed every 15 days) and maximum isometric resistance (MIR) (pre and post-training) tests. Both DRT and IRT were performed 5 times a week on non-consecutive days for 12 weeks, with a duration of ~22 min per session, consisting of 1 set of 8 uninterrupted clamps for 1 min, with a 30% overload of DSM. The animals of the IRT group remained in isometry for 1 minute.

The level of significance was set at P < 0.05.

**RESULTS:** The DRT group presented a greater gain of the DSM (390 ± 86 and 686 ± 66 g, pre and post-training, P < 0.05) compared to the groups CTL (339 ± 65 and 427 ± 39 g, pre and post-training, P > 0.05) and IRT (369 ± 31 and 393 ± 41 g, pre and post-training, P > 0.05). The DRT (6.9 ± 3.4 and 24.7 ± 5.3 min, pre and post-training) and IRT (9 ± 6.4 and 39 ± 39 min, pre and post-training) were maintained as the same gain in MIR (P > 0.05). The DRT group presented reduction of lipid peroxidation (17 ± 4 and 9 ± 3 µM, pre and post-training, P < 0.05) (TBARS), with increased bioavailability of nitric oxide (NO) (122 ± 32 and 715 ± 45 µM, pre and post-training, P > 0.05) and total antioxidant capacity (627 ± 32 and 715 ± 45 µM, pre and post-training, P > 0.05) (TAC). These redox status indicators did not change between CTL (155 ± 7 and 17 ± 7 µM, pre and post-training), NO (118 ± 15 and 125 ± 12 µM, pre and post-training) and TAC (636 ± 29 and 660 ± 10 µM, pre and post-training) and IRT (16 ± 3 and 15 ± 3 µM, pre and post-training), NO (126 ± 18 and 133 ± 14 µM, pre and post-training) and TAC (651 ± 18 and 647 ± 20 µM, pre and post-training) (P > 0.05).

**CONCLUSIONS:** These results suggest that DRT promotes better neuromuscular benefits with improved oxidative stress in healthy Wistar male rats.

2018 Board #91 May 31 3:30 PM - 5:00 PM
Prediction of Ground Reaction Forces of Flexible Barbells using their Bar End Displacement
Mehmood Mallick, Sunyeop Lee, Randolph E. Hutchison, Anthony Caterisano, FACSM. Farman University, Greenville, SC. (Sponsor: Anthony Caterisano, FACSM)

**PURPOSE:** The Flexible Barbell (FB) has been used in various strength and conditioning programs at levels from high school athletics to professional programs such as the National Football League. Yet, fundamental characteristics of the various models of the barbell are unknown. The purpose of this study was to investigate if flexible bar end displacement could predict peak ground reaction forces (GRFs) to aid in training applications.

**METHODS:** Six models of flexible barbells at nine different loading conditions were lifted by a machine set atop a force platform with barbell motion recorded by an eight-camera 3-D motion capture system. Typical exercises such as the bench press and squat were simulated lifting the barbell a total displacement of 30.5 cm up and 30.5 cm down per repetition at a range of lifting velocities from 0.15 m/s to 1.55 m/s. Linear regression models were run to predict measured GRFs from FB bar end displacements.

**RESULTS:** Significant linear regression models predicted peak GRFs for all models of the FB and the post-tested loading conditions based upon maximal bar end displacements (Table 1).

**CONCLUSIONS:** Although these results will require follow-up confirmation studies with human subjects, coaches in training programs can use bar end displacement to predict peak external loading from lifting the FB. These predictions are useful among a large range of physiologically relevant lifting velocities typically seen in athletic training programs.

### Prediction of peak ground reaction force based on bar end displacement linear regression model at ea

<table>
<thead>
<tr>
<th>Bar Type</th>
<th>Loading (kg)</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultra Light</td>
<td>6.56</td>
<td>0.938</td>
</tr>
<tr>
<td>Golf SS</td>
<td>10</td>
<td>0.922</td>
</tr>
<tr>
<td>Light</td>
<td>15</td>
<td>0.899</td>
</tr>
<tr>
<td>Light Plus</td>
<td>28.6</td>
<td>0.915</td>
</tr>
<tr>
<td>Level 1</td>
<td>28.6</td>
<td>0.976</td>
</tr>
<tr>
<td>Level 2</td>
<td>46.7</td>
<td>0.944</td>
</tr>
<tr>
<td>Level 3</td>
<td>28.6</td>
<td>0.954</td>
</tr>
<tr>
<td>Level 3</td>
<td>46.7</td>
<td>0.942</td>
</tr>
</tbody>
</table>

*denotes statistical significance (p < 0.005)
Resistance Exercise (RE), due to its short high intensity nature, primarily uses glycolysis; producing more CO₂ than utilizing O₂. The relationship between Mechanical Work, O₂, CO₂, and acute muscular fatigue during RE is not well understood.

**PURPOSE:** To investigate the relationship between volume of O₂ (VO₂), volume of CO₂ (VCO₂), and total mechanical work (TMW) in response to multiple sets of high intensity (90% 1-RM) 1-Leg Extension (LE) RE completed to failure.

**METHODS:** 25 males, Age=20.3±1.1yrs, BMI=24.2±2.1, BodyFat%=13.7±6.1, volunteered: Day1 included body composition (air-plethysmography) and 1-RM assessment of dominant 1-leg LE; Day2: (≥96 hours later) subjects’ completed multiple sets of 90%1-RM LE. Each set was completed to failure; 15-20 seconds later another set to failure was completed. This sequence (sets) was repeated until failure was obtained. The repetition was composed of < 1 repetition; subjects’ then completed 10 minutes of sitting rest (Post-RE R). Metabolic measures were recorded on a breath-by-breath basis. VO₂ and VCO₂ were calculated as the sum totals, in ml/min, for the total RE time (all reps & sets) & Post-RE R. TMW was measured with an ultrasound sensor (distance & time of weight stack movement) and custom-built software. Correlations, Linear Regression, and Min-Max Accuracy were used to assess the relationship between TMW, VO₂, and VCO₂.

**RESULTS:** Averages and standard deviations for comparison variables of interest: TMW=3491.1±2127.9in, VO₂=13210.9±2855.8ml/min, VCO₂=15407.4±4136.1ml/min, and failure-set=3.1±1.2. Insignificant correlations were found between TMW and VO₂ (r=0.28 to 0.27) and VCO₂ (r=0.24 to 0.26). Regressions suggested TMW had little explanatory power for VO₂ (p=0.18, AdjR²=0.04), and VCO₂ (p=0.31, AdjR²=0.01). Min-Max Accuracy measures, comparing in-sample predictions (TMW data plugged into Linear Regression Models) to observed values, were 84.5% for VO₂, and 79.1% for VCO₂.

**CONCLUSIONS:** Weak Correlations and low AdjR² values suggest very little relationship between TMW and metabolic measures during and following RE. Min-Max Accuracy measures suggest TMW does not predict VO₂ & VCO₂ well. These results are not unexpected as the work of RE is primarily governed by anaerobic processes and O₂ is not the primary energy source for this type of intensity of activity.
Squatting to different depths or with different loads changes the demands on the neuromuscular system, thus potentially altering training effects. Previous studies have used EMG to assess joint contributions with various depths or loads. Another method for assessing this is to examine how each joint contributes to the total support moment (M) during the squat. **Purpose:** Examine how hip, knee, and ankle contributions to M change with increasing squat loads and depths. **Methods:** 19 females (age: 25.1 ± 5.8 years; squatting experience: 3.8 ± 2.6 years) participated in this study. Participants performed squats at above parallel (AP), parallel (P), and below parallel (BP) depths with 0%, 50%, and 85% of a measured 1 rep max. Kinematics were recorded using a 12-camera motion capture system while ground reaction forces were measured with two force plates. Joint moments at the ankle, knee, and hip were summed to calculate M. Differences between depths and loads in peak M and the percent each joint contributed to peak M were evaluated using a 3x3 repeated measures ANOVA. **Results:** Peak M increased as load increased (0%: 2.2 ± 0.3 Nm/kg, 50%: 3.1 ± 0.2 Nm/kg, 85%: 3.8 ± 0.1 Nm/kg, p<0.001), but not as depth increased (p=0.149). There was a significant depth * load interaction for hip contributions to M (p=0.013), with hip contributions increasing with heavier loads for AP and P depths, but not BP (Figure 1A). There was also a depth * load interaction for knee contributions to M (p=0.046). However the opposite pattern was displayed. As load increased, knee contributions to M decreased for the AP and P depths, but not BP (Figure 1B). Ankle contributions to M did not change with depth (p=0.483) or load (p=0.581). **Conclusion:** Total demand on lower extremity joints increases with increasing load but not depth in the back squat. At AP and P depths, increasing load involves the hip musculature more and the knee musculature less. At deep depths changing load does not impact how much each joint contributes to M.

**Figure 1.** Percent contributions to total support moment at different depths and loads for the hip (A) and knee (B).

### Table 1

<table>
<thead>
<tr>
<th></th>
<th>CMI</th>
<th>IS</th>
<th>Appendix P Value</th>
<th>CMIAT</th>
<th>IS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flight Height (cm)</td>
<td>30.9</td>
<td>29.6</td>
<td>0.987</td>
<td>37.1</td>
<td>34.6</td>
</tr>
<tr>
<td>Jump Height (cm)</td>
<td>40.4</td>
<td>38.0</td>
<td>0.916</td>
<td>48.2</td>
<td>46.4</td>
</tr>
</tbody>
</table>

**Table 1.** CMIAT versus IS for vertical jump performance parameters.

### Figure 1

D-62 Free Communication/Poster - Mobile Monitoring

**Title:** Reliability and Validity of a Wireless Inertial Sensor for Assessing Vertical Jump Biomechanics

**Authors:** Joseph J. DeVita, Ian J. Kremenec, Karl F. Orishimo, Malachy P. McHugh, FACSAM, Nicholas Institute of Sports Medicine and Athletic Trauma, Lenox Hill Hospital, New York, NY. (Sponsor: Malachy P McHugh, FACSAM)

**Purpose:** Compare vertical jump metrics measured using force plates (FP) versus a wireless inertial sensor (IS).

**D-62**

**Board #96**

**May 31 3:30 PM - 5:00 PM**

**Support Moment Distribution While Squatting With Different Depths and Percentages One Rep Max**

**William Goodman1, Scott Wilson1, Linnea Zavala1, Victoria Flores1, Joshua Cotter1, James Becker1. Montana State University, Bozeman, MT. California State University, Long Beach, Long Beach, CA.**

(No relevant relationships reported)

3D motion capture (3D) systems are the gold standard for assessing displacement during movements such as a drop vertical jump (DVJ) and a countermovement jump (CMJ). However, it is not feasible to use 3D in the field during game or practice situations. **Purpose:** To examine validity of vertical jump height measured by inertial measurement units (IMU). **Methods:** Eleven male (15.4±0.9yrs, 178.0±6.5cm, 80.5±13.04kg) high school football players participated. A small IMU placed in an elastic belt was worn around the waist of each subject during 3 CMJ and 3 DVJ. Maximum vertical jump height was recorded as the vertical displacement of the pelvis using standard 3D techniques. A 2x2 repeated measures ANOVA (p<0.05) was used to determine differences in vertical displacement between measurement methods and movement type. 95% limits of agreement (LOA) and Bland Altman plots were utilized to determine the level of agreement between IMU and 3D during each task. **Results:** A significant interaction between measurement and movement was found in vertical displacement (p<0.05). During the CMJ, the displacement measurement was not different (3D: 46.9±5.4cm, IMU: 45.9±3.8cm; p=0.36). However, during the DVJ, the IMU measurement was statistically underestimated (45.0±3.7cm p=0.001) compared to 3D (48.7±5.7cm). Bland Altman points and 95% LOA (Figure) illustrate a systematic error between the IMU and 3D during the DVJ.

**Conclusions:** IMU technology is advancing with potential utility for on-field and in-game use. However, the algorithms which calculate vertical jump height may need to be adapted for varying types of complex movements.

**Figure 1.** Percent contributions to total support moment at different depths and loads for the hip (A) and knee (B).

**Table 1.** CMIAT versus IS for vertical jump performance parameters.

<table>
<thead>
<tr>
<th>Performance Metrics</th>
<th>CMI</th>
<th>IS</th>
<th>r-value</th>
<th>CMIAT</th>
<th>IS</th>
<th>r-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flight Height (cm)</td>
<td>30.9</td>
<td>29.6</td>
<td>0.987</td>
<td>37.1</td>
<td>34.6</td>
<td>0.987</td>
</tr>
<tr>
<td>Jump Height (cm)</td>
<td>40.4</td>
<td>38.0</td>
<td>0.916</td>
<td>48.2</td>
<td>46.4</td>
<td>0.885</td>
</tr>
</tbody>
</table>

**Table 1.** CMIAT versus IS for vertical jump performance parameters.

**D-62 Free Communication/Poster - Mobile Monitoring**

**Board #97**

**May 31 3:30 PM - 5:00 PM**

**Reliability and Validity of a Wireless Inertial Sensor for Assessing Vertical Jump Biomechanics**

**Joseph J. DeVita, Ian J. Kremenec, Karl F. Orishimo, Malachy P. McHugh, FACSAM, Nicholas Institute of Sports Medicine and Athletic Trauma, Lenox Hill Hospital, New York, NY.** (Sponsor: Malachy P McHugh, FACSAM)

(No relevant relationships reported)

**Table 1.** CMIAT versus IS for vertical jump performance parameters.

**Figure 1.** Percent contributions to total support moment at different depths and loads for the hip (A) and knee (B).

**D-62 Free Communication/Poster - Mobile Monitoring**

**Board #98**

**May 31 3:30 PM - 5:00 PM**

**Validity of a Commercially Available Inertial Measurement Unit for Vertical Jump Height Measurement**

**Gregory A. Crisafulli, Jeffrey B. Taylor, Anh-Dung Nguyen, Kevin R. Ford, FACSAM, High Point University, High Point, NC.** (Sponsor: Kevin R. Ford, FACSAM)

(No relevant relationships reported)
Running pace is one of the primary measures of running intensity, however, variations in grade and surface limit quantifying intensity solely based on pace. With the advent of wearable running power meters, runners can assess the external work stimulus inclusive of pace, grade, and surface. **Purpose:** To assess reliability, a running power meter was evaluated based on submaximal running on three different surfaces.

**METHODS:** Eight collegiate cross country runners (male n=4, age=21.25±0.50 yrs, weight=63.45±9.73 kg, height=178.5±10.82 cm; female n=4, age=20±1.41 yrs, weight=56.45±4.95 kg, height=169.5±7.97 cm) participated in two trials of submaximal running at 85% of lactate threshold (LT) on each of three different surfaces: treadmill, grass, and track. All subjects completed a VO2max and LT running test. For this investigation, sub-maximal running speed/pace was determined from the maximal effort / LT test. During subsequent submaximal running trials, ventilatory and metabolic measures and heart rate (HR) were collected with a portable breath analyzer (COSMED K4B2) and HR monitor (Polar). For the track and grass submaximal running, the runners were paced by a cyclist maintaining a constant speed using a speedometer. Intraclass correlations were run between trials 1 and 2 for the three different surfaces (Power: R=0.998).

**CONCLUSIONS:** The results support that the Stryd running power meter can reliably measure power of submaximal running on three different surfaces including treadmill, grass, and track.

**RESULTS:** Running power for the treadmill surface was significantly lower than both the grass and track (Mean±SE: RPowerTreadmill = 237±12.7 W, RPowerGrass = 244±13.4 W, RPowerTrack = 242±13.0 W). There were no significant differences between grass and track surfaces (*p<0.05).

**CONCLUSIONS:** This investigation found that running power (Stryd) is less when running on a treadmill compared to running on grass and a track which may indicate a different training stimulus when training on a treadmill versus other surfaces.

**D-63 Free Communication/Poster - Sports Performance and Injury**

**1840 Board #101 May 31 3:30 PM - 5:00 PM**

**Differences In Wearable Running Power On Three Different Surfaces During Submaximal Running**

Mason Coppi, Lee Shearer, Nicholas Hayden, Jake Ogden, Frank Lara, Scott Murr, Eric Sobolewski, Randolph Hutchinson. *Furman University, Greenville, SC.* (Sponsor: Anthony Caterisano, FACSM)

(No relevant relationships reported)

Running pace is one of the primary measures of running intensity, however, variations in grade and surface limit quantifying intensity solely based on pace. With the advent of wearable running power meters, runners can assess the external work stimulus inclusive of pace, grade, and surface. **Purpose:** To assess differences in running power (RP) on different surfaces, a Stryd running power meter was evaluated based on submaximal running on three different surfaces.

**METHODS:** Eight collegiate cross country runners (male n=4, age=21.25±0.50 yrs, weight=63.45±9.73 kg, height=178.5±10.82 cm; female n=4, age=20±1.41 yrs, weight=56.45±4.95 kg, height=169.5±7.97 cm) participated in two trials of submaximal running at 85% of lactate threshold (LT) on each of three different surfaces: treadmill, grass, and track. All subjects completed a VO2max and LT running test. For this investigation, sub-maximal running speed/pace was determined from the maximal effort / LT test. During subsequent submaximal running trials, ventilatory and metabolic measures and heart rate (HR) were collected with a portable breath analyzer (COSMED K4B2) and HR monitor (Polar). For the track and grass submaximal running, the runners were paced by a cyclist maintaining a constant speed using a speedometer. ANOVAs were run between trials on all surfaces including treadmill, track and grass.

**RESULTS:** The running power for the treadmill surface was significantly lower than both the grass and track (Mean±SE: RPowerTreadmill = 237±12.7 W, RPowerGrass = 244±13.4 W, RPowerTrack = 242±13.0 W). There were no significant differences between grass and track surfaces (*p<0.05).

**CONCLUSIONS:** This investigation found that running power (Stryd) is less when running on a treadmill compared to running on grass and a track which may indicate a different training stimulus when training on a treadmill versus other surfaces.

**1841 Board #102 May 31 3:30 PM - 5:00 PM**

**Comparisons Of Ankle And Knee Kinetics During Demi-Plié Ballet Movements**

Morris Levy, Darren Dutto, LilaAnn White. *University of Minnesota, Duluth, MN.* Eastern Oregon University, La Grande, OR.

(No relevant relationships reported)

The Demi-Plié (DP) and Demi-Plié Relevé (DP-R) movements are foundational to performance in Ballet. The DP and DP-R have similar downward phases with the difference consisting of an upward phase in the DP-R when the dancer goes up on her toes, while extending ankle and knee. **Purpose:** The purpose of this study was to compare ankle and knee motion (kinetics) during the downward phase of the Demi-Plié and Demi-Plié Relevé, with a hypothesis that peak moments would increase during the DP-R. **METHODS:** Ten college ballet students (mass = 70 ± 14 kg) performed three sets of eight Demi-Plié and Demi-Plié Relevé movements. Full body kinematics were collected using a 12-camera Vicon motion capture system (Oxford, UK). Two Force plates (AMTI) were used to isolate the Ground Reaction Forces (GRF) of each foot. For each individual, average peak ankle/foot and knee moments in the sagittal and frontal planes were determined for each leg, using the average of values determined for each cycle of movement. Beginning of each movement was identified as initiation of knee flexion during the downward phase. Peak moments were compared between the two movements using t-tests. **RESULTS:** Ankle extension moments were greater in the DP-R (Left: DP = 0.60 ± 0.11, DP-R: 0.76 ± 0.13 Nm/...
MEDICINE & SCIENCE IN SPORTS & EXERCISE®

1842 Board #103 May 31 3:30 PM - 5:00 PM
Technical Note: Measuring Muscle Activity During Plyometric Exercise In Shallow Water
Cordero Duvon Roche, Leland Barker, John A. Mercer, FACSM. University of Nevada, Las Vegas, Las Vegas, NV. (Sponsor: John A. Mercer, FACSM)

(no relevant relationships reported)

Plyometric exercise in water is used by a variety of people. Recently, a water proof system to measure muscle activity has become available but the procedures for analyzing muscle activity during water plyometrics are not established. PURPOSE: The aim of this study was to describe the procedures for collecting and analyzing muscle activity data during plyometrics in the water and on land. METHODS: A single subject (male, 29 yr, 170 cm, 81.8 kg) completed all conditions. The subject completed two plyometric exercises (countermovement jump (CMJ), drop jump (DJ)) during the two environmental conditions (on land, underwater). Electromyography (EMG) signals were recorded using a water proof EMG system (Cometa Miniwave Infinity, 2000 Hz). Each sensor measured along 3 axes. EMG was recorded from four muscles (rectus femoris (RF), biceps femoris (BF), gastrocnemius (GA) and tibialis anterior (TA)) during CMJ and DJ while on land and in water. The subject then performed three trials of CMJ then three trials of DJ (from 30.5 cm platform) on land. The subject stood still for at least 1 sec between each condition. After completion on land the subject performed the same conditions in the same order in the water. Depth of water was set to about navel high. EMG data were processed by removing zero offset and full wave rectifying with percent difference (%diff) calculated between on land and in water for each movement. The start and end of each movement was identified in the raw EMG and end of movement (standing still after landing from jump) was a 5% less than baseline after landing. EMG data were then averaged between start and end times. %Diff data were averaged across trials. RESULTS: The CMJ movement duration was similar on land (2.1±0.08 s) and in water (2.4±0.20 s) but different during DJ on land (1.9±0.13 s) vs. in water (3.0±0.86 s). During CMJ, %diff for RF (-0.6%) and TA (6.5%) was similar but BF (10.6%) and GA (70.9%) were more active during water. During DJ, BF (55.9%), GA (70.9%), and TA (34.4%) were more active but RF (-9.5%) less active during water vs. on land. CONCLUSION: Using sensors that incorporated EMG and accelerometers allowed for analysis of muscle activity during plyometrics.

Lower-extremity stiffness is suggested to contribute to lower-extremity injury risk. Specifically, lower stiffness is believed to lead to excessive joint motion and contribute to soft tissue injuries. Alternately, higher stiffness is thought to enhance overall joint stability, reduce ligament loading, and potentially increase bone loading. Thoughbeneficial in the short-term, the long-term bone loading (1.85±0.34 Hz) was lower (p=0.002, n=0.68) than flutter kicking frequency (2.33±0.33 Hz). Dolphin kicking (0.88±0.12) was more efficient as indicated by a lower Strouhal number (p=0.001, n=0.71) than flutter kicking (1.11±0.21). Body position had no effect on any measure of kicking performance (p>0.05). CONCLUSION: For these participants, dolphin kicking was a faster, more efficient form of underwater kicking. However, body position had little effect on the ability of these participants to perform the respective kicking style.

Despite an increasing emphasis on underwater dolphin kicking in competitive swimming, little objective evidence exists to explain its preference over flutter kicking. PURPOSE: To examine kinematic characteristics of flutter and dolphin kicking performed from lying and supine body positions. METHODS: Two video-based biomechanical analysis systems (1.77±0.07 m, 72.4±7.6 kg, 19.8±1.0 yrs) experienced with dolphin and kicking. PURPOSE: To examine kinematic characteristics of flutter and dolphin kicking. METHODS: Whole body speed was defined as horizontal hip velocity. Kicking was digitized for three complete kicking cycles to determine linear and angular kinematic variables. Linear velocities were computed using the first central difference method. Kinematic measurements were compared between kicking style and body positions using a 2x2 (kick x position) repeated measures ANOVA. RESULTS: Dolphin kicking velocity (1.22±0.18 m/s) was faster (p<0.001, n²=0.68) than flutter kicking velocity (0.99±0.12 m/s). Dolphin kicking amplitude (0.58±0.10 m) was larger (p<0.001, n²=0.93) than flutter kicking amplitude (0.48±0.06 m). Dolphin kicking frequency (1.85±0.34 Hz) was lower (p=0.002, n²=0.68) than flutter kicking frequency (2.33±0.33 Hz). Dolphin kicking (0.88±0.12) was more efficient as indicated by a lower Strouhal number (p=0.001, n²=0.71) than flutter kicking (1.11±0.21). Body position had no effect on any measure of kicking performance (p>0.05). CONCLUSION: For these participants, dolphin kicking was a faster, more efficient form of underwater kicking. However, body position had little effect on the ability of these participants to perform the respective kicking style.

1844 Board #105 May 31 3:30 PM - 5:00 PM
Higher Vertical Stiffness Is Related To Greater Fifth Metatarsal Bone Mineral Density In Football Players
Thomas J. Hockenjos, Kevin R. Ford, FACSM, Justin P. Waxman, Anh-Dung Nguyen, Audrey E. Westbrook, Michelle A. Aube, Jeffrey B. Taylor. High Point University, High Point, NC. (Sponsor: Kevin Ford, FACSM)

(no relevant relationships reported)

Lower-extremity stiffness is suggested to contribute to lower-extremity injury risk. Specifically, lower stiffness is believed to lead to excessive joint motion and contribute to soft tissue injuries. Alternately, higher stiffness is thought to enhance overall joint stability, reduce ligament loading, and potentially increase bone loading. Though beneficial in the short-term, the long-term bone loading (1.85±0.34 Hz) was lower (p=0.002, n=0.68) than flutter kicking frequency (2.33±0.33 Hz). Dolphin kicking (0.88±0.12) was more efficient as indicated by a lower Strouhal number (p=0.001, n²=0.71) than flutter kicking (1.11±0.21). Body position had no effect on any measure of kicking performance (p>0.05). CONCLUSION: For these participants, dolphin kicking was a faster, more efficient form of underwater kicking. However, body position had little effect on the ability of these participants to perform the respective kicking style.

1843 Board #104 May 31 3:30 PM - 5:00 PM
Kinematic Comparison of Dolphin Kicking Performed in a Prone and Supine Body Position
Mickey B. Scharbrough, Taylor L. Adams, Peter E. Robinson, Kalli T. Rose, Scott P. McPeian. Southwestern University, Georgetown, TX. (Sponsor: John Bartholomew, FACSM)

(no relevant relationships reported)

Despite an increasing emphasis on underwater dolphin kicking in competitive swimming, little objective evidence exists to explain its preference over flutter kicking. PURPOSE: To examine kinematic characteristics of flutter and dolphin kicking performed from lying and supine body positions. METHODS: Two video-based biomechanical analysis systems (1.77±0.07 m, 72.4±7.6 kg, 19.8±1.0 yrs) experienced with dolphin and flutter kicking. PURPOSE: To examine kinematic characteristics of flutter and dolphin kicking performed from lying and supine body positions. METHODS: Two video-based biomechanical analysis systems (1.77±0.07 m, 72.4±7.6 kg, 19.8±1.0 yrs) experienced with dolphin and flutter kicking. RESULTS: Dolphin kicking velocity (1.22±0.18 m/s) was faster (p<0.001, n²=0.68) than flutter kicking velocity (0.99±0.12 m/s). Dolphin kicking amplitude (0.58±0.10 m) was larger (p<0.001, n²=0.93) than flutter kicking amplitude (0.48±0.06 m). Dolphin kicking frequency (1.85±0.34 Hz) was lower (p=0.002, n²=0.68) than flutter kicking frequency (2.33±0.33 Hz). Dolphin kicking (0.88±0.12) was more efficient as indicated by a lower Strouhal number (p=0.001, n²=0.71) than flutter kicking (1.11±0.21). Body position had no effect on any measure of kicking performance (p>0.05). CONCLUSION: For these participants, dolphin kicking was a faster, more efficient form of underwater kicking. However, body position had little effect on the ability of these participants to perform the respective kicking style.

1845 Board #106 May 31 3:30 PM - 5:00 PM
The Influence Of Load On Preferred Countermovement Depth During Jump Squats
Leland Barker, John Mercer, FACSM, UNLV, Las Vegas, NV. (Sponsor: John Mercer, PhD, FACSM, FACSM)

(no relevant relationships reported)

ABSTRACT

The jump squat exercise is used in training to provide increased stress to the countermovement jump. However, it is not clear how load influences preferred countermovement depth during the jump squat. PURPOSE Compare preferred countermovement depth (PREF) to full and quarter depths (FULL, QTR) during the jump squat across a range of loads. METHODS On any one, participants (Male, n=12; 52 ± 3.9 yrs, 1.77 ± 0.7 m, 88.3 ± 15.7 kg) performed a 3 repetition maximum (3 RM) back squat, which was used to estimate the 1 RM back squat (1 RM = 3 RM/0.9). On the second collection 2-10 days later, jump squats were performed with barbell loads of 0%, 15%, 30%, 45%, 60%, and a return to 0% of 1 RM. Three trials at each load were performed with instructions being to jump as high as possible. Order between conditions was counterbalanced. Vertical ground reaction force (vGRF) was measured from a dual force platform setup (f=1000 Hz). Vertical cues were given for each depth. Acceleration was calculated from vGRF (ZF=ma), velocity was integrated from acceleration, and position was integrated from velocity. Countermovement depth was calculated as the minimum position during the jump squat. Jump height was calculated as: (takeoff velocity)²/(2*9.81). 3 (technique)

1846 Board #107 May 31 3:30 PM - 5:00 PM
The Influence Of Pectoralis Major And Tricep, On Vertical Jump Height
Catherine A. Anderson, Melissa D. Glatz, Joshua E. Adams, John L. Funk, FACSM, Air Force Institute of Technology, Dayton, OH. (Sponsor: John L. Funk, FACSM)

(no relevant relationships reported)
RESULTS

Three-dimensional (3D) motion analysis has been regarded as the gold standard for measuring landing mechanics. However, motion analysis is limited in clinical settings due to the time and expertise requirements. The amount of knee flexion during a single leg landing task is commonly assessed and has been found to be related to a number of injuries. However, to date there have been few studies investigating the relationship between a simple two dimensional (2D) measure to 3D measurements. Establishing this relationship would be important to provide better tools for clinicians to use.

Purpose: To determine if there is a relationship between 2 and 3 dimensional knee flexion angle during a single leg hurdle task.

Methods: 2D Healthy Subjects (11 M, Age 22.4 ± 3.14, BMI 22.96 ± 3.60). Subjects performed instrumented single leg jumps over a series of 30.5 cm hurdles. The landing over the final hurdle was recorded with both a video camera and motion capture equipment. 2D knee flexion angles were measured using National Institute of Health image J program at the point of initial contact and peak knee flexion. An angle was determined by bisecting the knee along the mid shaft of the femur and tibia for the 2D motion. Peak knee flexion was determined in both the 2D video and 3D motion capture data with the association between the two assessed with a Pearson product moment correlation coefficient.

Results: Mean values for knee flexion in 3D were 24.8±9.7° at initial contact and 59.8±9.2° at peak knee flexion. Mean values for the 2D data were 28.0±6.6° at initial contact and 66.0±8.9° of peak knee flexion. There was a significant correlation at initial contact (r=0.717, p<0.001) as well as for peak knee flexion angle (r=0.617, p<0.006) between the 2D method and motion capture data.

Conclusion: At both initial contact and peak knee flexion, there was a strong relationship between the 2D and 3D angle values. Both measurements trended similarly but were different in magnitude. This suggests a simple 2D technique may be applicable in the clinical setting providing similar precision but different accuracy to the 3D motion capture data.

x 5 (load) repeated measures ANOVAs were performed on depth and jump height, followed by planned comparisons (1x5 and 1x5 ANOVAs) if an interaction was present (p<0.05). A paired-samples t-test was used to compare first and last 0% loads to assess possible fatigue and/or potentiation.

RESULTS

Neither depth nor jump height were influenced by an interaction (p>0.05). Countermovement depth was significantly different among jumps (p<0.05). FULL (0.44 m ± 0.08), and QTR (-0.24 m ± 0.06) regardless of load (p<0.05). Jump height was not influenced by technique (p>0.05), but there was a main effect for load (p<0.05) with jump height decreasing with load regardless of technique. Jump height was not different between the first and last 0% 1RM jump squat trials (p>0.05).

CONCLUSION

Countermovement depth was different among P lat, FULL, and QTR across loads, but jump height was not influenced by P lat, FULL, or QTR. These results demonstrate that verbal cues can elicit distinct countermovement depths during jump squats.
IPCs compared with SHAM and control sessions (25.1 ± 4 vs. 19.2 ± 2 vs. 20.3 ± 3 min respectively, session effect: P < 0.004). MVC at task failure was 80 ± 2 % lower than baseline (time effect: P < 0.001) for all test sessions (session × time: P = 0.31). At 25 % of time to task failure, exercise-induced pain was lower in IPC compared with SHAM and control sessions (1.3 ± 1 vs. 1.9 ± 2 vs. 2.6 ± 2 respectively, P = 0.03). Ratings of perceived exertion were similar between test sessions (session effect and session × time: P > 0.05). CONCLUSIONS: Compared with the control session, IPC increased time to task failure and decreased exercise-induced pain during fatiguing contraction of the plantar flexor muscles. Placebo effects induced in the SHAM session had minimal effects in these variables.

Increased participation in high school girls’ lacrosse has coincided with higher rates of game related head and facial injury. In response, rules allowing for the use of headgear following American Society for Testing and Materials (ASTM) performance standards has been adopted. However, due to the novelty of this equipment it remains unknown how lacrosse headgear responds to impacts after repeated use. PURPOSE: To compare the resultant peak linear acceleration (RPLA) between used and pristine girls’ lacrosse headgear during blunt impacts. METHODS: 10 pristine and 10 used Cascade LX Women’s Lacrosse Headgear were tested. Pristine headgear were tested in their original condition and were not worn or exposed to external elements or impacts prior to testing. Used headgear were worn for an entire competitive season (15 games, 51 practices). A Cadex Monoral Impactor impacted all headgear fitted to an EN 960 size J headform following ASTM standards (F1446-15b, F2220-15, and F3137-15) in the front, side, rear, and front boss, crown and one random locations. The resultant tri-axial acceleration of the EN 960 J headform was measured with Cadex Software. A factorial ANOVA was employed to compare RPLA among headgear conditions (pristine and used) and impact locations. RESULTS: A significant main effect for position was observed (P < 0.001). With the exception of random location with side location, all pairwise comparisons denoted statistically significant differences among them for RPLA (front = 50.6 ± 3.5, side = 37 ± 1.7, rear = 23.4 ± 2.1, rear boss = 56 ± 4.3, front boss = 63.1 ± 4.7, crown = 58.7 ± 3.5, random = 38.5 ± 5.2 RPLA). There was no significant difference between headgear conditions for RPLA. CONCLUSIONS: All headgear regardless of condition, met the ASTM performance standard. No differences existed in RPLA between pristine and used headgear. No differences existed among the pristine and used headgear. This indicates that the headgear is capable of being used beyond a single season. Our findings are comparable to those that investigate the RPLA of certified head impacts in high school girls’ lacrosse games. Further field research is necessary to evaluate if headgear improves the safety of girls’ lacrosse, including changes in behavior subsequent to the additional safety standard.

Compression clothing is commonly worn by athletes and anecdotally believed to elicit beneficial responses both physiologically and biomechanically during a performance. PURPOSE: To determine if compression socks influence muscle activity of the lower extremities while running. A secondary purpose was to assess whether compression socks had an effect on heart rate (HR) and rating of perceived exertion (RPE) during running. METHODS: Recreational runners (n = 5; 165 ± 5.77 cm; 67.48 ± 8.9 kg; 21.8 ± 3.25y) completed three running conditions: wearing graduated compression socks (CS), regular socks (RS), and placebo socks (PS). Each run was 10 minutes at a self-selected pace with speed controlled between conditions. CS were knee-high socks that had graduated compression moving proximally up the leg. Sock size used was based on shoe size as per manufacture instructions. RS were determined by the type of sock each subject was wearing on the day of testing. PS were regular soccer socks in which we fitted all subjects with LXL to minimize any compression and instructed each subject they were a different brand of compression socks. Subjects were blind to conditions. HR was recorded during the last 30s of all trials telemetrically (Polar, Lake Success, NY). Muscle activity of the lower extremity was measured through electrondomyography (EMG; Delays, Natick, MA). RPE was recorded at 3 minute intervals. EMG data were processed by removing any zero offset, rectifying, and averaging over 30 seconds of minutes 4, 7, and 10 of each trial. Dependent variables (EMG, HR, RPE) were each compared between conditions using repeated measure
ANOVAs (r=0.05). RESULTS HR and RPE were not significantly different between conditions (p>.05). Muscle activity for the Rectus Femoris (RF), Biceps Femoris (BF), and Gastrocnemius (GA) were not significantly different between conditions (p>.05). Muscle activity for the Tibialis Anterior (TA) was significantly different (p=0.042) during CS condition (47.8 ± 2.2 µV) compared to RS condition (63.0 ± 2.0 µV). This accounts for ~24% reduction in muscle activity while wearing compression socks. CONCLUSION Compression socks significantly decrease muscle activity of the TA during running but had no effect on the RF, BF, or GA.

Partial funding for this project was provided by NIH/NIADDK STEP-UP (R25DK078382).

The straight leg raise test and its variations are ubiquitous in clinical sports medicine practice to assess hamstring flexibility. However, the test techniques such as the straight leg raise test may not provide an accurate measurement of hamstring flexibility due to the many confounding variables including lumbar spine motion, lumbar spine positioning and femoro-acetabular motion. PURPOSE. The current study contrasted the difference in the measurement of supine, passive straight leg raise with and without a block lumbar spine. Passive straight leg raise was performed in both non-seated and seated positions. METHODS. Fourteen elite soccer players (males; 16.3 ± 0.5 years; 70.7 ± 4.16 kg; 1.78 ± 0.06 m) during freedom conditions (p>.05) in the non-seated position. Significant modifications (p<0.05) in muscle activation were also observed. Changes occurred in intermediary bouts, mainly in bout 2. CONCLUSION: Creatine supplementation has potential to influence biomechanical parameters related to impact control during a single session of HIIT based on running. Results indicate possible improvements in shock attenuation under creatine supplementation.

The snatch is a high-speed lift that is performed by many weightlifters ranging from recreational to Olympic athletes across a wide spectrum of ages. Despite the regular use of the snatch by athletes, limited research exists on the components of the movement that provide the greatest success. Research on competitive weightlifters is even more limited, particularly those individuals competing at the Masters level. Purpose: To determine the extent to which several second pull components relate to snatch performance, and the relationship between age, sex, and success in a high-level Masters competition. METHODS: 42 competitors, 23 women (35 to 64yrs) and 19 men (36 to 76yrs), from the 2017 National Masters Championship completed four snatch lifts using 85% of their 1RM to replicate match conditions. Simultaneously, three-dimensional barbell kinematics were collected and used to compute several characteristics describing the second pull, including peak (relative to body weight) and time (relative to full snatch time) to peak vertical force and power, and second pull time. Additionally, the barbell distance to displacement trajectory ratio across the entire snatch was computed as an indicator of mechanical efficiency. Backward multiple regression analysis was conducted to determine the factors that could predict each lifter’s championship meet performance, defined as their final snatch to body mass ratio. RESULTS: The final set of variables which were significant predictors (P<.001, R²=.84) of meet performance included second pull time (β=.175, P=.013), peak vertical second pull power (β=.303, P<.001), sex (β=.326, P<.001), and age (β=.412, P<.001). CONCLUSION: When comparing sex and age, men and younger competitors lifted more weight relative to their body mass while performing the snatch. Even when shorter second pull times were accounted for in the model, peak vertical force remained the most potent predictor for meet performance. Therefore, for optimal competitive success, Masters weightlifters should consider training that maximizes their capacity to exert high-speed force against the bar in the second pull. Such training might focus on vertical explosion utilizing shrug and triple-extension techniques while minimizing curvature in their second pull trajectory.

High-intensity interval training (HIIT) is an exercise mode designed to repeatedly stress the body with intense stimulus. Intense running can increase impact forces that could lead to exhaustion and impairments on shock attenuation during intense exercise and reduce impairments on shock attenuation. PURPOSE: The purpose of this study was to assess whether HIIT sessions under two conditions: after placebo supplementation (Pl) and after Creatine supplementation (Cr) significantly affected the body’s ability to attenuate shock during high-intensity sprinting. METHODS: Utilizing 25 collegiate male and female cross country runners, goniometric measurements of the passive straight leg raise with and without a block lumbar spine were taken on both the right and left leg. RESULTS: A correlation between the average straight leg raise with and without at blocked lumbar spine was found to have a moderate to high correlation (r=0.693, p value < .001). A dependent t-test revealed that there was a significant difference between straight leg raise measurements with and without a block lumbar spine; M (SLR) = 112.47°, SD = 19.41°, t (24) = -4.76, p<.001. CONCLUSION: Maintaining neutral lumbar spine position, replicating normal contra-directional lumbo-pelvic rhythm during the measurement of hamstring flexibility. The results of this study indicate that consideration must be given to lumbar spine position and normal, functional, contra-directional lumbo-pelvic rhythm during the measurement of hamstring flexibility. Changes in testing procedures need to be made in the clinical setting to ensure that athletes are being correctly identified as demonstrating normal hamstring flexibility before being cleared to return to activity after hamstring injury.

Cyclists tend to spontaneously switch from a seated to standing (non-seated) position when they need to produce high pedal torque and power (i.e. during steep climbs, accelerations and sprinting). Existing evidence shows that adopting a non-seated position can result in better economy at high power outputs and an increased level of peak power, yet the mechanisms underpinning these performance advantages remain unclear. PURPOSE: To compare lower limb muscle activity, joint moments and joint mechanical efficiencies between seated and non-seated cycling at varying cadences. METHODS: Sixteen, male participants rode on an instrumented ergometer at 50% of peak power (above the reported threshold for sit to stand transition) under different pedalling conditions: seated (S) and non-seated (NS). All experiments were performed under (rest) and (incremental) conditions whilst we recorded electromyography from lower limb muscles, full body motion capture and crank radial and tangential forces. A scaled full-body OpenSim model was used to calculate joint kinematics, moments and mechanical efficiencies. Statistical comparisons were made using a repeated measures, two-way ANOVA (position x cadence). RESULTS: The main effect of position on the distribution of total work across the joints in comparing seated to non-seated conditions. This was demonstrated by a decrease in knee work (S=1.74±0.01 vs. NS=1.38±0.01 W.kg⁻¹, p<0.05) and an increase in hip (S=2.33±0.52 vs. NS=2.57±0.53 W.kg⁻¹, p>0.05) and ankle work (S=0.85±0.15 vs. NS=0.97±0.17 W.kg⁻¹, p<0.05) in the non-seated relative to the seated position. At 70rpm (the mean cadence) the mean knee joint moment was reduced and ankle power increased in the non-seated condition. In contrast, at 120 rpm knee power was reduced in the non-seated position, while there was only a moderate increase in ankle power (S=0.75±0.24 vs. NS=0.85±0.29 W.kg⁻¹, p<0.05). CONCLUSION: These
Saccadic eye movements are produced from several frontal and parietal cortical regions of the brain that also aid in the execution of cognitive functions. However, no known research has examined the relationship between a sport-like antagonistic task and standard neurocognitive exams. **Purpose:** To evaluate the relationship between the Immediate Post-Concussion Assessment and Cognitive Testing (ImpACT) cognitive domains and a sport-like antagonistic task (SLT) of Division I athletes on symptom free-day of post-sport like concussion. **Methods:** 10 concussed individuals (8 males; 2 females; age: 20 ± 2 years) were assessed on the ImpACT test and the SLT on a symptom free day post-sport related concussion. A monocular eye tracker (240Hz, Argus Science) synced with the Vicon Motion Capture System (Vicon Motion Ltd., Version 1.85, Oxford, England) was employed to track raw cortical coordinates and further analyzed to obtain resultant distance (RD), mean horizontal velocity (MHV), and prosaccade errors (PE) during the athlete’s participation in the SLT. ImpACT variables included verbal and visual memory composite, visual motor speed, reaction time composite (RT), and impulse control. All eye movements were run through a custom Matlab code (MATLAB 2017, Mathworks, Inc., Matick, MA). Spearman rho correlations were used to assess the relationship between ImpACT variables and neurocognitive metrics. **Results:** Significant negative moderate relationships (r = -0.70, p < 0.02) between MHV (5.78 ± 1.28 pixels/second) and reaction time composite score (0.57 ± 0.07) were observed. Similarly, there was a significant negative moderate relationship (r = -0.65, p < 0.03) between RD (2.73 ± 0.03 pixels) and Impulse control composite score (6.4 ± 3.75). No other significant relationships were noted. **Conclusion:** These significant relationships suggest that as eye velocities increase, RT decreases which is possibly due to a decrease in accuracy on overall cognitive efficiency. As impulse control decreases, the eye movement resultant distances are minimal. This may be due to more cognitive errors that lead to an inability to properly control antagonistic eye movements. Due to the relationships exhibited between the ImpACT and SLT, it can be suggested that saccadic eye movements contain a neurocognitive component.
rectus abdominis, erector spinacel longissimus, and biceps brachii long head using a wireless EMG system (Trigno, Delays, USA). Breath-by-breath pulmonary gas exchange data were measured continuously throughout (Ventus, Carefusion, USA).

RESULTS: There were no differences between the two ergometers in energy cost or neuromuscular activation (peak EMG amplitude) of 5 muscles. However, mean handle force and impulse during the drive phase were greater on the Skillrow than Concept II (P=0.002), also with a tendency for higher peak force (P=0.087). Skillrow involved a lower peak handle velocity (0.006) and longer drive phase (P=0.003) than Concept II.

CONCLUSION: The two ergometers were similar in terms of energy cost and neuromuscular activation. In term of biomechanical parameters rowing with the Skillrow required a higher average force and impulse, a lower peak velocity and a longer drive phase.

While there is limited research examining the kinematics of the quarterback passing throw, to date there have not been any studies reporting on ground reaction forces (GRF) during this type of throwing motion. Additionally, there have been no studies reporting how foot positions or drop patterns used by quarterbacks might change GRF parameters. This information would useful to both coaches and sports medicine professionals as it provides both performance and injury related insights.

METHODS: Compare GRF parameters between three commonly used quarterback drop patterns: a one step (1S), a three step (3S), and a three plus one step (3P1) when performed with the rearfoot angled 90° relative to the throwing direction and 45° relative to the throwing direction. METHODS: Three NCAAA Division I quarterbacks participated in this study. Participants performed three throws using each type of drop and each foot position. Two force plates were used to record GRF data at 1000 Hz. Trials were considered valid if both the front (FF) and rear (RF) feet landed on their respective force plates, with the RF foot in the appropriate orientation. For both the RF and FF, peak horizontal and vertical forces, and horizontal and vertical impulses were calculated. Differences between foot positions and drop patterns were evaluated using a 2x3 repeated measures ANOVA. RESULTS: There were no differences in any force metrics for the FF. For the RF, peak horizontal GRFs showed a main effect of drop (F2,43=9.9, p=0.002), with peak forces being lower in the 3P1 (120.7 ± 13.5 N) than the 3S (476.7 ± 50.5 N) or 1S (387.8 ± 2.6 N) conditions. Peak vertical forces in the RF also showed a main effect of drop (F2,43=13.2, p=0.000), with peak forces being lower in the 3P1 (102.7 ± 18.9 N) than the 3S (1359 ± 105.8 N). Lastly, there was a main effect of drop for RF horizontal impulse (F2,43=5.5, p=0.001), with impulses being lower in the 3P1 (58.2 ± 9.12 Ns) than the 3S (150.7 ± 4.5 Ns) or 1S (150.8 ± 5.1 Ns) conditions.

CONCLUSION: A 3P1 drop pattern makes use of horizontal momentum, thus requiring the athlete to generate less force and smaller impulses with the RF during the throw. As such, coaches should emphasize pushing with the RF when using a 1S or 3S drop pattern. Changing foot positions does not appear to influence force parameters.

Hip joint torques during the golf swing of young and senior female golfers. Female participation in golf has increased throughout the past few decades and now comprises approximately 20% of all golf participants. However, little is known regarding the biomechanics of the golf swing for women, and even less is known about hip torques.

PURPOSE: To describe and compare the hip torques associated with the golf swing of healthy young and senior female golfers. METHODS: 21 right-handed, female golfers, aged from 18-70 years old volunteered. Age groups were divided into young (18 – 39) and senior (40 – 70) subjects. Completed 10 swings with a standardized driver. A high speed motion capture system and force plates were used to collect kinematic and kinetic data. 3-D hip torques for trail and lead legs were calculated using inverse dynamic analyses. 2-way mixed model ANOVAs (group by leg) were calculated, with club head velocity as a covariate.

RESULTS: There were no differences between the groups for BMI (24.6 ± 3.5), handicap (22 ± 7), or club head velocity (30.1 ± 4.2 m/s). The trail hip extensor torque was the largest torque produced by both groups. A main effect for leg was found for hip internal rotator torque (p=0.024) with the largest torques produced by the trail leg. There was an interaction between the legs by groups for hip abductor torque (p=0.043); the young group had larger torques for the lead leg, while the senior group had no difference between legs. Club head velocity was significantly (p<0.05) correlated with hip internal rotator torques of both the lead and trail leg (r=0.7 and 0.56, respectively), however, when separated by group, these correlations were only significant for the young group (r=0.8, p=0.001).

CONCLUSIONS: Overall, hip torques in the trail leg were larger, which suggests their important contribution to the golf swing. These findings are similar to previous literature for healthy male golfers.

While putting in golf, the direction of movement and force of the club head should be consistent among each swing. In order to maintain consistency in swing timing, the cerebellum provides temporal information, motor timing, control of rhythm, and timing of movements. We utilized a brain training neurotechnology that combines the concept of a musical metronome with a computer-based program that facilitates the improvement of an individual’s rhythm and timing. PURPOSE: To determine if metronome training (MT) activates neural networks involved in the swing put and decreases variation in the swing speed.

METHODS: Twenty professional female golfers (KPGA) were randomly assigned to either MT training group (n=10, 35-40 min per session, twice a week for 6 weeks) or a control group (n=10). The putting performance and brain activity were analyzed using kinematic software and resting state functional MRI. Consistency was measured as the standard deviation of the mean swing speed (SSD) during three sections of the swing: backswing/AD-BS, backswing-impact (BS-IMP), impact-finish (IMP-FIS). RESULTS: The MT group improved consistency in the time between the back swing and ball impact in a 2 meter putt compared to the control group (pre: 0.97 ± 0.02 vs 0.90 ± 0.03, post: 0.93 ± 0.02 vs 0.90 ± 0.03). In addition, the MT group showed greater consistency (measured as a lower SSD) in the duration of the full swing of the 5 meter putt compared to the control group (pre: 2.11 ± 0.61 vs 1.67 ± 0.07, post: 1.41 ± 0.9 vs 1.11 ± 0.6, F=5.59, p=0.02) and in swing time in the SAD-BS section of the 5 m putt compared to the control group (pre: 0.72 ± 0.04 vs 0.52 ± 0.04, post: 0.43 ± 0.03 vs 0.51 ± 0.06, F=9.24, p<0.01). After the training period, the MT group showed increased functional connectivity from the superior cerebellar vermis to the right medial frontal gyrus, left superior temporal gyrus, right middle occipital gyrus, right middle temporal gyrus, right cingulate gyrus, and right supramarginal gyrus (uncorrected p<0.001, voxels>40).

CONCLUSION: MT training in professional female golf players may improve the consistency and reduce variability in putt timing. In addition, MT training may increase brain connectivity from the cerebellum to the frontal cortex which plays an important role in the timing process.

Differences in ground reaction forces when collegiate quarterbacks throw using different drop patterns. Cailyn Schroeder, Samantha Bessert, John Seifert, James Becker. Montana State University, Bozeman, MT. (No relevant relationships reported)

PURPOSE: To describe and compare the hip torques associated with the golf swing of healthy young and senior female golfers. These findings are similar to previous literature for healthy male golfers.

Hipp Joint Torques During the Golf Swing of Young and Senior Healthy Females
Judy Foxworth, Chris Wendt, Audrey L. Millar, FACSM. Winston-Salem State University, Winston-Salem, NC. (Sponsor: Audrey Lynn Millar, FACSM) (No relevant relationships reported)

Hip joint torques during the golf swing of young and senior healthy females. Female participation in golf has increased throughout the past few decades and now comprises approximately 20% of all golf participants. However, little is known regarding the biomechanics of the golf swing for women, and even less is known about hip torques.

PURPOSE: To describe and compare the hip torques associated with the golf swing of healthy young and senior female golfers. METHODS: 21 right-handed, female golfers, aged from 18-70 years old volunteered. Age groups were divided into young (18 – 39) and senior (40 – 70) subjects. Completed 10 swings with a standardized driver. A high speed motion capture system and force plates were used to collect kinematic and kinetic data. 3-D hip torques for trail and lead legs were calculated using inverse dynamic analyses. 2-way mixed model ANOVAs (group by leg) were calculated, with club head velocity as a covariate.

RESULTS: There were no differences between the groups for BMI (24.6 ± 3.5), handicap (22 ± 7), or club head velocity (30.1 ± 4.2 m/s). The trail hip extensor torque was the largest torque produced by both groups. A main effect for leg was found for hip internal rotator torque (p=0.024) with the largest torques produced by the trail leg. There was an interaction between the legs by groups for hip abductor torque (p=0.043); the young group had larger torques for the lead leg, while the senior group had no difference between legs. Club head velocity was significantly (p<0.05) correlated with hip internal rotator torques of both the lead and trail leg (r=0.7 and 0.56, respectively), however, when separated by group, these correlations were only significant for the young group (r=0.8, p=0.001).

CONCLUSIONS: Overall, hip torques in the trail leg were larger, which suggests their important contribution to the golf swing. These findings are similar to previous literature for healthy male golfers.
Lower back pain (LBP) in golf has been associated with repeated swing performance and high-speed swing loads/rotations. While different swing techniques exist, no studies have examined the “traditional” or modern swing with the lower body swing. The lower body swing, a novel technique, is believed to reduce the risk of LBP, as it does not require extensive lateral axis tilt of the upper body as rotations are achieved through increased motion at the knees and hips. PURPOSE: To analyze the modern and lower body swing with respect to the risk of developing LBP. METHODS: Nine athletes performed the modern swing (Age 48 ± 13.6 yrs, Height 176.8 ± 4.4 cm, Mass 82.1 ± 53.3 kg) and seven lower body swing (Age 53.9 ± 12.1 yrs, Height 182.9 ± 8.6 cm, Mass 92.5 ± 14.8 kg) all free from LBP. Whole-body kinematics were recorded during a motion analysis system and a continuous test (point by point) was performed to determine differences in functional assessments associated with LBP (high crunch factor and thorax to pelvis abduction velocity and acceleration, flexion velocity, thorax rotational velocity and acceleration). Cohens d was calculated to determine the magnitude of effects. RESULTS: Significant differences with strong effects (p < 0.05; d > 0.80) were observed for: thorax to pelvis abduction acceleration (lower=535 ± 333°/s²; modern=1024 ± 464°/s²; p = 0.009). The difference in the peak flexion velocity contributing towards excessive contralateral trunk lean during the pitching kinetic chain have not been well described in collegiate level pitchers. PURPOSE: To examine the relationship between trunk muscle fatigue, trunk flexibility, and balance in relation to maximum contralateral lean at maximal shoulder external rotation demonstrating excessive contralateral rotation. METHODS: Anthropometric measurements, isometric holds in trunk flexion, extension, lateral planks, flexibility, and STAR Excursion Balance Test assessments were performed on 10 Division I Collegiate baseball pitchers ages 18-21 (mean 19.6, SD=1.04) with an average of 7.36 years of pitching experience (SD=3.23). Pitching kinematic analysis of fastball pitches was performed using 3-dimensional motion analysis techniques. RESULTS: Pearson correlations were performed to assess the association between functional assessments with trunk contralateral lean. The average degree of contralateral lean was 2.33 (SD=3.66). The average pitch speed was 80.3 (SD=5.40). No statistically significant correlations were found between any of the assessments and degree of contralateral trunk (r= -0.494, p= .146). CONCLUSION: The negative correlation between contralateral trunk lean and fastball pitch velocity and trunk assessments and contralateral trunk lean mean be a result of the small sample size (10 subjects) as previous studies of approximately 100 subjects have shown a positive correlation of contralateral trunk tilt of 10 degrees from neutral with an increase of only 0.5-1mph in pitch velocity.

In competitive baseball, the most common pitch is the fastball; its velocity associates linked with increased pitching velocity and increased joint forces. Pitchers with a less efficient transmission of the generated force from the lower limbs to the upper extremities consistent with less forward trunk flexion, less upper torso rotation, and greater upper torso contralateral flexion at maximal shoulder external rotation demonstrated excessive contralateral rotation. METHODS: Anthropometric measurements, isometric holds in trunk flexion, extension, lateral planks, flexibility, and STAR Excursion Balance Test assessments were performed on 10 Division I Collegiate baseball pitchers ages 18-21 (mean 19.6, SD=1.04) with an average of 7.36 years of pitching experience (SD=3.23). Pitching kinematic analysis of fastball pitches was performed using 3-dimensional motion analysis techniques. RESULTS: Pearson correlations were performed to assess the association between functional assessments with trunk contralateral lean. The average degree of contralateral lean was 2.33 (SD=3.66). The average pitch speed was 80.3 (SD=5.40). No statistically significant correlations were found between any of the assessments and degree of contralateral trunk (r= -0.494, p= .146). CONCLUSION: The negative correlation between contralateral trunk lean and fastball pitch velocity and trunk assessments and contralateral trunk lean mean be a result of the small sample size (10 subjects) as previous studies of approximately 100 subjects have shown a positive correlation of contralateral trunk tilt of 10 degrees from neutral with an increase of only 0.5-1mph in pitch velocity.

Individuals with sensory-integration delays may have some deficit in motor planning, or difficulty interacting with and influencing their surroundings. The demonstration of age-appropriate motor skills is therefore a primary outcome measure in this population. Therapeutic horseback riding may provide the necessary physical adaptations to improve motor skill proficiency. PURPOSE: To characterize motor skill proficiency following 8 weeks of therapeutic horseback riding with sensory integration therapy in children with sensory processing dysfunction. Methods: Twenty-seven children, ages 5 to 18 years, were recruited. All participants completed the same 32-week protocol that was separated into 4, 8-week blocks: a) a control period (no riding); b) a riding only period; c) a washout period (no riding); d) riding with additional sensory integration was separated into 4, 8-week blocks: a) a control period (no riding); b) a riding only period; c) a washout period (no riding); d) riding with additional sensory integration therapy (combination). Before and after each period, motor skills were assessed using the Bruininks-Oseretsky Test for Motor Proficiency (2nd edition). A one-way repeated-measures ANOVA was used to determine any differences between testing periods. A significant level of 0.05 was used. Results: All subtest scores were statistically similar (p > 0.05), with the exception of manual dexterity, which was different between pre-control and post-washout (p = 0.018), post-control and post-washout (p = 0.024), and pre-control and post-combination (p = 0.037). Overall scores were different between pre-control and post-combination (p = 0.003) and post-control and post-combination (p = 0.009). Conclusion: Therapeutic riding may have a latent effect of improving overall motor skills in children with sensory processing dysfunction.

Table 1: Average and overall scores on the BOT-2 subtests at different time points
### Results

**Descriptive values of the studies parameters of the COP**

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Max Pre-control</th>
<th>Post-control</th>
<th>Post-riding</th>
<th>Post-washout</th>
<th>Post-combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine motor precision</td>
<td>14</td>
<td>6.0±4.9°</td>
<td>6.0±4.7°</td>
<td>6.1±4.9°</td>
<td>6.2±4.5°</td>
</tr>
<tr>
<td>Fine motor integration</td>
<td>10</td>
<td>4.4±3.2°</td>
<td>4.2±3.0°</td>
<td>4.2±2.9°</td>
<td>5.0±3.3°</td>
</tr>
<tr>
<td>Manual dexterity</td>
<td>9</td>
<td>2.2±2.1°</td>
<td>2.6±2.0°</td>
<td>2.9±2.0°</td>
<td>3.3±2.4°</td>
</tr>
<tr>
<td>Bilateral coordination</td>
<td>7</td>
<td>3.4±3.0°</td>
<td>3.7±2.7°</td>
<td>4.0±3.2°</td>
<td>4.0±3.0°</td>
</tr>
<tr>
<td>Balance</td>
<td>8</td>
<td>4.0±3.1°</td>
<td>3.9±2.9°</td>
<td>3.4±2.8°</td>
<td>4.1±2.7°</td>
</tr>
<tr>
<td>Running speed and agility</td>
<td>10</td>
<td>4.0±3.6°</td>
<td>4.0±3.4°</td>
<td>3.9±3.3°</td>
<td>4.0±3.4°</td>
</tr>
<tr>
<td>Upper-limb coordination</td>
<td>12</td>
<td>4.7±4.4°</td>
<td>3.9±3.8°</td>
<td>5.2±4.2°</td>
<td>4.7±4.1°</td>
</tr>
<tr>
<td>Strength</td>
<td>88</td>
<td>3.6±3.3°</td>
<td>4.4±3.3°</td>
<td>5.1±3.6°</td>
<td>4.7±3.5°</td>
</tr>
<tr>
<td>Overall</td>
<td>88</td>
<td>32.4±21.6°</td>
<td>32.5±21.9°</td>
<td>35.4±22.9°</td>
<td>36.1±22.6°</td>
</tr>
</tbody>
</table>

**Values are mean±s.d. Means with the same superscript are statistically similar (p > 0.05).**

### Methods

**Adherence and Continued Participation in a Wellness Class for Individuals with Disabilities**

Megan E. Ware, Kathleen P. DeMarrais, Kevin K. McCully, FACSM, University of Georgia, Athens GA 30602

Adherence and continued participation are areas of concern in wellness interventions and programming. For individuals with disabilities, this can be an even larger challenge because of barriers like transportation and decrease in overall health. However, the factors that could increase participation and adherence in this population group remains unclear. Adherence and continued participation were explored in a wellness class at the University of Georgia for people in the surrounding community with disabilities. This class is driven by students under the supervision of a graduate student and a faculty member. PURPOSE: To understand what factors impact participant adherence and participation in the unique environment of the wellness class. METHODS: Eight wellness class participants, with a wide range of physical and mild intellectual disabilities who had been in the class for 6-36 months, were chosen for in-depth qualitative interviews. Interview responses across participants were coded and analyzed for overarching themes. RESULTS: 71 codes were obtained from the interview data, with 7 categories from these codes. The primary theme identified was that adherence in the class was related to personal interaction with the student trainers. The personal interaction could be divided into subthemes of social accountability, motivation, supporting classroom environment, and student interaction. The overwhelming majority of these codes were positive, indicating satisfaction with the wellness class on the part of participants. Duration in the class did not influence the subthemes, other than longer durations were associated with a greater appreciation of the role of the participants educating the students. CONCLUSION: The primary factor that influences adherence and continued participation was related to personal interaction with the student trainers. These results suggest that encouraging positive social interactions related to social accountability and a positive environment can play a powerful role in maintaining exercise adherence in people with physical and intellectual disabilities.

### Introduction

Static standing balance (SSB) is essential for upright posture and for most functional activities. It has been shown that fatigue worsens SSB in general population. Adults with intellectual disability (ID) may have delayed responses to postural perturbations, especially with concurrence of fatigue. Little is known about SSB in individuals with ID. PURPOSE: To study the effects on SSB before and after a maximal treadmill test (MTT) in adults with ID. METHODS: 92 adults (49 men) with mild to severe ID including Down syndrome (age: 43.6 ±12.0 y; weight: 72.45±15.0 kg; height: 159.8±11.1 cm) were recruited from an occupational day center. Participants performed a MTT until exhaustion. Immediately before and after the MTT, the center of pressure (COP) radial area, total travel distance (TTD), mean medium-lateral (MLD) and mean anterior-posterior (APD) displacements, and mean velocity sway (MVS) of the COP were measured with a pressure platform for 52sec at 100Hz, with open and closed eyes. Paired t-tests were applied to analyze differences between tests (p < 0.05). RESULTS: After a MTT, a significant increase in APD with OE (3.7 vs 4.0°; p = 0.020) was observed. Also, a significant improvement in the X axe position of the COP (MCOP X) with CE (9.9 vs 7.1mm; p = 0.039) was observed. The observed values showed no significant changes. Conclusions: Regular exercise may improve balance in persons with ID, but if fatigue appears, their postural motor system may be impaired. More research is needed, as balance is important to prevent falls.

### Related Work

Regular exercise may improve balance in persons with ID, but if fatigue appears, their postural motor system may be impaired. More research is needed, as balance is important to prevent falls.
1872 Board #133 May 31 2:00 PM - 3:30 PM Changes in Physical Activity during a Pilot Weight Loss Program Before and After Knee Replacement
Christine A. Pellegrini1, Rowland W. Chang2, Dorothy D. Dunlop2, David E. Conroy2, Jungwha Lee2, Kenzie A. Cameron2. 1University of South Carolina, Columbia, SC. 2Northwestern University, Chicago, IL. 3The Pennsylvania State University, University Park, PA.

No relevant relationships reported

PURPOSE: Although knee replacement (KR) surgery typically results in pain reductions and functional improvement, most patients do not increase their physical activity. This study examined changes in objectively measured physical activity in KR patients who were participating in a weight loss program that started either before or after surgery.

METHODS: Consented patients scheduled for KR were randomized to a 14 session pilot weight loss program starting ≤6 weeks before surgery (PACE) or 12 weeks post-op (Delayed PACE). Participants were encouraged to increase activity, set weekly activity goals, and self-monitor using paper, website, app, or Fitbit. Coaching sessions took place weekly or biweekly based on patient preference. Activity (moderate-to-vigorous activity [MVPA]) bouts of ≥10 min of ≥2020 cpm and daily steps) was assessed using Actigraph GT3X monitors. PROMIS was used to assess pain intensity and function. Assessments were completed at baseline (pre-op), 12, and 26 weeks after surgery. Intent-to-treat was used with the last observation carried forward. Repeated measures ANOVAs examined changes in activity across time and group.

RESULTS: Seventeen participants (mean±SD:63.5±7.9 years, 69% female, 69% White, BMI 35.7±5.1 kg/m2) provided physical activity data at baseline. Physical activity data was obtained for 77% of the sample at 12 and 26 weeks. Pain intensity decreased (P<0.001) and function improved (P<0.001) significantly, but no significant changes were observed in physical activity (Table 1).

CONCLUSIONS: On average, KR patients participating in a weight loss program did not increase physical activity (weekly bouted MVPA and daily steps) after surgery. The lack of changes in activity, even in the presence of an intensive behavioral intervention and improvements in pain and function, highlight the challenges of altering behavior in this population. Future studies are needed to explore methods to increase activity after knee replacement.

| Physical Activity Pre- and Post-Surgery in PACE (n=6) & Delayed PACE (n=7) |
|-----------------|-----------------|-----------------|
|                  | Baseline        | 12 Weeks        | 26 Weeks        |
|                  |                 |                 |                 |
| Bouted MVPA, min/week |
| PACE             | 81.2±141.8      | 3.5±5.4         | 33.3±76.4       |
| Delayed PACE     | 37.6±85.7       | 62.1±135.8      | 78.1±108.0      |
| Steps/day        | 5715.7±3098.0   | 4255.6±1687.8   | 4991.8±2910.2   |
| Delayed PACE     | 6092.4±2817.6   | 4943.6±1653.2   | 6324.4±2201.3   |

1873 Board #134 May 31 2:00 PM - 3:30 PM Use of Video Modeling to Teach Weight Lifting Techniques to Adults with Down Syndrome
Kathy Carter1, Alexandra Roberts1, Robert Penington1, Elizabeth Ledford1. 1University of Louisville, Louisville, KY. 1Australian Institute of Sport, Canberra, Australia.

No relevant relationships reported

As adults with Down syndrome (DS) age strength decreases resulting in difficulty performing activities of daily living. Research suggests that progressive resistance training for adults with DS may lead to improvements in their functional ability. PRT requires minimal equipment, which may be important for individuals with DS, as they may have limited disposable income for gym memberships, and reduced access to transportation to and from training facilities. Video modeling (VM) involves the demonstration of a target behavior through the video recording of that behavior. PURPOSE: The purpose of this study was to determine whether the use of video modeling is appropriate for teaching adults with DS to perform weight lifting techniques.

METHODS: Three adult males with Down syndrome, ages 24 to 34 years, participated in this study. A subject multiple probe design across behaviors (i.e. lifts) was used to evaluate the effectiveness of VM. A certified U.S. weight lifting coach completed a task analysis for split squat (SS), punch-out squat (POS), and overhead press (OP). For baseline measures participants watched a demonstration of each lift and were then recorded performing the lift. Once baseline measures became stable, participants viewed a video of a model using correct lifting technique three times. They were then video recorded performing the lift. No verbal or corrective feedback was given. Participants performances were scored by totaling the number of steps performed correctly, dividing that number by the total number of steps in the task, then multiplied by 100. RESULTS: Participants were least successful with the SS averaging 16% correct at baseline and 36% correct after viewing the videos. POS went from 50% correct to 87%; OP started at 42% and increased to 80% correct movement. Our video-modeling intervention, alone was not sufficient to produce an effective outcome across all lifts, but did help participants acquire more components of each lift. CONCLUSION: This study suggests that VM might serve as a useful component of a larger intervention; one that includes VM, rehearsal with feedback, and programmed reinforcement contingencies. It is our hope that future research with provide a path forward in this critical area.

1874 Board #135 May 31 2:00 PM - 3:30 PM Changes of Physical Activity Patterns among Down Syndrome Youth In a Weight-loss Randomized Control Trial
Qun Le, Philimon Gona, Richard Fleming. UMass Boston, Boston, MA.

No relevant relationships reported

Children with intellectual and development disabilities (IDD) engage in lower levels of moderate to vigorous intensity physical activity (MVPA) than do typically developing children. In addition, research suggests that light intensity physical activity (LPA) might have health benefits independent of those recognized for MVPA in people in general. To our knowledge, there is no recommendation for LPA, and the recommendation for all people with disabilities is simply encourage them to do “as much physical activity (PA) as they can.” PURPOSE: The purpose of this study was to analyze the baseline PA patterns of adolescents and young adults with Down syndrome (DS) who participated in a 12-month weight loss intervention, and to assess whether the intervention would change PA patterns.

METHODS: A total of 21 adolescents and young adults with DS aged 13 to 26 years were enrolled and randomized to either a 6-month nutrition and activity education intervention (N/IAE) or a nutrition and activity education+ behavioral intervention (N/IAE+B), with a 6-month follow-up. Accelerometers were used to assess the PA levels of participants at baseline, 10-weeks, 6-months, and 12-months. RESULTS: Results indicated that at baseline participants spent a high proportion of their time in SB (68.2%), and lower proportions in LPA (28.5%) and MVPA (3.2%). At the same time, a strong negative linear correlation was found between SB and LPA (r=-0.938, p <0.001); and a weak negative linear correlation was found between SB and MVPA (r=-0.468, p=0.038). Linear trend analysis showed that SB decreased more in the N/IAE+B group than in N/IAE at 6-months, and the trajectory of LPA increased more steeply at 10-week, 6-month, and 12-month in N/IAE+B than in N/IAE. CONCLUSIONS: LPA was found to have a stronger inverse association to SB than did MVPA to SB. We conclude that decreasing SB and promoting healthy outcomes may be achieved more effectively by increasing LPA, as compared to increasing MVPA, among this population. The implications could be used to fill in the gap of PA guidelines to include promoting LPA among adolescents and young adults with IDD, a step that could bring health benefits. Supported by: National Institutes of Health 5R03DK70627-02.

1875 Board #136 May 31 2:00 PM - 3:30 PM Influence of Pain and Mood on Physical Activity after Knee Replacement
Sara M. Rotherberger, Courtney M. Monroe, Christine A. Pellegrini. University of South Carolina, Columbia, SC.

No relevant relationships reported

Many patients undergoing knee replacement do not increase physical activity levels after surgery. PURPOSE: The proposed study aimed to use ecological momentary assessment (EMA) and accelerometry to examine the time-varying associations between mood, pain, and physical activity following knee replacement to determine if mood is influencing activity.

METHODS: Over one week, knee replacements patients ≤12 months of surgery rated their mood (1 negative to 9 positive) and pain (1 none to 9 extreme) after 6 random prompts during waking hours. Physical activity was assessed during the same week using an Actigraph GT3X worn on the waist. Only valid days of ≥10 hours/day were included. Average steps/day and the time spent in sedentary (<100 cpm) were included.
an activity in any of the 3 main motion categories: vertical {up-down, down-up, lateral {left-right, right-left, both directions}.% 

The purpose of this study was to determine the feasibility and efficacy of an 8-week (3d wk {1}) UTU program in a unilateral, transtibial amputee with limited ambulation potential. The hypothesis was that the participant's post-UTU and mood did not influence current or subsequent physical activity. Future studies are needed to explore alternative factors that may be influencing activity after surgery.

An accelerometer is widely used to objectively assess physical activity (PA) levels in field-based research. Accelerometer-wearing compliance has been one of critical issues for a successful data collection because it directly affects the quality of accelerometer data. However, the noncompliance patterns are unknown in children and adolescents with a developmental disability (DD). PURPOSE: To assess the noncompliance patterns of children and adolescents with DD in accelerometer-based research. METHODS: Forty-eight children and adolescents with DD who could independently walk were recruited from 6 schools in the U.S. (30 from 4 schools) and Korea (18 from 2 schools). Participants were asked to wear a GT3X+ accelerometer {Actigraph, Pensacola, FL} from the time they wake up until going to bed for the next six consecutive days, except for water activities. Data inclusion criteria were '≥ 6 hours wear time from 8am to 10pm a day, and 20 consecutive minutes of zero counts as was considered non-wear time (Belton et al., 2013). Time of day was broken into four segments: (a) morning (8am-noon), (b) afternoon (noon-5pm), (c) evening (5pm-8pm), and (d) night (8pm-10am). RESULTS: Seventeen participants met the inclusion criteria on all 6 days, followed by 25 participants on 5 days and 28 participants on 4 days. For further analysis, 3 weekdays/1 weekend day criteria (n=27) was added. A Wilcoxon Signed-ranks test indicated weekend non-wear time (Mdn = 167.50) was significantly higher than weekdays (Mdn = 98.75), Z=-2.28, p<0.02. Mean non-wear time in each time segment over 6 days was 49.88, 23.91, 42.74, and 140.07 minutes in order. The challenges of non-compliance included: time management (e.g., challenges with scheduling), lack of motivation by the parent and the child (e.g., unmotivated, sick). Facilitators of implementation included: incorporating the program into their lives (e.g., making it a routine and scheduling it), making a commitment, fostering their child’s motivation (e.g., children actively making choices, tailoring to the child’s interests), social support and the equipment and curriculum (e.g., easy to use and child-friendly). Parent perceived outcomes included: improvement in child’s motor skills, confidence, and motivation, improvement in parents’ ability to teach motor skills as well as enjoyment and quality time with their child.

CONCLUSIONS: Implementation of an at home PA intervention with young children is challenging. Parent strategies such as scheduling, building a routine and engaging their child may help overcome difficulties. Nonetheless, parents perceived the PA routine implementation led to building motor skills and self-confidence in their children.

Funded by USAMRAA W81XWH-11-1-0765

1876 Board #137 May 31 2:00 PM - 3:30 PM Noncompliance Patterns In Accelerometer-based Research For Children And Adolescents With A Developmental Disability

Jooyeon Jin, Byungmo Ku.

University of Seoul, Seoul, Korea, Republic of.

Purpose: To assess the noncompliance patterns of children and adolescents with DD in accelerometer-based research. Methods: Forty-eight children and adolescents with DD who could independently walk were recruited from 6 schools in the U.S. (30 from 4 schools) and Korea (18 from 2 schools). Participants were asked to wear a GT3X+ accelerometer (Actigraph, Pensacola, FL) from the time they wake up until going to bed for the next six consecutive days, except for water activities. Data inclusion criteria were ‘≥ 6 hours wear time from 8am to 10pm a day, and 20 consecutive minutes of zero counts as was considered non-wear time (Belton et al., 2013). Time of day was broken into four segments: (a) morning (8am-noon), (b) afternoon (noon-5pm), (c) evening (5pm-8pm), and (d) night (8pm-10pm). Results: Seventeen participants met the inclusion criteria on all 6 days, followed by 25 participants on 5 days and 28 participants on 4 days. For further analysis, 3 weekdays/1 weekend day criteria (n=27) was added. A Wilcoxon Signed-ranks test indicated weekend non-wear time (Mdn = 167.50) was significantly higher than weekdays (Mdn = 98.75), Z=-2.28, p<0.02. Mean non-wear time in each time segment over 6 days was 49.88, 23.91, 42.74, and 140.07 minutes in order. The challenges of non-compliance included: time management (e.g., challenges with scheduling), lack of motivation by the parent and the child (e.g., unmotivated, sick). Facilitators of implementation included: incorporating the program into their lives (e.g., making it a routine and scheduling it), making a commitment, fostering their child’s motivation (e.g., children actively making choices, tailoring to their child’s interests), social support and the equipment and curriculum (e.g., easy to use and child-friendly). Parent perceived outcomes included: improvement in child’s motor skills, confidence, and motivation, improvement in parents’ ability to teach motor skills as well as enjoyment and quality time with their child.

Conclusions: Implementation of an at home PA intervention with young children is challenging. Parent strategies such as scheduling, building a routine and engaging their child may help overcome difficulties. Nonetheless, parents perceived the PA routine implementation led to building motor skills and self-confidence in their children.
Amotrophic Lateral Sclerosis (ALS) is a neurodegenerative disease that is characterized by muscular atrophy which leads to increased fatigue, loss of balance, and spasticity. Currently, there is no cure for ALS and limited medical treatments are available. Weak muscles make it challenging for these individuals to exercise although physical activity is important to prevent deconditioning. However, dynamic cycling, which utilizes a motor to assist rapid movement of the legs, may be an effective mode of exercise for individuals with muscle weakness and has yet to be investigated in this population.

**Purpose:** The purpose of this case study was to determine the efficacy of two weeks (6 sessions) of dynamic cycling at a high cadence on gait function and daily activity function in an individual with ALS. **Methods:** One male individual with ALS (67 years old) completed an amotrophic lateral sclerosis exercise rating scale revised (ALSF-RS-R) assessment and a 6-minute walk test (6MWT) on a treadmill before and after the two-week intervention. After the baseline visit, the six subsequent visits consisted of the dynamic cycling intervention and 6MWT. The dynamic cycling sessions consisted of repeated bouts of cycling at 75-85 revolutions per minute for 5 minutes with 5 minutes of rest for a total of 30 minutes. **Results:** The 6MWT showed progressive improvement from baseline to after the last cycling session. The subject walked 306 m, 338 m, 370 m, 354 m, 354 m, and 386 m respectively (a 21% improvement). The subject’s ALSFRS-R score slightly improved from 41 to 42. **Conclusion:** The dynamic cycling paradigm proved to be effective in improving mobility and gait in one subject. The individual was able to successfully complete the intervention despite muscle weakness. The promising results of dynamic cycling in our subject warrants the need for further studies within the ALS population.

**1880 Board #141**
May 31 2:00 PM - 3:30 PM
The Efficacy of Dynamic Cycling in an Individual with ALS: A Pilot Study
Bryan Dowdell, Kristin Noll, Angela Ridel. Kent State University, Kent, OH. (Sponsor: Ellen L Glickman, Ph.D., FACSM)

(Purpose and methods reported)

**Background:** Spinal cord injury (SCI) disrupts motor recruitment patterns at or below the injury site resulting in diminution or loss of ambulatory function. Individuals with SCI exhibit reduced daily physical activity levels and an increased sedentary lifestyle. Cardiovascular risk factors are prevalent post-injury with increased adiposity, elevated triglyceride concentrations, insulin insensitivity, and reduced cardiovascular fitness. Technologic advancements have emerged to provide individuals with SCI an opportunity to ambulate in the community and increase daily activity level using exoskeletal robotic assist devices. **Purpose:** To examine cardiovascular fitness (as measured by peak VO$_2$) and body composition (as measured by DXA) in non-ambulatory individuals with SCI before and after a 36-session exoskeleton walking program. **Methods:** Four males with a spinal cord injury greater than six months prior all requiring wheelchair use for community mobility, agreed to participate in a randomized six-month study (with a three month 36 session exoskeleton intervention phase) designed to examine multiple outcome measures. As part of the collected dataset, pre and post exoskeletal intervention assessments were determined for peak VO$_2$ (arm ergometry) and body composition (DXA). **Results:** Participants experienced the following changes after the intervention: Participant 1: peak VO$_2$ (20.73 to 20.89 ml·kg$^{-1}$·min$^{-1}$), body mass (64.5 to 68.1 kg), %body fat (13.3 to 17.6%). Participant 2, peak VO$_2$ (15.60 to 16.63 ml·kg$^{-1}$·min$^{-1}$), body mass (79.6 to 80.6 kg), %body fat (31.1 to 32.7%). Participant 3, peak VO$_2$ (26.11 to 27.19 ml·kg$^{-1}$·min$^{-1}$), body mass (60.5 to 61.9 kg), %body fat (5.2 to 5.7%). Participant 4, peak VO$_2$ (23.06 to 20.70 ml·kg$^{-1}$·min$^{-1}$), body mass (57.2 to 56.3 kg), %body fat (4.5 to 4.7%). **Conclusion:** The study is the first to consistently improve cardiovascular fitness, body mass, and body composition (percent fat). Exoskeletal ambulation may not provide an adequate cardiometabolic stimulus to alter standard measures of cardiovascular health in this population.

**1882 Board #143**
May 31 2:00 PM - 3:30 PM
GetFit: An Interdisciplinary Approach To Exercise And Nutrition For Individuals With Autism Spectrum Disorder
M. Alysia Mastrangelo, FACSM,1 Mary Kientz,2 Joan Perks1, Rachel Gavigan1, Carissa Clayton1, Edward C. Chaloupka, FACSM.1 Stockton University, Galloway, NJ. 1Rowan University, Glassboro, NJ. (No relevant relationships reported)

**Purpose:** GetFIT is an interdisciplinary exercise and nutrition program designed for individuals with a diagnosis of Autism Spectrum Disorder (ASD) and other developmental disabilities. The purpose of the GetFIT program is to improve participants’ health and wellness, quality of life and socialization. PT, Nursing, and Health Science students collaborate to educate and enhance the healthy habits of participants. Together these disciplines create a client-centered nutrition and fitness program. GetFIT for All addressed behaviors associated with ASD; restrictive eating habits, poor nutritional intake, and gross motor skill deficits that may lead to an unhealthy lifestyle and lack of participation and exercise. Adolescents diagnosed with ASD were two times more likely to be obese than adolescents without developmental disabilities. Young adults diagnosed with ASD were found to have a higher incidence of developing type 2 diabetes when compared to those without ASD. METHODS: Participants included 8 individuals with ASD who completed the pre-test; age range 16-42 with a mean age of 24 y.o. One participant dropped out, 2 others did not come to the final data collection session. Pre and post data were collected the first and last day of a 12 week session. The Sensory Profile 2 was used to identify sensory issues so that modifications could be made to the program. Social skills were measured using the Social Responsiveness Scale, 2nd ed. Data collected included anthropometric measures, vital signs, cardiovascular endurance, strength, flexibility, a nutritional screen, and a QOL measure. Summary of RESULTS: Percent change was used to assess data due to the sample size. Positive changes in health indicators including strength (plank +26%, right and +64%, left). Results indicated decreased waist (-8%) and hip (-5%) circumference and Timed up and Go (+3%). **Conclusion:** These results indicated improvement in overall fitness measures for participants with ASD involved in a 12 week client-centered fitness and nutrition education program. In addition, participants expressed their enjoyment in attending GetFIT and the social interaction with university students. Funded by a Doug Flutie Jr. Foundation Grant.

**1883 Board #144**
May 31 2:00 PM - 3:30 PM
Accuracy Of Parent And Child Self-Reported Physical Activity In Children With Special Needs: A Pilot Study
Michele L. Polfuss, Ph.D. R.N.1, Bethany M. Forseth, M.S.1, Dale A. Schoeller, Ph.D.2, Paula E. Papanek, PhD FACSM, FACSM.1 1University of Wisconsin - Milwaukee, Milwaukee, WI. 2University of Wisconsin, Madison, WI. (Sponsor: Paula Papanek, FACSM) (No relevant relationships reported)

**Purpose:** Physical activity (PA) is an essential component of health that necessitates accurate measurement. Parents of children with special needs (SN) have an increased involvement in their child’s daily life; therefore, it would seem plausible that they could provide an accurate assessment of their child’s PA. The accuracy of self-report measures in children with SN has not been established. **Results:** Determined the accuracy of self-reported PA as compared to doubly labeled water (DLW) for children with SN. Furthermore, we assessed if child’s age or diagnosis was related to the accuracy.

**1881 Board #142**
May 31 2:00 PM - 3:30 PM
Cardiovascular Fitness and Body Composition in Spinal Cord Injured after a 36-session Exoskeleton Program
William H. Scott, Paula Geigle, Peter Gorman. University of Maryland, Baltimore, MD. (No relevant relationships reported)

(Purpose and methods reported)

**Background:** Spinal cord injury (SCI) disrupts motor recruitment patterns at or below the injury site resulting in diminution or loss of ambulatory function. Individuals with SCI exhibit reduced daily physical activity levels and an increased sedentary lifestyle. Cardiovascular risk factors are prevalent post-injury with increased adiposity, elevated triglyceride concentrations, insulin insensitivity, and reduced cardiovascular fitness. Technologic advancements have emerged to provide individuals with SCI an opportunity to ambulate in the community and increase daily activity level using exoskeletal robotic assist devices. **Purpose:** To examine cardiovascular fitness (as measured by peak VO$_2$) and body composition (as measured by DXA) in non-
METHODS: This prospective cross-sectional study, included 36 child/parent dyads stratified by child’s age (4-7; 8-12; and 13-18 years), diagnosis and ambulatory status (spina bifida-ambulatory n=9, Down syndrome n=9, and control n=9). PA energy expenditure by weight (kcal kg⁻¹ day⁻¹) was calculated from total energy expenditure, measured via DLW, by subtracting an estimated resting metabolic rate and thermic effect of food and then dividing by the child’s weight. Self-reported PA (METmin⁻¹ day⁻¹) was measured by an activity journal completed by parents and children ≥3 years for four weekdays and two weekend days. T-tests compared MET min⁻¹ day⁻¹ reported between the parents and children. Pearson correlations assessed relationships between journals and DLW.

RESULTS: No significant differences between activity levels reported by parents and children (25.05 vs. 27.32 MET hrs/day; p = 0.29). Parent and child self-reported activity levels were moderately correlated to DLW (r=0.63, p<0.001; r=0.74, p<0.005, respectively). When examined by age, parent reported activity and DLW were significantly related all age groups. No significant relationship between self-reported activity levels and DLW based on diagnosis.

CONCLUSION: With their increased involvement, parents of children with SN were able to report activity levels of their child similar to the child’s self-reported activity. Both parent and child reporting had moderate relationships to the criterion. Self-report methods while cost-effective, have been minimally tested in children with SN. Therefore, further examination in larger samples is recommended along with utilizing objective measures of PA.

1884 Board #145 May 31 2:00 PM - 3:30 PM Guardian Perception Of Self-esteem And Mastery In A Special Needs Population

Kelly D. Barns, Jason D. Wagganer, Anthony J. Faber, Thomas J. Pujol, FACSM. Southeast Missouri State University, Cape Girardeau, MO. (Sponsor: Thomas Pujol, FACSM)

(No relevant relationships reported)

Self-esteem and mastery are psychological factors that may be affected by learning a new physical skill. The primary objective of iCan Bike (ICB) is to instruct individuals with special needs and/or disabilities on how to ride a two-wheeled bicycle. Very few studies have assessed the effects of learning a new physical skill on self-esteem and mastery in special needs and/or disabled populations. PURPOSE: To assess guardian perceived self-esteem and mastery scores, of the ICB participant, as measured by the Rosenberg Self-Esteem Scale (RSES) and Pearlin Mastery Scale (PMS). METHODS: The RSES (10 items; 5 positive and 5 negatively worded items) and PMS (7 items) questionnaires were completed by the guardians of the participants at the ICB camp. A one-way repeated measures Analysis of Variance, with a Bonferroni post hoc test, was conducted to compare questionnaire results across pre-, post-, and 30-days post camp. All data was analyzed using SPSS (v24.0) with significance set at p<0.05.

RESULTS: A total of 141 questionnaires were completed on an ICB participant sample consisting of 63.8% (n=90) males and 36.2% (n=51) females. A total of 63.1% (n=56, 65.6%, female=58.8%) of participants learned to independently ride a bicycle. A significant increase in mastery was observed [F(2,280)=23.699, p<0.001], with significant increases observed pre- (23.03±4.64) to post camp (25.44±4.60) (p<0.001), and post- to 30-days post camp (26.61±5.24) (p<0.001). No significant RSES effect was observed. CONCLUSIONS: A significant increase in mastery may be related to the daily observable progress associated with the participant learn to ride a bicycle. The success rate of this study (63.1%) was lower than the ICB advertised rate of 80%, which may be a primary reason for the lack of change in self-esteem scores. More research needs to be conducted on the psychological effects that learning to ride a bicycle has on self-esteem and/or mastery in the special needs population.

1885 Board #146 May 31 2:00 PM - 3:30 PM Replacing Sedentary Time with Light Physical Activity Reduces Mobility Limitation in Older Adults: NHANES 2003-2006

Nicholas L. Lerma, Chi C. Cho, Hotaka Maeda, Ann M. Swartz, FACSM, Scott J. Strath, FACSM. University of Wisconsin - Milwaukee, Milwaukee, WI. (Sponsor: Scott Strath, FACSM)

(No relevant relationships reported)

PURPOSE: Increased time spent in sedentary behavior (SB) and reductions in total physical activity (PA) are linked to functional limitations in aging populations. The purpose of this study is to examine the relationship of replacing SB time with light intensity PA (LPA) and/or moderate-vigorous-intensity PA (MVPA) on physical function in a nationally representative sample of older adults.

METHODS: A cross-sectional analysis using isostemal substitution models with multinominal regression was performed in older adult participants from the 2003-2006 National Health and Nutrition Examination Survey (NHANES). T-tests compared self-reported functional limitations when replacing SB with LPA and/or MVPA. Covariates included age, sex, race/ethnicity, body mass index, smoking, education, income, and ambulatory status.

RESULTS: The analysis included a sample of 1971 older adults (60-85 years) averaging 583 ± 166 min d⁻¹ (mean ± SD) in SB, 287 ± 102 min d⁻¹ in LPA, and 11 ± 15 min d⁻¹ in MVPA. Within the sample 39.8% reported no limitation, 16.7% with one limitation, and 45.3% with 2+ limitations. The odds of having one functional limitation was significantly reduced when replacing 5 min of SB with 60 min MVPA (odds ratio 0.303, 95% CI 0.116-0.791), but not with 60 min of LPA (0.926, 0.832-1.031). However, replacing 60 min of SB with a combination of 55 min of LPA and as little as 5 min of MVPA significantly reduced the odds of having one limitation (0.844, 0.746-0.955). The odds of having 2+ limitations was significantly reduced when replacing 60 min of SB with LPA (0.736, 0.679-0.798) or MVPA (0.074, 0.018-0.293). Lastly, the odds of transitioning from one to 2+ limitations was significantly reduced when replacing 60 min of SB with LPA (0.794, 0.716-0.881) or MVPA (0.245, 0.070-0.858).

CONCLUSION: While the functional benefits of MVPA are well-established, altering the daily balance between LPA and SB is shown to be protective against developing functional limitations. Further, replacing SB with LPA and complimentary doses of MVPA may be a more practical approach to effectively prevent or reduce functional limitations among older adults.

D-65 Free Communication/Poster - Physical Activity and Exercise in Children and Youth

Thursday, May 31, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

1886 Board #147 May 31 2:00 PM - 3:30 PM Participation In Physical Education Classes And Physical Activity And Sedentary Behavior In Children

Diego A S Silva¹, Jean-Philippe Chaput², Peter T. Katzmarzyk, FACSM¹, Mikael Fogelholm¹, Gang Hu¹, Carol Maher¹, Timothy Olds¹, Vincent Onywera³, Olga L. Sarmiento³, Martyn Standage⁴, Catrin Tudor-Chisoreanu⁵, Carol Maher⁴, Thomas Pujol, FACSM⁶. (Sponsor: Thomas Pujol, FACSM)

1. Centro de Estudios de Epidemiología y Salud Pública, Universidad de la Sabana, Sesquilé, Colombia. 2. Faculty of Kinesiology, University of Waterloo, Ontario, Canada. 3. Research Centre for Health Promotion, University of Nairobi, Kenya. 4. School of Exercise and Health Sciences, University of Western Australia, Perth, WA. 5. Faculty of Physical Activity, Sport and Exercise, University of Manchester, Manchester, UK. 6. School of Physical and Health Education, University of Western Australia, Australia. 7. Faculty of Physical Activity, Sport and Exercise, University of Manchester, Manchester, UK. 8. School of Physical and Health Education, University of Western Australia, Australia. 9. Faculty of Physical Activity, Sport and Exercise, University of Manchester, Manchester, UK.

(No relevant relationships reported)

PURPOSE: To examine the associations between participation in Physical Education (PE) classes and objective measures of physical activity (PA) and sedentary behavior (SB) in children from 12 countries at different levels of human and socioeconomic development. METHODS: This multinational, cross-sectional study included 5874 children aged 9-11 years from sites in Australia, Brazil, Canada, China, Colombia, France, Finland, India, Kenya, Portugal, South Africa, the United Kingdom, and the United States. PA and SB were measured over 7 consecutive days using a wrist-worn accelerometer. Participation in PE classes was determined by questionnaire. Multilevel modeling analyses were used to account for the hierarchical nature of the data.

RESULTS: PE classes were not attended by 6.6% of the total sample, and in low- and middle-income countries this prevalence was higher than in high-income countries (8.4% vs. 4.7%, respectively, p<0.01). After adjusting for age, sex, parental education, and BMI z-score, results showed that children from low- and middle-income countries who participated in PE classes at least once a week were more likely to meet the moderate-to-vigorous physical activity (MVPA) recommendations (male - OR: 1.80; 95%CI: 1.17-2.77; female - OR: 2.17; 95%CI: 1.44-3.27), to spend more time at different PA intensities, and to have shorter SB time (male - OR: 1.61; 95%CI: 1.01-2.60; female - OR: 2.20; 95%CI: 1.38-3.50) than those who did not attend PE classes. In high-income countries, boys that participated in PE classes were more likely to meet the recommendations for PA (OR: 2.20; 95%CI: 1.29-3.76) and to have shorter SB time (OR: 2.42; 95%CI: 1.22-4.81). For girls in high-income countries, attending PE classes increased the likelihood of spending more time in MVPA, especially if they attended three or more classes per week (OR: 2.42; 95%CI: 1.22-4.80).

CONCLUSION: Attending PE classes is associated with a higher level of PA and lower level of SB in children from countries at various levels of human and socioeconomic development. PE classes should be compulsory in all countries as an important contributor to healthy movement behaviors of children.
MEDICINE & SCIENCE IN SPORTS & EXERCISE®

1887 Board #148 May 31 2:00 PM - 3:30 PM
Difference In Physical Activity Between Children Without Siblings And With Siblings
Chelsea L. Smith1, Emily Guseman2, Laura Hubbs-Tait3, Jennifer Graef4, Sandra Arnold5, Allen Knehrans1, Susan B. Sisson, FACSM1.
1University of Oklahoma Health Sciences Center, Oklahoma City, OK. 2Ohio University, Athens, OH. 3Oklahoma State University, Stillwater, OK. (Sponsor: Susan B. Sisson, FACSM)

(No relevant relationships reported)

Children without siblings, singletons, have higher rates of obesity than children with siblings, non-singletons. Physical activity, such as increased moderate-to-vigorous physical activity (MVPA) and decreased sedentary behavior, can curb excess weight gain early in life. PURPOSE: The purpose of this study is to examine the differences in physical activity and sedentary behavior between singleton and non-singleton children. METHODS: Mothers of singleton children ages 5.0-7.9 years old and mothers of non-singleton children ages 5.0-7.9 years old with a sibling between the ages of 2.0-4.9 years old in their primary household were recruited. Height, weight, and waist circumference (WC) of child were objectively measured. Mothers reported demographic characteristics of the child and self, and completed a questionnaire on their physical activity. Children wore an accelerometer at the ankle for at least for at least full days while parents recorded daily activities and time spent in away from home care (such as child care or kindergarten). Body mass index (BMI) was calculated, and BMI and WC percentiles were calculated for age and sex. MVPA and sedentary behavior per hour were calculated using accelerometer cut points and total wear time. RESULTS: 43 mother-child dyads (10 singletons and 33 non-singletons) participated. On average mothers were 34.7 years old, employed full time (69%), married (77%), and the child’s biological mothers (97%); while children were 5.81 years old and predominantly white (62%). Singletons had a higher BMI percentile (80.1±21.3) and waist circumference percentile (77.6±21.7) compared to non-singletons (55.7±29.0, p<0.02; 53.4±21.3, p<0.01). In individual models, singletons did not differ in time away from home care (p=0.60) or in their mother’s average MET minutes per week compared to non-singleton children (p=0.90). After adjusting for child BMI percentile and month of wear, singletons spent 2.96 less minutes per hour in MVPA (p=0.01) and 5.18 more minutes per hour in sedentary behavior compared to non-singletons (p=0.01). CONCLUSIONS: In this sample, singletons had a higher BMI percentile and were less active compared to non-singletons. Investigation into differences in singleton/ non-singleton families, including family health behaviors, may support understanding of the mechanism.

1888 Board #149 May 31 2:00 PM - 3:30 PM
Parent Physical Activity Practices and Associations with Physical Activity and Sedentary Time in Preschool-Age Children
Emily C. Huber1, Jessica R. Meendering2, Loras College, Dubuque, IA. 1South Dakota State University, Brookings, SD. (Sponsor: Matt Yukovich, FACSM)

(No relevant relationships reported)

Preschool-age children have the potential to be influenced by parent physical activity (PA) practices more than older children as preschool-age children are more reliant on parents for PA opportunities. Previous research with this focus has relied predominantly on various subjective assessments of child activity which often results in an overestimation of PA and an underestimation of sedentary time (ST). PURPOSE: The purpose of this study was to explore associations among parent PA practices and child PA and ST by utilizing objective measures of activity and the full range of PA intensities in a cross-sectional sample of preschool-age children. METHODS: Child PA was assessed for 7 days via accelerometer (ActiGraph GT3X+) using age-appropriate cut-points. Parent PA practices were assessed via parent completion of the Activity Support Scale for Multiple Groups (ACTS-MG). A total of 169 parent (34.5 ± 6.1 yrs.; 30 males, 134 females, 5 unreported)/child (3.6 ± 0.7 yrs.; 80 boys, 89 girls) dyads had compliant PA and survey data and were used for analyses. Multiple multilevel mixed-effects linear regression analyses were utilized to identify parent PA practices that were significantly associated with PA intensities, including total PA (TPA). ACTS-MG individual item analyses were also completed by recalcing ACTS-MG item responses. Statistical significance was set at p≤0.05. RESULTS: Vigorous PA (VPA) (p=0.02) and moderate-to-vigorous PA (MVPA) (p=0.04) in boys was positively associated with the parent PA practice of using community resources and negatively associated with parents that reported “I take my child to places where he can be active” (p=0.01; p=0.05, respectively). VPA in boys was positively associated with parents that reported “I enroll my child in community-based programs (such as Girls and Boys Club, YMCA) where he can be active” (p=0.05). VPA in girls was positively associated with parents that reported “I limit how long my child plays video games” (p=0.03). CONCLUSION: Parent utilization of community resources and restricting sedentary activity, especially video game use, have been found to be significantly associated with preschool-age child activity. However, there is a need to help parents understand other strategies to promote PA and discourage ST in young children.

1889 Board #150 May 31 2:00 PM - 3:30 PM
The Relationship Between Screen Time and Sleep Duration in Children
Joseph Carlson1, Nara A. Paulsen2, Breanne Carlson1, Eric J. Petushek1, Karin A. Pfeiffer, FACSM1, 2Michigan State University, East Lansing, MI. 3Northern Michigan University, Marquette, MI.

(No relevant relationships reported)

Excess screen time (ST), low sleep duration (SLD), and physical inactivity, are risk factors for childhood obesity. Also, excess ST has been associated with poorer sleep quality and shorter SLD. The American Sleep Foundation recommends 9-11 hours of sleep per night for school aged children. PURPOSE: To determine the relationship between ST and SLD among children who participated in a school based nutrition and physical activity intervention. METHODS: Cross sectional analysis of 5th grade public school students (N = 742, mean age 10.5 years, range 9-13 years). Participants self-reported their ST, SLD, and wake time.

RESULTS: A Pearson correlation coefficient indicated a small but significant negative correlation between ST and SLD (r = -0.13, p < 0.01). A one-way ANOVA comparison of ST and SLD between three groups categorized into “low”, “medium”, and “high” ST levels showed a significant difference in SLD between groups (F (2,739) = 6.82, p < 0.001). Post hoc comparisons using the Tukey HSD test indicated the mean SLD for the low ST group (M =10.17, SD =1.20) was significantly higher compared to the SLD in the high ST group (M = 9.77, SD = 1.29), but the Cohen’s effect size value (d = 0.34) indicated a small difference in magnitude.

CONCLUSIONS: The results suggest an inverse relationship between ST and SLD. The children with low ST had significantly higher SLD versus children with high ST, though the mean hours of sleep for all groups met current recommendations. Intervention studies in youth should consider incorporating strategies to decrease ST in youth not only increase physical activity, but also to improve SLP duration. Funding Sources: -Blue Cross Blue Shield Foundation of Michigan; -Michigan State University Extension USDA Supplemental Nutrition Assistance Program; -Supervisor Health Foundation, Marquette MI.

1890 Board #151 May 31 2:00 PM - 3:30 PM
Lipoprotein Subclasses And Their Associations With Physical Activity, Cardiorespiratory Fitness And Adiposity In Norwegian Schoolchildren
Paul R. Jones1, Olav M. Kvalheim2, Geir K. Resland3, Sigmund A. Andersen4, Ulf Ekelund, FACSM1, 2Norwegian School of Sport Sciences, Oslo, Norway. 3University of Bergen, Bergen, Norway. 4Western Norway University of Applied Sciences, Sogndal, Norway. (Sponsor: Professor Ulf Ekelund, FACSM)

(No relevant relationships reported)

Physical activity (PA), cardiorespiratory fitness (CRF) and adiposity are associated with certain lipoproteins. Research in adults has shown that these associations are not consistent across lipoprotein subclasses.

Purpose: To examine cross-sectional associations in children between objectively measured PA and sedentary time (SED), CRF and adiposity with a number of biomarkers of lipoprotein metabolism.

Methods: We included 1056 healthy fifth-grade (mean age 10.2 yrs) Norwegian children (47.3% females). Total PA (PA), PA intensity (light (LPA) moderate (MPA); vigorous (VPA); and SED were assessed using triaxial accelerometry. We used the Andersen test to measure CRF, and waist circumference to measure abdominal adiposity. We quantified 31 measurements of lipoprotein metabolism including concentrations of 15 subclasses and particle size of three major classes (VLDL, LDL, HDL) using nuclear magnetic resonance spectroscopy. We used multiple linear regression models adjusted for age, sex, pubertal development and socioeconomic status (standard model). Additional IPA, PA intensity and CRF models were adjusted for adiposity, and additional adiposity models were adjusted for moderate-vigorous PA (MVPA) and CRF separately. We applied a false discovery rate (FDR) correction to p-values of each regression model.

Results: Adiposity was associated with all 31 biomarkers in the standard and PA-adjusted models, and 30 biomarkers having adjusted for CRF. CRF was associated with 29 of the biomarker measures in the standard model and 22 having adjusted for adiposity. Total PA, VPA, MPA, LPA and SED were associated with 13, 21, 14, 0 and 9 of the 31 biomarker measures, respectively in the standard model. Additional tPA, PA intensity and CRF models were adjusted for adiposity, and additional adiposity models were adjusted for moderate-vigorous PA (MVPA) and CRF separately. We applied a false discovery rate (FDR) correction to p-values of each regression model.

Conclusion: CRF is associated with the majority of markers of lipoprotein metabolism independent of adiposity. Physical activity, especially of higher intensity, is associated with...
with some of these biomarkers independent of adiposity, whereas EPA and sedentary time appear associated with a small number of biomarkers. This suggests that improving CPR and increasing physical activity of at least moderate intensity may favourably affect lipoprotein metabolism in healthy children.

Conclusion: %, race/ethnicity, and household income were not. For each 1ml/kg/min increase in health professional in the last year (13%), compared to Blacks (8%) and Mexican (4%) and Non-Hispanic Blacks (7%); they were also more likely to have seen a mental likely to have been diagnosed with ADHD (13%) compared to Mexican Americans (4%) and PA categories (n=985), a detailed assessment of leisure-time PA volume, duration and intensity (a modified Kuopio Ischemic Heart Disease Risk Factor Study Questionnaire, n=982) enabling calculation of mean daily metabolic equivalent (MET-h/day) index as a proxy of the previous 12 months PA and objectively measured total PA over seven-days by hip-worn accelerometer (Actigraph GT3X+ or WGT3X+, n=734). Statistical differences were tested using chi-squared test, independent samples t-test or Mann-Whitney U test. RESULTS: Participants were assigned into youth athlete (n=136) or non-athlete (n=849) groups based on their participation in competitive sports at the age of 13-to-16. Youth athlete group had 1.5 kg higher LBM (p<0.002) and 1.0 kg higher SMM (p<0.001) at middle-age, but no statistically significant difference in FM. Youth athletes reported more vigorous PA (32.4% vs. 20.3%, p<0.007) and higher leisure-time MET index (4.3 vs. 3.4 h/day, p<0.001) than non-athletes. No difference was observed in accelerometer-measured sedentary time, light PA, moderate-to-vigorous PA or total PA (counts) between groups. CONCLUSION: Participation in sport competitions as a teenager has long lasting health benefits that associates with healthier body composition and higher leisure-time PA later in life. However, the discrepancy between self-reports and objective measures needs further studies to delineate the benefits of different components of PA.

Abstract Purpose: The study investigated the relationship between cardiovascular fitness, body composition, and ADHD diagnosis. Obesity and ADHD are highly comorbid—ADHD children are twice as likely to become obese adults than typically developing peers. However, the role of physical fitness in this relationship remains unexplored. Methods: Youth age 12-19 years old (N=4,790) participating in the National Health and Nutrition Examination Survey (NHANES) 2001-2004 were included. Parents reported demographics and whether their child had ever been diagnosed with ADHD. Children underwent examinations of body fat percentage via bioelectrical impedance and estimated VO2 max via a submaximal treadmill test. Chi-square analyses and t-tests assessed differences between ADHD and typically developing (TD) youth on fitness and composition. Three age-specific multiple linear regression with ADHD diagnosis as the dependent variable and estimated VO2 max, percent body fat, age, race/ethnicity, gender, and household income as predictors. Results: Males were 3 times more likely to be diagnosed with ADHD than females (12% vs. 4%) (p<1.09, Exp(B)=3.03, p<.001). Non-Hispanic Whites were more likely to have been diagnosed with ADHD (13%) compared to Mexican Americans (4%) and Non-Hispanic Blacks (7%); they were also more likely to have been seen a mental health professional in the last year (13%), compared to Blacks (8%) and Mexican Americans (6%). Children diagnosed with ADHD evidenced significantly higher VO2 max than typically developing peers (45.3 ml/kg/min vs. 42.0 ml/kg/min; t=-5.06, p<.001) and lower % body fat (26% vs. 29%, p=0.03). In regression analyses, age, gender, and estimated VO2 Max were related to ADHD, while body fat %, race/ethnicity, and household income were not. For each 1ml/kg/min increase in VO2 max odds of ADHD diagnosis increased by 2% (p=0.017, Exp(B)=1.02, p<.01). Conclusion: The associations between ADHD, physical fitness and percent body fat were in the opposite direction of hypotheses and previous literature. This may be a function of ADHD diagnosis as the outcome, rather than symptoms. Unfortunately low-income and racial/ethnic minority children are less likely to be diagnosed and more likely to be obese and unfit. Future studies should directly assess ADHD.

Benefits of life-long physical activity (PA) are widely recognized. Fewer studies have investigated how being young competing athlete reflects to later life body composition and PA. PURPOSE: To investigate the impact of participation in competitive sports in youth on the body composition and subjectively and objectively measured PA at middle-age. METHODS: The study participants are 47-to-55-year old Finnish women (n=985) attending to the Estrogenic Regulation of Muscle Apoptosis study (ERMA). Their participation in competitive sports at the age of 13-to-16 was assessed by retrospective self-report. Midlife lean mass body (LBM), skeletal muscle mass (SMM) and fat mass (FM) were measured with bioimpedance (Inbody 720) after overnight fasting (n=866). Midlife PA included 7-scaled self-estimate that was reclassified to form sedentary, light, moderate and vigorous PA categories (n=985), a detailed assessment of leisure-time PA volume, duration and intensity (a modified Kuopio Ischemic Heart Disease Risk Factor Study Questionnaire, n=982) enabling calculation of mean daily metabolic equivalent (MET-h/day) index as a proxy of the previous 12 months PA and objectively measured total PA over seven-days by hip-worn accelerometer (Actigraph GT3X+ or WGT3X+, n=734). Statistical differences were tested using chi-squared test, independent samples t-test or Mann-Whitney U test. RESULTS: Participants were assigned into youth athlete (n=136) or non-athlete (n=849) groups based on their participation in competitive sports at the age of 13-to-16. Youth athlete group had 1.5 kg higher LBM (p<0.002) and 1.0 kg higher SMM (p<0.001) at middle-age, but no statistically significant difference in FM. Youth athletes reported more vigorous PA (32.4% vs. 20.3%, p<0.007) and higher leisure-time MET index (4.3 vs. 3.4 h/day, p<0.001) than non-athletes. No difference was observed in accelerometer-measured sedentary time, light PA, moderate-to-vigorous PA or total PA (counts) between groups. CONCLUSION: Participation in sport competitions as a teenager has long lasting health benefits that associates with healthier body composition and higher leisure-time PA later in life. However, the discrepancy between self-reports and objective measures needs further studies to delineate the benefits of different components of PA.

Abstract Purpose: The study investigated the relationship between cardiovascular fitness, body composition, and ADHD diagnosis. Obesity and ADHD are highly comorbid—ADHD children are twice as likely to become obese adults than typically developing peers. However, the role of physical fitness in this relationship remains unexplored. Methods: Youth age 12-19 years old (N=4,790) participating in the National Health and Nutrition Examination Survey (NHANES) 2001-2004 were included. Parents reported demographics and whether their child had ever been diagnosed with ADHD. Children underwent examinations of body fat percentage via bioelectrical impedance and estimated VO2 max via a submaximal treadmill test. Chi-square analyses and t-tests assessed differences between ADHD and typically developing (TD) youth on fitness and composition. Three age-specific multiple linear regression analysis with ADHD diagnosis as the dependent variable and estimated VO2 max, percent body fat, age, race/ethnicity, gender, and household income as predictors. Results: Males were 3 times more likely to be diagnosed with ADHD than females (12% vs. 4%) (p<1.09, Exp(B)=3.03, p<.001). Non-Hispanic Whites were more likely to have been diagnosed with ADHD (13%) compared to Mexican Americans (4%) and Non-Hispanic Blacks (7%); they were also more likely to have been seen a mental health professional in the last year (13%), compared to Blacks (8%) and Mexican Americans (6%). Children diagnosed with ADHD evidenced significantly higher VO2 max than typically developing peers (45.3 ml/kg/min vs. 42.0 ml/kg/min; t=-5.06, p<.001) and lower % body fat (26% vs. 29%, p=0.03). In regression analyses, age, gender, and estimated VO2 Max were related to ADHD, while body fat %, race/ethnicity, and household income were not. For each 1ml/kg/min increase in VO2 max odds of ADHD diagnosis increased by 2% (p=0.017, Exp(B)=1.02, p<.01). Conclusion: The associations between ADHD, physical fitness and percent body fat were in the opposite direction of hypotheses and previous literature. This may be a function of ADHD diagnosis as the outcome, rather than symptoms. Unfortunately low-income and racial/ethnic minority children are less likely to be diagnosed and more likely to be obese and unfit. Future studies should directly assess ADHD.
1895 Board #156 May 31 2:00 PM - 3:30 PM Associations of Short Bout Sedentary Behavior and Physical Activity with Adiposity and Fitness in Children
Melissa A. Jones¹, Paula Skidmore², Lee Stoner¹, Harriet Harrexp, Pouya Saeedi¹, Katherine Black², Bethany Barone Gibbs¹, University of Pittsburgh, Pittsburgh, PA. ¹University of Otago, Dunedin, New Zealand. ²University of North Carolina, Chapel Hill, NC.

PURPOSE: Total duration of sedentary behavior (SB) is not consistently associated with adiposity and fitness in children. In adults, SB accumulated in long bouts has been positively associated with adiposity while short bouts are inversely related. We studied the effect of displacing long bout SB with short bout SB and physical activity in children.

METHODS: This cross-sectional study included 450 children aged 9-11 from New Zealand. Objective SB and activity were measured via wrist-worn accelerometer for ≥ 3 days. Activity was classified as long (≥10 min) and short (<10 min) bout SB, light, and moderate-to-vigorous physical activity (MVPA). Estimated cardiorespiratory fitness (mL/kg∙min) was assessed using the 20 metre shuttle run test. Adiposity estimates were World Health Organization BMI z-score (zBMI), waist circumference (WC) and Fat Mass Index (FMI). Isotemporal substitution estimated the effect of displacing long bout SB with short bout SB, light and MVPA (per SD) on adiposity and fitness in adjusted linear mixed models.

RESULTS: Children accumulated the following mean (SD) in min/day: 32 (17) long bout SB, 302 (42) short bout SB, 235 (27) light activity, and 131 (29) MVPA. Overall and in boys only, substituting long bout SB with short bout SB and physical activity was not associated with adiposity. Among girls, substituting with short bout SB (std. coef. = -0.84, p<0.039) and MVPA (std. coef. = -0.78, p=0.017) were inversely associated with FMI. Overall and by sex, substituting with MVPA was associated with higher fitness (std. coef. =2.08 mL/kg∙min, p<0.001). Substituting with short bout SB was associated with higher fitness in girls (std. coef. = -1.44 mL/kg∙min, p=0.036).

CONCLUSIONS: As compared to long bouts, short bout SB (<10 min) was not adversely associated with outcomes and, in some cases, was related to more favorable adiposity and fitness. SB pattern (long vs. short bout) may be important for clarifying the associations of short bout SB with adiposity and fitness in children. In adults, SB accumulated in long bouts has been positively associated with adiposity while short bouts are inversely related. We studied the effect of displacing long bout SB with short bout SB and physical activity in children.

1896 Board #157 May 31 2:00 PM - 3:30 PM Associations Between School Transport Mode And Obesity By Gender, Grade, Physical Activity, Ethnicity, And Economic Disadvantage
Allen M. Hallett,⁴ Nalini Ranjit¹, Harold W. Kohl, III, FACSM¹, Kelley Pettee Gabriel, FACSM¹, Natalie P. Archer², Deanna M. Hoelscher¹. ¹University of Texas Health Science Center-Houston UTHealth School of Public Health in Austin, Austin, TX. ²Texas Department of State Health Services, Austin, TX. (Sponsor: Harold W. (Bill) Kohl, III, FACSM) (No relevant relationships reported)

PURPOSE: To examine the prevalence of school transport modes and obesity by gender, grade, physical activity, race/ethnicity, and economic disadvantage in a representative sample of Texas school children.

METHODS: Cross-sectional data on reported sociodemographic characteristics, school transport mode, and physical activity behavior were collected from the Texas School Physical Activity and Nutrition (SPAN) Survey, 2015-2016. SPAN surveyed height and weight were used to calculate BMI and classify 4th, 8th, and 11th grade students by obesity status. The sampling frame had 14,976 students from 452 schools to provide weighted state-level estimates by grade. Descriptive statistics and associations were conducted between school transport modes and obesity. Interaction terms were included to test if school transport modes-obesity associations differed by gender, grade, physical activity, race/ethnicity, or economic disadvantage.

RESULTS: Participants were predominately Hispanic (69.8%), normal weight (55.8%), used passive school transport modes (90.9%), and did not meet physical activity guidelines (82.4%). Active and passive school transport modes were not significantly associated with obesity (all p>0.05). Gender, race/ethnicity, physical activity, and economic disadvantage were significantly associated with obesity (all p<0.05). Bike to school by race/ethnicity and walk to school by grade were significantly associated with obesity (all p<0.05). Hispanic/AA students who biked to school were significantly more likely to have obesity compared to White/Other students who did not bike to school (OR=4.58, p=0.05, 95% CI: 1.25, 16.00). Students in 8th grade who walked to school were significantly less likely to have obesity than 4th and 11th grade students who did not walk to school (OR=0.98, p=0.05, 95% CI: 0.19, 0.91).

CONCLUSIONS: These findings suggest that associations between active school transport modes and obesity differ by sociodemographic characteristics, including race/ethnicity and grade. Population-based approaches to childhood obesity prevention may benefit from understanding disparities in opportunities for school transport modes. Supported by the Texas DSHS with funds from the Title V MCH Block Grant to Texas, the CDC HHS Block Grant, and the Michael & Susan Dell Foundation.
RESULTS: The search yielded 50 studies, a total of 15 studies were included in the review. Most of the included studies employed a randomized controlled trial study design (12/15, 67%). Samples sizes ranged from 20 to 60. Intervention length ranged from 6-60 weeks. The major indicator of CRF was $V_{O_2max}$, measured by laps (20-m shuttle run) or minutes (1-mile run). Aerobic exercise was utilized in most of the interventions (73%), followed by resistance training (20%), and a combination of aerobic and resistance training (6%). Interventions with intensity of ≥60% maximal heart rate (HRmax) and ≥60% VO$_2$max showed improvement in CRF (ES ≥0.8, 95% CI 0.5-1.2, $p<0.001$). The intervention length and duration that had the largest ES would be 20-45 minutes at 3-4 days per week for 10-12 weeks. Seven (70%) included results that showed improvement in "social and behavioral issues" and "motor skill development" from pre-to post trial. One (10%) showed an effect size that was statistically significant (ES=0.8, 95% CI -0.17 to 2.04, $p=0.00$). Conclusion: The exercise interventions with moderate intensity, 20-45 minutes, 3-4 days per week, and lasting 10-12 weeks seemed helpful for children with autism.

PURPOSE: To determine if high PA youth have a better CVD risk factor status and higher intakes of micronutrients linked to cardiovascular health, compared to low PA youth. METHODS: In a cross-sectional analysis of data from 5th grade students (N=947, 11 ± 0.5 y; 58.2% females; 58.4% white), trained research assistants collected height, weight, percent body fat (%BF) via bioelectrical impedance, resting blood pressure (SBP/DBP), and non-fasting blood samples by finger prick for total cholesterol (TC), low density lipoprotein (LDL), high-density lipoprotein cholesterol (HDL-C) and TC:HDL levels. Micronutrient intakes were derived from the Block Kids Food Frequency Questionnaire. MPVA groups were determined by median split (High PA:≥5days, Low PA:<5days). One-way ANCOVAs were used to determine if CVD risk factors and micronutrients differed between High- and Low PA groups, when controlling for age and gender. RESULTS: High PA youth had lower %BF (23.1 ± 2.53, F(1,926)=14.98, p<0.05) and higher HDL-C (49.7 vs. 46.5, F(1,667)=9.12, p<0.05) compared to Low PA, with no differences in TC, TC:HDL, or BP measures. Micro-nutrient intakes were assessed per 1000 kcal. High PA youth reported higher intakes of K (11.38 vs. 1.29 g, F(1,890)=19.98, p<0.05), Mg (136 mg vs. 128 mg, F(1,890)=26.27, p<0.05), vitamin A (335 mcg vs. 332 mcg, F(1,890)=5.04, p<0.05), vitamin C (79 mg vs. 67 mg, F(1,890)=12.37, p<0.05), vitamin E (3.6 mg vs. 3.3 mg, F(1,890)=6.64, p<0.05) and lower Na+ (1.48 g vs. 1.52 g, F(1,890)=19.19, p<0.05) compared to Low PA, with no differences in calcium or vitamin D. CONCLUSIONS: The better CVD risk factor status in High PA compared to Low PA youth parallels previous cross-sectional findings. The higher intakes of cardioprotective micronutrients in High PA youth may have contributed to better CVD risk status.

Funding source: Cross Blue Shield Foundation of Michigan, Supplemental Nutrition Assistance Program-Nutrition Education, USDA

D-66 Free Communication/Poster - Population-Based Surveillance

Thursday, May 31, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

1901 Board #162 May 31 2:00 PM - 3:30 PM Differences in CVD Risk Factor Status and Micronutrient Intakes by Physical Activity Level in Youth

Jeanette M. Ricci, Joseph J. Carlison, Erich Petushke, Karin A. Plichter, FACSM. Michigan State University, East Lansing, MI. (No relevant relationships reported)

Physical inactivity is an independent CVD risk factor. In 5th graders few reports show associations between moderate to vigorous physical activity (MVPA) and multiple CVD risk factors, or between MVPA and micronutrients that contribute to cardiovascular health. PURPOSE: To determine if high PA youth have a better CVD risk factor status and higher intakes of micronutrients linked to cardiovascular health, compared to low PA youth. METHODS: In a cross-sectional analysis of data from 5th grade students (N=947, 11 ± 0.5 y; 58.2% females; 58.4% white), trained research assistants collected height, weight, percent body fat (%BF) via bioelectrical impedance, resting blood pressure (SBP/DBP), and non-fasting blood samples by finger prick for total cholesterol (TC), low density lipoprotein (LDL), high-density lipoprotein cholesterol (HDL-C) and TC:HDL levels. Micronutrient intakes were derived from the Block Kids Food Frequency Questionnaire. MPVA groups were determined by median split (High PA:≥5days, Low PA:<5days). One-way ANCOVAs were used to determine if CVD risk factors and micronutrients differed between High- and Low PA groups, when controlling for age and gender. RESULTS: High PA youth had lower %BF (23.1 ± 2.53, F(1,926)=14.98, p<0.05) and higher HDL-C (49.7 vs. 46.5, F(1,667)=9.12, p<0.05) compared to Low PA, with no differences in TC, TC:HDL, or BP measures. Micro-nutrient intakes were assessed per 1000 kcal. High PA youth reported higher intakes of K (11.38 vs. 1.29 g, F(1,890)=19.98, p<0.05), Mg (136 mg vs. 128 mg, F(1,890)=26.27, p<0.05), vitamin A (335 mcg vs. 332 mcg, F(1,890)=5.04, p<0.05), vitamin C (79 mg vs. 67 mg, F(1,890)=12.37, p<0.05), vitamin E (3.6 mg vs. 3.3 mg, F(1,890)=6.64, p<0.05) and lower Na+ (1.48 g vs. 1.52 g, F(1,890)=19.19, p<0.05) compared to Low PA, with no differences in calcium or vitamin D. CONCLUSIONS: The better CVD risk factor status in High PA compared to Low PA youth parallels previous cross-sectional findings. The higher intakes of cardioprotective micronutrients in High PA youth may have contributed to better CVD risk status.

Funding source: Cross Blue Shield Foundation of Michigan, Supplemental Nutrition Assistance Program-Nutrition Education, USDA
RESULTS: (1) regional characteristics: the overall trend of urban girls aged 7-17 in China showed an upward trend, from east to west, from coastal to inland gradient decreasing trend. 5 provinces in North, 4 provinces in northeast, 6 coastal provinces in southeast and Xingjiang Uygur Autonomous Region, higher than the central and northwest provinces. (2) characteristics of the times: With the increase of he year, the differences between provinces and cities gradually reduced. Until 2014, short students in all provinces had been eliminated. This feiture is most significant change in Inner Mongolia from 1991-2000. (3) There was a significant positive correlation between the temperature and the height of the urban girls in China. The temperature was positively correlated with the height of the female. The precipitation had a negative correlation with the height of the urban girls.

CONCLUSIONS: Air pressure and sunshine make a positive influence of girl’s height, while a negative influence on temperature. The general trend of Chinese Female Student’s height presented a trend of declining from east to west and decreasing from coastal to inland. GIS strong data management analysis and display function is the good way to explore the quality of students physical fitness database. It will serve and apply to student physique promotion and intervention.

1903 Board #164 May 31 2:00 PM - 3:30 PM Thirty Years Secular Trend Of Rest Heart Rate In An Epidemiological Transition Society

Wesley Dornelas1, Victor KR Matsudo2, João P. Junior3, Timoteo L. Araujo3. 1CELAFICS, São Caetano do Sul, Brazil. 2CELAFICS - FMU, São Caetano do Sul, Brazil.

(Purpose relationships reported)

PURPOSE: to analyze the rest heart rate secular trend among schoolchildren from Ilhabela, a city in a marked epidemiological shift. Methods: the study is part of the Mixed-Longitudinal Project on Growth and Development from Ilhabela, organized by CELAFICS since 1978. Sample consisted of 897 boys, aged 12 to 14 years-old, divided into 4 decades: 1978 (n=41), 1988 (n=43), 1998 (n=61), and 2008 (n=52). Measures included body weight and height, and rest heart rate (RHR) measured right before a bicycle ergometer test. Statistical analysis included an ANOVA one way to determine eventual differences among RHR from different decades. A post hoc Scheffe test was used to localize these differences. A level of p<0.01 was taken as significant. Results: Mean RHR was 81.3 bpm in the 1978 decade, of 85.2 bpm in 1988 decade, of 79.4 bpm in 1998 decade, and of 91.7 bpm in the 2008 decade, confirming a positive secular trend with a significant increase of RHR between 1998 and 2008 in comparison to 1978 values. It represented an increase of 9.1% and 11.3%, respectively, when compared 1998 and 2008 values to 1978 ones. It was also noted an increase of 1.4 kg in body weight, and an increase of BMI from 17.1 to 18.1, suggesting an important change in level of physical activity and/or diet. Conclusion: This positive secular trend in RHR values between 1978 and 1998 and 2008 represents a signal of cardiovascular health deterioration in that community under marked epidemiological shift, as consequence of a decline in active life standards.

1904 Board #165 May 31 2:00 PM - 3:30 PM Knowledge of the Adult and Youth 2008 Physical Activity Guidelines for Americans

Eric T. Hyde, John D. Obara, Kathleen B. Watson, Janet E. Fulton, FACSM, Susan A. Carlson. Centers for Disease Control and Prevention, Atlanta, GA.

(Purpose relationships reported)

PURPOSE: The 2008 Physical Activity Guidelines for Americans recommends adults engage in at least 150 minutes/week of moderate-intensity aerobic equivalent physical activity to achieve substantial health benefits. Youth should engage in 60 minutes of physical activity daily to receive overall health benefits. This study estimated the proportion of U.S. adults knowledgeable of the adult aerobic guideline and the proportion of parents knowledgeable of the youth aerobic guideline. METHODS: Data from a nationwide sample of U.S. adults who completed the 2017 Summer Consumer Surveys were analyzed. Participants were asked if they had heard of the government recommended amount of physical activity needed for adults and youth to gain health benefits. Knowledge was defined as a response of “150 minutes spread out over a week” for the adult guideline, and “60 minutes, 7 days a week” for the youth guideline. Prevalence of knowledge of the adult guideline was estimated among all respondents (n=5,910), and of the youth guideline among respondents with school-aged children (n=1,288). Differences by demographic characteristics, body mass index (BMI) categories, and physical activity levels were tested using adjusted chi-square tests. RESULTS: Overall, 2.4% (95% confidence interval (CI): 1.9, 3.1) of adults were knowledgeable of the adult guideline and 22.9% (95% CI: 20.5, 25.7) of parents were knowledgeable of the youth guideline. Knowledge of the adult guideline differed among students’ sex, education, income, physical activity level, and BMI category, while knowledge of the youth guideline differed by parental education and physical activity level. For example, knowledge of the adult and youth guideline was lowest among those with a high school degree or less compared to those with a college degree or higher (adult: 1.9% (95% CI: 1.2, 3.0) versus 4.0% (95% CI: 2.9, 5.3); youth: 16.1% (95% CI: 12.3, 20.8) versus 24.9% (95% CI: 21.1, 29.2)). CONCLUSIONS: Despite the release of the 2008 Physical Activity Guidelines for Americans nearly a decade ago, most U.S. adults and parents lack knowledge of the adult and youth aerobic physical activity guidelines. Effective communication strategies may help raise awareness of current and future editions of national guidelines for physical activity.

1905 Board #166 May 31 2:00 PM - 3:30 PM Member Movement Rates Of Fitness Facilities In England

Nadja Willinger1, Elizabeth Horton1, Lou Atkinson1, Tim Williams2, Alfonso Jimenez3, Steven Mann3, 1Coventry University, Coventry, United Kingdom. 2Aston University, Birmingham, United Kingdom. 3Active Research Institute, London, United Kingdom. (Sponsor: Gary Liguori, FACSM)

(No relevant relationships reported)

PURPOSE: Low retention rates of fitness centre customers have previously been reported in the UK. To understand the scale of this problem, data were collected from fitness centres across England with respect to acquisition and attrition rates, or ‘rate of movement’. METHODS: Data were obtained from 481 fitness facilities throughout England during 2016 (private 22%; public 73%; university 1%; council operated 4%), resulting in a representative sample of the UK fitness sector. Movement rates, which are defined as the net gain or loss of members from the beginning to the end of each month, are the main outcome measure, and are analysed using Friedman’s Two-Way ANOVA, Wilcoxon Signed tests, and linear regression, with significance set at p<0.05. RESULTS: An average annual movement rate of 0.12 (0.01%) net movement across all centres. A comparison of the data provided for each quartile resulted in significant differences between all quartiles (p<0.001). The highest movement rate was observed during the first quartile of the year (2.29±0.04%), with a continuous decrease until quarter four (−1.38±0.02%). The rate reversed in quarter three from a net gain towards a loss of members. Regression analysis demonstrated a significant correlation between calendar month and movement rate (R=−0.816, p<0.001), where calendar month explained over 60% of the variation (adjusted R²=0.632). On average, movement rates decreased by 0.4% each month (B=−0.404, 95% CI (-0.606 to -0.202)). CONCLUSIONS: Fitness centres in the UK only report a net increase of members during the first six months of the year, with a constant decrease in rates for each quarter. This indicates the need for interventions aiming to increase retention rates of members of fitness facilities. More information is needed to correlate attrition rates with member characteristics to identify high risk customers and develop suitable interventions.

1906 Board #167 May 31 2:00 PM - 3:30 PM Improving the Operationalization of Neighborhood Built Environment Exposures in Physical Activity Research: Houston TRAIN Study

Deborah Salvo1, Casey P. Durand1, Abidoun Oloyomi2, Kelley Pettee Gabriel, FACSM1, Alexandra van den Berg1, Adriana Perez1, Harold W. Kohl III, FACSM1, 1The University of Texas Health Science Center at Houston - School of Public Health (Austin), Austin, TX. 2The University of Texas Health Science Center at Houston - School of Public Health (Houston), Houston, TX. 3Baylor College of Medicine, Houston, TX.

(No relevant relationships reported)

Although evidence links the built environment (BE) to physical activity, findings remain inconsistent. Baseline Houston TRAIN study data used to examine how geographic scale affects the relation between neighborhood BE measures (NBEMs) and physical activity.

PURPOSE: Determine if model fit and statistical significance of the associations between NBEMs and physical activity vary by participant-centric buffer sizes and identify an optimal geographic scale for operationalizing NBEMs.

METHODS: Using Geographic Information Systems, participant addresses were geocoded and a series of street-network, participant-centric buffers were built, with radii 250m-2500m (250m increments). NBEMs studied were park access and transit stop access (counts/buffer). Physical activity was measured with wGT3X-BT Actigraph monitors, and weekly minutes of moderate to vigorous physical activity (MVPA) were estimated using Freedson cut-points. Linear regressions were run estimating the association between NBEMs and MVPA per buffer size, and identifying an optimal geographic scale for operationalizing NBEMs.

RESULTS: Data were available for 337 adults. For park access, significant (p<0.05) associations were observed at buffer sizes 225m and 250m. The 250m scale had the best fit (R²=0.15). Each additional park in the 250m buffer was associated with 1.0 additional minutes of weekly MVPA. The interquartile range for number of parks within 2500m was 15. For transit access, significant associations with MVPA were observed at all scales. The highest R² (0.16) was at 2000m. Each additional transit

ACSM May 29 – June 2, 2018 Minneapolis, Minnesota

THURSDAY, MAY 31, 2018
STOP within 2000m was associated with 1.1 additional minutes of weekly MVPA. Those living in the highest quartile of transit access had 79 more transit stops within 2000m than those in the lowest quartile. **CONCLUSIONS:** Larger scales (>2000m, i.e. >24 min walk) than those commonly used in physical activity research (400-1000m) may be better suited for studying the relation of the BE with physical activity. Despite low effect sizes per unit increase, the geospatial variability of park and transit access is large, and could account for substantial differences in physical activity across Houston. Supported by NIH R01 DK101593.

1907 Board #168 May 31 2:00 PM - 3:30 PM

**Objectively Measured Physical Activity and Self-Reported Screen Time Behaviors in Omani Children: A Cross-Sectional Study**

Youngdeok Kim,1 Marc Lochbaum,1 Azhaar Ab-Abri,1 Majeed Al-Jabr,2 Hafa Al-Sabti,2 Sabah Almuqbal,3 Suad Alfordi.1 1Texas Tech University, Lubbock, TX. 2Ministry of Education, Muscat, Oman.

(No relevant relationships reported)

World health organization recommends that children engage in at least 60 minutes of moderate- and vigorous-intensity PA (MVPA) per day, with at least 30 minutes of MVPA being achieved afterschool hours. Worldwide, the evidence shows that the prevalence of meeting PA recommendation in children is low. But the majority are from the Western and Asian countries and there is little data available from a country in the Middle-East that have different ethnic and cultural backgrounds. **PURPOSE:** This study examined the levels and patterns of objectively measured MVPA during afterschool hours in Omani children and to relate them with the self-reported PA and screen time behaviors. **METHODS:** 4th grade children attending public elementary schools in Oman during October 2017 participated in the cross-sectional survey. A stratified, two-stage cluster sampling method resulted in a total of 324 children (boys=144; mean age=9.16 yrs old) completing all measures. Children were asked to wear the Polar Active watch across the three consecutive school days and to complete a questionnaire on PA and screen time behaviors. 30-sec epoch, metabolic equivalent (MET) data obtained from the device were used to estimate time spent in sedentary (~2) and MVPA (~3) during 7-hour of afterschool period. **RESULTS:** On average, boys were less sedentary (251.3 mins/d) and more active, with greater MVPA (35.9 mins/day) and vigorous-intensity PA (VPA; 11.5 mins/d) than girls (251.3 mins/d, 26.0 mins/d, and 7.3 mins/d, for sedentary, MVPA, and VPA, respectively). Boys (69.9%) were more likely meeting 30-min MVPA guideline than girls (30.9%; Odds Ratio = 0.3). Most children reported one or less hours of watching TV (76.6%) and using computer/video games (85.5%) during school days, with girls being more likely to report No-TV watching (20.0%) or using computers (62.8%) than boys (13.2% and 41.67%, respectively). Girls are less likely participating in at least one sport team outside of school (45.0%) than boys (62.5%); yet PA and screen time behaviors were not associated with a likelihood of meeting 30-min MVPA guideline. **CONCLUSIONS:** The results showed that objectively measured PA levels of Omani children during afterschool hours are similar with those from the western countries. However, gender-disparities shown in the results should receive further attention.

1908 Board #169 May 31 2:00 PM - 3:30 PM

**Prevalence And Characteristics Of Us State-level Physical Activity And Public Health Planning**

Harold W. Kohl, III, FACSM1, Ashleigh M. Johnson2, Brooke C. Towner,3 Erin E. Dooley,4 Kurt Heischmidt,5 Eloise Elliott,1 1University of Texas, Austin, TX. 2University of Texas School of Public Health, Austin, TX. 3West Virginia University, Morgantown, WV. 4University of South Carolina, Columbia, SC.

(No relevant relationships reported)

**PURPOSE:** The prevalence and attributable risk of disease due to physical inactivity requires it be made a public health priority. Public health planning allows for prioritization and resource allocation, particularly at the state and local level. The extent to which state planning efforts for physical activity exist in the US is unknown. **METHODS:** We developed and conducted a standardized internet search audit of each of 50 US states and the District of Columbia to determine the prevalence and characteristics of health planning documents that include physical activity. Data regarding prevalence and characteristics and degree of alignment with existing physical activity guidelines were abstracted for all relevant documents.

**RESULTS:** Overall, physical activity was part of 215 health planning documents in 50 states. These documents ranged from those addressing various chronic diseases in adults, physical education in children and/or adolescents, or specifically stand-alone physical activity physical activity plans (n=2). Only 9.8% of documents specifically mentioned older adults as a priority population. For children and adolescents, 28.5% of documents aligned correctly with current aerobic activity physical activity guidelines, 6.6% with current muscle strengthening guidelines and 5.3% with current bone-strengthening guidelines. For adults, 28.5% of health planning documents aligned with current aerobic activity guidelines and 11.6% aligned with muscle strengthening guidelines. Only 22 (11%) of state planning documents aligned entirely with the US National Physical Activity Plan sector-based approach to physical activity promotion. **CONCLUSION:** Efforts to improve state-level physical activity planning in the US are needed.

1909 Board #170 May 31 2:00 PM - 3:30 PM

**Global Physical Inactivity**

David Q. Thomas, FACSM, Lea J. Anderson, Monica N. Tyler, Rachel M. Sherman, Jennifer Spring. Illinois State University, Normal, IL.

(No relevant relationships reported)

The World Health Organization (WHO) labelled physical inactivity the fourth leading risk factor for global mortality. The rate of physical inactivity is increasing globally. Participating regularly in physical activity reduces risk for many non-communicable diseases. **PURPOSE:** To investigate the extent of physical inactivity, causative factors, and common obstacles. **METHODS:** A descriptive analysis of data generated by the WHO, governmental, and non-governmental organizations was conducted to discern the extent of physical inactivity, causative factors, and common obstacles. Percentages were calculated and analyzed to provide global, regional, and individual country profiles of physical inactivity. **RESULTS:** Data are not available from all countries equally. Wide variability exists between countries as to the prevalence of, and obstacles causing physical inactivity. Almost one-third of adults are physically inactive globally (15.0% in Southeast Asia to 43% in the Region of the Americas and the Eastern Mediterranean Region). The prevalence was lowest in South-East Asia (15%) and Africa (21%). Women were less active than men with differences of 10% and greater in some areas and greatest in the Eastern Mediterranean Region and Region of the Americas. Physical inactivity was highest in countries with technological advancement. **CONCLUSIONS:** Physical inactivity is a global issue affected by regional factors. It is also a universal problem world-wide and a leading cause of non-communicable diseases. Common factors: age, health, sex, socio-economic status, and urbanization are associated with the level of physical activity/inactivity. Cultural and religious factors limit opportunities for women in many places. Countries with high levels of physical activity rely on human powered transportation and physical labor. Leisure-time physical activity is low in all countries and does not make up for the lost activity associated with access to technology.

1910 Board #171 May 31 2:00 PM - 3:30 PM

**Differences in Park Plans and Policies Across US Municipalities**

Erin L. Peterson. CDC, Atlanta, GA. (Sponsor: David R. Brown, FACSM)

(No relevant relationships reported)

**PURPOSE:** Park use has been positively associated with physical activity, and people are more likely to use parks they perceive to be safe and attractive. Park planning documents and municipality policy or budget provisions that address park safety and maintenance can play an important role in promoting park use. This study examines differences in the presence of park plans, policies, or budget provisions by municipality characteristics and examines the association between presence of park plans and municipal policy or budget provisions to provide safe and well-maintained parks. **METHODS:** Data from a survey of local officials from the 2014 National Survey of Community-Based Policy and Environmental Supports for Healthy Eating and Active Living (CBS HEAL) were analyzed for a nationally representative sample of US municipalities (n=2005, response rate: 45%). Data were merged with Census data to determine municipality characteristics, and ESRI Street Map Premium’s HERE GIS database to determine number of local parks in respondent municipalities. Prevalence of park and recreation planning efforts for physical activity exist in the US is unknown. **RESULTS:** Overall, 68% of US municipalities had a parks and recreation plan. A higher prevalence of plans was observed among municipalities that had more parks (>2 compared with 0 or 1), had a larger population size, were classified as urban, were located in the West, and had a higher median municipal education level. Prevalence of specific policies or budget provisions in parks or outdoor recreation areas was 78% for lighting, 85% for patrols by police and security, and 87% for maintenance of green space and equipment. The presence of each policy or budget provision had a positive association with presence of a parks and recreation plan (p < 0.05) and population size (p < 0.05), controlling for other municipality characteristics.

**CONCLUSIONS:** About 7 out of every 10 US municipalities have a parks and recreation plan. Addressing differences across municipalities in plan prevalence can be an important step toward improving access to safe and well-maintained parks.
Adequate energy availability (EA) is important for the health of female athletes. EA is calculated by subtracting exercise energy expenditure from total energy intake, and normalizing by fat-free mass (FFM). The international consensus statement indicates that reproductive function, energy metabolism, endocrine function, and bone health are affected by the threshold of EA, which falls below 30 kcal/kg FFM/day. However, several previous studies have reported that EA is associated with reduced physical function or metabolism. Further, these data have been based on active women of Caucasian, European, or European-American descent. There are no published scientific studies regarding EA in Asian athletes.

**METHODS:** Fifty-six collegiate athletes participated in this study. Menstrual status was based on self-reported menstrual history and confirmed by the ovulation test kit. Energy intake was determined by 7-day weighed food records. Exercising energy expenditure was assessed by the HR-Vo2 method. REE was measured by indirect calorimetry using the Douglas bag technique during the early follicular phase. Body composition was measured by dual-energy X-ray absorptiometry (DXA).

**RESULTS:** Subjects with lower EA (<25 kcal/kg FFM/day) had lower REE/FFM than those with normal EA (23.2±3.1 vs. 27.0±2.4 kcal/kg FFM/day, p<0.05), and had lower triiodothyronine (T3) levels (80.8±8 vs. 101±9 ng/dl, p<0.01). In addition, energy intake level was significantly lower (1615±317 kcal/day vs. 2102±364 kcal/day, p<0.05) in subjects with lower EA. However, the levels of estradiol, insulin-like growth factor 1, luteal hormone, follicle stimulating hormone, and progesterone were not significantly different between the two groups.

**CONCLUSIONS:** In Japanese female athletes, energy metabolism was suppressed in subjects with lower EA, which was under 25 kcal/kg FFM/day, and was associated with lower REE due to lower T3 levels. Thus, lower EA may influence energy metabolism in Japanese female athletes.

**PREDICTING ENERGY EXPENDITURE IN MALES AND FEMALES DURING HIGH-INTENSITY FUNCTIONAL TRAINING**

Jesse A. Stein1, Yuki Fieto, FACSM2, Katie M. Heinrich1
1Kansas State University, Manhattan, KS. 2Kennesaw State University, Kennesaw, GA.

**PURPOSE:** Researcher report improved body composition after high-intensity functional training (HIFT), which may result from high energy expenditure (EE) during training sessions. Incorporating predictive models for EE during HIFT may benefit practitioners, yet no investigation has attempted to predict EE during HIFT, which is likely different between sexes. Our study aimed to compare EE between sexes and predict EE using anthropometric, physical fitness and performance characteristics of the sports.

**METHODS:** Fifteen collegiate athletes participated in this study. Participants were randomized to two groups, one of which was assigned to perform thrusters in 15 minutes. Independent-samples t-test was used to compare EE between males and females, and multiple linear regression with stepwise selection was used to predict EE for females and males based on age, HT, WT, LVL, VO2peak, and %BF.

**RESULTS:** Mean EE was significantly different between females (48.9±18.2 kcal/min) and males (71.2±20.0 kcal/min; p < 0.001). For females, greater LVL (β = 9.92) and WT (β = 0.94), and lower %BF (β = -1.03) predicted 67% of the variance in EE, F(3, 40) = 24.9, p < 0.001. For males, greater LVL (β = 15.50) and height (β = 0.96), and lower %BF (β = -0.69) predicted 70% of the variance in EE, F(3, 58) = 43.3, p < 0.001.

**CONCLUSIONS:** During a HIFT session, males exhibit higher EE than females, and anthropometric and experience measures predicted EE. It is promising for practitioners that greater experience along with decreased %BF are related to increased EE. However, since HIFT utilizes different exercises in each session, EE likely varies. Future research could assess EE across a variety of HIFT sessions and continue to translate findings to practical applications for practitioners.
X-ray absorptiometry. Kilocalorie and macronutrient intake were assessed utilizing an online application. Subjects were also given the BSQ-16A self-report questionnaire of body shape preoccupation typical of eating disorders.

RESULTS: There was a significant difference in body fat % between the middle distance and long distance runners (31±4.3 vs 25±1.37, p<0.004) and in lean body mass % (63.8±4.2 vs 71.2±3.8). There were no significant differences in body mass index (21.4±2.0 vs 23.6±3.3, p=0.11). RMR was approaching a significance difference between groups with the long distance runners having a greater energy deficit and increased energy expenditure found in the long distance runners.

CONCLUSION: Both middle distance and long distance runners showed a greater energy deficit and increased energy expenditure. Despite having significantly more lean body mass, long distance recreational runners had a lower RMR. This may have been due to the greater energy deficit and increased energy expenditure found in the long distance runners.

### 1916 Board #177 May 31 2:00 PM - 3:30 PM

**Macronutrient Intake and Resting Metabolic Rate in Middle and Long Distance Recreational Female Runners**

- **Joanne DiFrancisco-Donohue**, Mina Divan, Ashley DeLuce, Courtney Barnack, William G. Werner, Hallie Zwibel. New York Institute of Technology College of Osteopathic Medicine, Old Westbury, NY. 

**Purpose**: To examine macronutrient intake on resting metabolic rate and body composition in recreational female middle distance runners compared with long distance female runners.

**Methods**: Twenty-one female runners were recruited; 12 middle distance (age 23.6±1.19) and 9 long distance (age 24.4±1.3), who completed a 3-day dietary food recall on non-consecutive days. Subjects were grouped by weekly mileage; middle distance averaged 9.5±6.1 miles weekly and long distance runners averaged 30.5±7.4 miles weekly. Subjects completed a morning fasting 15-minute indirect calorimetry resting metabolic rate (RMR) and a body composition assessment using dual-energy

**Results**: Energy deficit due to caloric restriction and increased expenditure has been shown to decrease resting metabolic rate (RMR). However, it is unclear how much of this deficit creates the reduced RMR. PURPOSE: To examine macronutrient intake on resting metabolic rate and body composition in recreational female middle distance runners compared with long distance female runners.

**Methods**: Twenty-one female runners were recruited; 12 middle distance (age 23.6±1.19) and 9 long distance (age 24.4±1.3), who completed a 3-day dietary food recall on non-consecutive days. Subjects were grouped by weekly mileage; middle distance averaged 9.5±6.1 miles weekly and long distance runners averaged 30.5±7.4 miles weekly. Subjects completed a morning fasting 15-minute indirect calorimetry resting metabolic rate (RMR) and a body composition assessment using dual-energy

**Results**: Energy deficit due to caloric restriction and increased expenditure has been shown to decrease resting metabolic rate (RMR). However, it is unclear how much of this deficit creates the reduced RMR. PURPOSE: To examine macronutrient intake on resting metabolic rate and body composition in recreational female middle distance runners compared with long distance female runners.

**Methods**: Twenty-one female runners were recruited; 12 middle distance (age 23.6±1.19) and 9 long distance (age 24.4±1.3), who completed a 3-day dietary food recall on non-consecutive days. Subjects were grouped by weekly mileage; middle distance averaged 9.5±6.1 miles weekly and long distance runners averaged 30.5±7.4 miles weekly. Subjects completed a morning fasting 15-minute indirect calorimetry resting metabolic rate (RMR) and a body composition assessment using dual-energy

**Results**: Energy deficit due to caloric restriction and increased expenditure has been shown to decrease resting metabolic rate (RMR). However, it is unclear how much of this deficit creates the reduced RMR. PURPOSE: To examine macronutrient intake on resting metabolic rate and body composition in recreational female middle distance runners compared with long distance female runners.

**Methods**: Twenty-one female runners were recruited; 12 middle distance (age 23.6±1.19) and 9 long distance (age 24.4±1.3), who completed a 3-day dietary food recall on non-consecutive days. Subjects were grouped by weekly mileage; middle distance averaged 9.5±6.1 miles weekly and long distance runners averaged 30.5±7.4 miles weekly. Subjects completed a morning fasting 15-minute indirect calorimetry resting metabolic rate (RMR) and a body composition assessment using dual-energy

**Results**: Energy deficit due to caloric restriction and increased expenditure has been shown to decrease resting metabolic rate (RMR). However, it is unclear how much of this deficit creates the reduced RMR. PURPOSE: To examine macronutrient intake on resting metabolic rate and body composition in recreational female middle distance runners compared with long distance female runners.

**Methods**: Twenty-one female runners were recruited; 12 middle distance (age 23.6±1.19) and 9 long distance (age 24.4±1.3), who completed a 3-day dietary food recall on non-consecutive days. Subjects were grouped by weekly mileage; middle distance averaged 9.5±6.1 miles weekly and long distance runners averaged 30.5±7.4 miles weekly. Subjects completed a morning fasting 15-minute indirect calorimetry resting metabolic rate (RMR) and a body composition assessment using dual-energy

**Results**: Energy deficit due to caloric restriction and increased expenditure has been shown to decrease resting metabolic rate (RMR). However, it is unclear how much of this deficit creates the reduced RMR. PURPOSE: To examine macronutrient intake on resting metabolic rate and body composition in recreational female middle distance runners compared with long distance female runners.

**Methods**: Twenty-one female runners were recruited; 12 middle distance (age 23.6±1.19) and 9 long distance (age 24.4±1.3), who completed a 3-day dietary food recall on non-consecutive days. Subjects were grouped by weekly mileage; middle distance averaged 9.5±6.1 miles weekly and long distance runners averaged 30.5±7.4 miles weekly. Subjects completed a morning fasting 15-minute indirect calorimetry resting metabolic rate (RMR) and a body composition assessment using dual-energy

**Results**: Energy deficit due to caloric restriction and increased expenditure has been shown to decrease resting metabolic rate (RMR). However, it is unclear how much of this deficit creates the reduced RMR. PURPOSE: To examine macronutrient intake on resting metabolic rate and body composition in recreational female middle distance runners compared with long distance female runners.

**Methods**: Twenty-one female runners were recruited; 12 middle distance (age 23.6±1.19) and 9 long distance (age 24.4±1.3), who completed a 3-day dietary food recall on non-consecutive days. Subjects were grouped by weekly mileage; middle distance averaged 9.5±6.1 miles weekly and long distance runners averaged 30.5±7.4 miles weekly. Subjects completed a morning fasting 15-minute indirect calorimetry resting metabolic rate (RMR) and a body composition assessment using dual-energy

**Results**: Energy deficit due to caloric restriction and increased expenditure has been shown to decrease resting metabolic rate (RMR). However, it is unclear how much of this deficit creates the reduced RMR. PURPOSE: To examine macronutrient intake on resting metabolic rate and body composition in recreational female middle distance runners compared with long distance female runners.

**Methods**: Twenty-one female runners were recruited; 12 middle distance (age 23.6±1.19) and 9 long distance (age 24.4±1.3), who completed a 3-day dietary food recall on non-consecutive days. Subjects were grouped by weekly mileage; middle distance averaged 9.5±6.1 miles weekly and long distance runners averaged 30.5±7.4 miles weekly. Subjects completed a morning fasting 15-minute indirect calorimetry resting metabolic rate (RMR) and a body composition assessment using dual-energy

**Results**: Energy deficit due to caloric restriction and increased expenditure has been shown to decrease resting metabolic rate (RMR). However, it is unclear how much of this deficit creates the reduced RMR. PURPOSE: To examine macronutrient intake on resting metabolic rate and body composition in recreational female middle distance runners compared with long distance female runners.

**Methods**: Twenty-one female runners were recruited; 12 middle distance (age 23.6±1.19) and 9 long distance (age 24.4±1.3), who completed a 3-day dietary food recall on non-consecutive days. Subjects were grouped by weekly mileage; middle distance averaged 9.5±6.1 miles weekly and long distance runners averaged 30.5±7.4 miles weekly. Subjects completed a morning fasting 15-minute indirect calorimetry resting metabolic rate (RMR) and a body composition assessment using dual-energy

**Results**: Energy deficit due to caloric restriction and increased expenditure has been shown to decrease resting metabolic rate (RMR). However, it is unclear how much of this deficit creates the reduced RMR. PURPOSE: To examine macronutrient intake on resting metabolic rate and body composition in recreational female middle distance runners compared with long distance female runners.

**Methods**: Twenty-one female runners were recruited; 12 middle distance (age 23.6±1.19) and 9 long distance (age 24.4±1.3), who completed a 3-day dietary food recall on non-consecutive days. Subjects were grouped by weekly mileage; middle distance averaged 9.5±6.1 miles weekly and long distance runners averaged 30.5±7.4 miles weekly. Subjects completed a morning fasting 15-minute indirect calorimetry resting metabolic rate (RMR) and a body composition assessment using dual-energy

**Results**: Energy deficit due to caloric restriction and increased expenditure has been shown to decrease resting metabolic rate (RMR). However, it is unclear how much of this deficit creates the reduced RMR. PURPOSE: To examine macronutrient intake on resting metabolic rate and body composition in recreational female middle distance runners compared with long distance female runners.
availability (NEA) trial. Energy availability was manipulated to set as 20 kcal / kg FFM / day for LEA trial and 45 kcal / kg FFM / day for NEA trial, respectively. The subjects completed three consecutive days of endurance training (75 min of treadmill running at 70 % of VO2max) during days 1-3. Venous blood samples were collected in early morning on days1-4 and 3 h after exercise completion on day 3. Serum hepcidin, ferritin, iron, myoglobin and plasma IL-6 levels were evaluated. Muscle glycogen contents were evaluated in early morning on days 1-4 by 1H-NMR.

RESULTS: Averaged VO2 during the 2.08 ± 1.61 kcal / day in LEA trial and 3.967 ± 90 kcal / day in NEA trial (p < 0.001). Muscle glycogen content were decreased in LEA trial during days 2.4 (p < 0.05, vs. day 1) whereas no significant change was observed in NEA trial. Area under the curve of serum hepcidin levels during days 1-4 was significantly higher in LEA trial (40.2 ± 11.8 ng/ml in LEA trial vs than in the NEA trial (7.0 ± 9.0 ng/ml, p < 0.04). CONCLUSIONS: Three consecutive days of endurance training under LEA decreased muscle glycogen content and increased serum hepcidin levels in male long distance runners.

### 1919 Board #180
May 31 2:00 PM - 3:30 PM
Development Of A Validated EnergyExpenditure Prediction Equation In Asian Adults

Xi Jin, Paul Dinneen Loprinzi, Martha Ann Bass, Ling Xin, Teresa Carr Carthills, Mark Loftin, FACSM. The University of Mississippi, University, MS.

(No relevant relationships reported)

Knowledge of energy expenditure (EE) is an important factor for weight management and helps fitness professionals more appropriately design exercise programs for obesity reduction in the obesity prevalence of Asian. PURPOSE: The aim of this study was to develop a regression equation to predict EE during walking or running corrected for one mile in normal weight and overweight Asian adults and to cross-validate the equation. METHODS: Eighty-five subjects, including normal weight normals (NWW) (fat percentage≤25 for males, ≤30 for females), overweight normals (OW) (fat percentage>25 for males, >30 for females) and runners (R), participated to test EE through indirect calorimetry. Analysis of variance (ANOVA) was used to test overall significance with post hoc Scheffe test employed to compare energy expenditure in three groups (NWW, OW, and R). Multiple regression analysis was employed for EE prediction and differences between the measured and predicted EE in the cross-validation group was compared by a dependent t-test. Also, regression coefficients generated from cross-validation group were compared to the original equation’s coefficients using the Chow statistical test. RESULTS: There was not significantly different absolute EE among three groups (p>0.05). When EE was expressed relative to body weight, R group (1.70±0.03 kcal/mile kgBW) was found to expend significantly more energy than the other two groups (NWW: 1.50±0.04 kcal/mile kgBW; OW: 1.4±0.03 kcal/mile kgBW; p < 0.05). However, when EE was expressed relative to fat free mass, there was significant difference between NWW (2.0±0.05 kcal/mile kgFFM) and R group (2.3±0.05 kcal/mile kgFFM; p < 0.05). Predicting EE (kcal) during walking or running corrected for one mile yielded EE=(0.933×body weight)+4.127×Gender (M=1, F=2)+47.256×(sitting and lying) the Hedges g was used as a measure of effect size. The purpose of such a analysis was employed to assess practical significance. Results: As can be seen in Table 1, there was no difference in the resting metabolic rate, and even in the case of oxidation of energetic substrates (fat and carbohydrate), the difference was not significant, considering the mean, since the effect size (hedges g) was 0.012. Conclusions: For clinical purposes, the use of the sitting or lying position does not present differences in terms of resting metabolic rate, as well as energetic substrate oxidation.

**Table 1: RMR and Oxidation of FAT and CHO**

<table>
<thead>
<tr>
<th>RMR (sitting and lying)</th>
<th>% Fat Sitting Lying</th>
<th>% CHO Sitting Lying</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1885,0</td>
<td>48.82</td>
</tr>
<tr>
<td>2</td>
<td>1773,7</td>
<td>16.83</td>
</tr>
<tr>
<td>3</td>
<td>1279,8</td>
<td>73.25</td>
</tr>
<tr>
<td>4</td>
<td>1332,8</td>
<td>5.09</td>
</tr>
<tr>
<td>5</td>
<td>1502,6</td>
<td>21.47</td>
</tr>
<tr>
<td>6</td>
<td>1526,0</td>
<td>43.22</td>
</tr>
<tr>
<td>7</td>
<td>1958,8</td>
<td>24.63</td>
</tr>
<tr>
<td>8</td>
<td>1958,7</td>
<td>34.78</td>
</tr>
<tr>
<td>9</td>
<td>1516,6</td>
<td>74.83</td>
</tr>
<tr>
<td>10</td>
<td>1311,6</td>
<td>42.23</td>
</tr>
<tr>
<td>Mean</td>
<td>1604,9</td>
<td>38.52</td>
</tr>
<tr>
<td>SD</td>
<td>268,5</td>
<td>22.98</td>
</tr>
</tbody>
</table>

### 1920 Board #181
May 31 2:00 PM - 3:30 PM
The Effects of Wearing Cold Garments on EnergyExpenditure

John P. Porcari, FACSM, Samuel Hartinger, Scott Doberstein, Kimberly Radtke, Abigail Rydkey, Carl Foster, FACSM. University of Wisconsin - La Crosse, La Crosse, WI.

(No relevant relationships reported)

Stimulation of brown adipose tissue (BAT) by cold exposure purportedly upregulates energy expenditure and has been suggested as a method to reduce adiposity. BAT in humans is located primarily in the upper torso. Manufacturers have developed garments that contain ice packs and are designed to be worn over these areas. Two such products are the Cool Fat Burner and the Cool Gut Buster. The Cool Fat Burner places ice packs against the shoulders and neck, while the Cool Gut Buster targets BAT around the abdomen. Purpose: This study was designed to determine changes in energy expenditure and heart rate when wearing the Cool Fat Burner and the Cool Gut Buster. Twenty subjects (12 males; 8 females) sat quietly for a total of 90 minutes while heart rate and VO2 were recorded. Data collection was separated into three 30-minute phases: rest, low-intensity, and high-intensity. Subjects sat quietly during the rest phase, wore both the Cool Fat Burner and the Cool Gut Buster during the low-intensity phase, and wore both garments and drank cold water during the high-intensity phase. Results: Average VO2 increased significantly across all three phases (rest: 295.6 ± 69.1 ml/min; low intensity: 333.0 ± 83.2 ml/min; high intensity: 372.8 ± 87.5 ml/min). Average heart rate decreased significantly across all three phases (rest: 67 ± 8.2 bpm; low intensity: 65 ± 7.1 bpm; high intensity: 59 ± 6.8 bpm). When VO2 was converted to caloric expenditure, it was found that 11.2 additional kcals were burned in the 30-min low-intensity phase compared to rest, and that 23.1 additional kcals were burned during the 30-min high-intensity phase compared to resting values. Conclusion: Wearing cold garments resulted in a significant increase in energy expenditure. How ever, the magnitude of the increase may not be practically useful as a weight loss tool.

### 1921 Board #182
May 31 2:00 PM - 3:30 PM
Test of Two Distinct Protocols in Indirect Calorimetry

Andressa F. de Abreu, Anderson Santana, Domingos R. Pandelo Jr. Centro de Alta Paerformance, Santos, Brazil.

(No relevant relationships reported)
RESULTS: Infusions were made without leaks despite differences in design across the metabolic chamber. Average effect size of gas infusions was 0.19 (95%CI = 0.13 to 0.25) for VO$_2$ and VO$_2$ and 0.02 (95%CI = 0.01 to 0.03) for VCO$_2$. Variations were seen in baseline O$_2$ and CO$_2$ readings taken at the beginning of the test even though there were only 5 min: O$_2$ (20.85 - 20.94 vol%) and CO$_2$ (0.037 - 0.12 vol%).

CONCLUSIONS: Gas infusions are an independently traceable standard practice. Calibration and validation for most RC across a wide range of VO$_2$ and VCO$_2$. Traceability also establishes a standard between labs independent of model and manufacturer. Extending the same techniques to MC provides essential assurance to users, allows data to be analyzed based on location, and enables manufacturers to improve performance. More testing will determine best practices for MC, and possibly reduce the effects of environmental changes on MC.

1923 Board #184 May 31 2:00 PM - 3:30 PM

Comparison of Predicted and Measured Resting Metabolic Rate Methods Among CrossFit-Trained Athletes.

Aylisis Rodriguez, Isabel Fabacher, Kathryn Brown, Alyssa J. Holmes, Trisha A. VanDusseldorp, Gerald T. Mangine, Tiffany A. Esmat, Yuri Fetto, FACSM. Kennesaw State University, Kennesaw, GA.

(No relevant relationships reported)

The use of prediction equations and machinery estimation for the assessment of resting metabolic rate (RMR) has grown in popularity. While RMR is crucial when assessing expenditure to maintain energy balance. The use of prediction equations and machinery estimation for the assessment of resting metabolic rate often exclude initial data from analysis. Controlled gas infusions were run on the Max II: High infusion error was 7.4% (Range: 0.5 to 13.4%) for VO$_2$ and 1.1% (Range: 0.9 to 1.3%) for VCO$_2$. Variations were seen in baseline O$_2$ and CO$_2$ readings taken at the beginning of the test even then every 5 min: O$_2$ (20.85 - 20.94 vol%) and CO$_2$ (0.037 - 0.12 vol%).

CONCLUSIONS: Gas infusions are an independently traceable standard practice. Calibration and validation for most RC across a wide range of VO$_2$ and VCO$_2$. Traceability also establishes a standard between labs independent of model and manufacturer. Extending the same techniques to MC provides essential assurance to users, allows data to be analyzed based on location, and enables manufacturers to improve performance. More testing will determine best practices for MC, and possibly reduce the effects of environmental changes on MC.

1924 Board #185 May 31 2:00 PM - 3:30 PM

Priming Whole-room Calorimeters With CO$_2$ To Improve Performance And Reduce Test Time

Michael Busa, Eric Rudd, Erica Wohlers-Karaisch, Jon Moon.

University of Massachusetts Amherst, Amherst, MA. "MEI Research, Ltd., Enid, MN. (Sponsor: Patty Freedson, FACSM)

(No relevant relationships reported)

PURPOSE: Studies using whole-room calorimetry to quantify resting and/ or long-term metabolic rate often exclude initial data from analysis. Controlled gas infusions to simulate metabolic rate also show higher error in these initial measurements. This study examined if infusing CO$_2$ into the chamber prior to measurement reduced the time before measurements are within error specifications. We hypothesized that priming the chamber to 0.2% CO$_2$ would significantly reduce the time to get valid measurements of VO$_2$ and VCO$_2$.

METHODS: We used a precision gas blender to infuse pure gases (N$_2$ and CO$_2$) into a 32,500 L metabolic chamber (MEI Research Ltd, Edina, MN). Seven different infusion profiles constructed to mimic VO$_2$ and VCO$_2$, associated with 1.1 METS in 50 kg, 70 kg, 90 kg, and 110 kg individuals with an RQ of 0.74, with and without infusing CO$_2$, to bring the chamber to 0.2% CO$_2$ prior to infusion. Ambient inflow rate to the chamber was held constant at 5 L•min$^{-1}$. Additionally, an 88 kg male individual completed a resting metabolic rate study and the time it took for the chamber to reach 0.2% CO$_2$, i.e. enter the validated range, was found experimentally. A pairwise t-test was used to compare the time before both VO$_2$ and VCO$_2$ to exhibit error of less than 4% in CO$_2$ primed vs. ambient (-0.04% CO$_2$) conditions, p<0.05. For the human data, the time it took for the chamber to reach 0.2% CO$_2$ is reported. No statistical comparison was made for the human data.

RESULTS: Priming the chamber to 0.2% CO$_2$ significantly (p<0.02) reduced the time it took for the chamber to be brought into the validated range. Specifically, when the chamber was primed to 0.2% CO$_2$ it took 101, 91, 62, 75, and 31 min before the infusion data came within the chamber specification compared to greater than 120 min in every condition when the chamber was not primed. It took 190 min before the chamber reached the 0.2% CO$_2$ when the participant entered a chamber with ambient CO$_2$ levels.

CONCLUSIONS: Priming a metabolic chamber to a CO$_2$ level that brings the chamber into its validated range could significantly reduce the time after a participant enters a whole-room calorimeter before valid data is observed. This could improve experimental efficiency and reduce participant burden by 80 min on average.

1925 Board #186 May 31 2:00 PM - 3:30 PM

The Effects Of Aerobic, Concurrent, And Resistance Exercise On Compensatory Eating Behaviors

Mark P. Takacs, Shawn Munford, Chad A. Wittmer, Emily J. Sauers. East Stroudsburg University, East Stroudsburg, PA.

(No relevant relationships reported)

Obesity is a worldwide epidemic and can be defined as a disorder of positive energy balance, which occurs when the amount of energy consumed is greater than the amount of energy expended. PURPOSE: To observe the differences in compensatory eating behaviors between four groups (aerobic training, concurrent training, resistance training, and a non-exercise control) in recreationally active, resistance trained, college-aged subjects. METHODS: Ten recreationally active college-aged (21.7 ± 1.3yrs) males and females participated in this study. A 5-week, randomized, crossover design with one full week between each session. Preliminary assessments consisted of a PAR-Q, informed consent, body composition, rep-set best, and VO$_2$max. Aerobic exercise (AE) consisted of 30-minutes of cycling at 70% HR$_{max}$. Resistance exercise (RE) consisted of seven, full-body circuit of three sets of 12 repetitions at 70% self-reported best. Concurrent exercise (CE) consisted of four-resistance exercises at the same intensity with 15-minutes of cycling at 70% HR$_{max}$. The control (CON) consisted of 30-minutes of sitting. Food logs via MyFitnessPal were required for the 24-hour period following each session. SPSS 24.0 was used for data analysis using one-way and two-way ANOVAs and deltas. Level of significance was set at p≤0.05. Results: There were no significant differences in total calorie (CON: 2,164 ± 657 kcal, AE: 1,973 ± 764 kcal, RE: 2,254 ± 1,077 kcal, p=0.743), carbohydrate (CON: 219 ± 66.4g, AE: 244 ± 87.3g, CE: 204 ± 55.4g, RE: 237 ± 94.9g, p=0.657), fat (CON: 57 ± 21.9g, AE: 58 ± 24.0g, RE: 59 ± 31.3g, CE: 63 ± 23.8g, p=0.964), or protein intake (CON: 97 ± 48.6g, AE: 101 ± 48.9g, CE: 89 ± 53.4g, RE: 99 ± 46.4g, p=0.942). HR (CON: 77 ± 10.3bpm, CE: 153 ± 16.2bpm, RE: 136 ± 15.8bpm, p=0.122), and RPE (CON: 6 ± 2.0, AE: 11 ± 2.1, CE: 12 ± 1.9, RE: 10 ± 2.7, p=0.147) between the four sessions. Conclusion: These findings demonstrate that the exercise-induced caloric deficit was not compensated via an increase in caloric and/or macronutrient intake, therefore, resulting in a negative energy balance. Further, the aforementioned findings provide evidence that exercise is a viable mechanism to create an energy deficit, which can ideally lead to successful weight loss.

D-68
Free Communication/Poster - Energy Balance and Weight Management

Thursday, May 31, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

1926 Board #187 May 31 2:00 PM - 3:30 PM

Leptin and Ghrelin Concentrations Differ At Fasting, Post-prandial, And Post-exercise In Active And Inactive Females

Dina Acosta, Mindy Patterson, Jenna Lin, Jonathan Craig, Alexis Ortiz, FACSM. Texas Woman’s University, Houston, TX.

(No relevant relationships reported)

Leptin and ghrelin are counterregulatory hormones that control food intake and energy expenditure to maintain energy balance. PURPOSE: To determine changes in leptin and ghrelin between collegiate female runners (n=12; age 22.2±3.3 years) and inactive females (n=14; age 25.3±1.9 years) across time.

Abstracts were prepared by the authors and printed as submitted.
METHODS: Using a cross-sectional design, blood was collected at three different time points: fasting, immediately following plain bagel consumption (T1), and immediately following a 30-minute steady-state submaximal VO2 treadmill test (T2) in both groups. Leptin and ghrelin were measured using enzyme-linked immunosorbent assay. Fat mass (FM) was determined by dual-energy X-ray absorptiometry. Repeated measures ANCOVA (time x group) compared differences in leptin and ghrelin across time.

RESULTS: Body mass index differed between runners (19.3±1.4 kg/m2) and inactive females (22.6±2.8 kg/m2; p<0.004). FM also differed between groups (runners: 10.76 kg; inactive: 18.32 kg; p<0.001). Baseline fasting leptin was lower in runners (3.3±1.3 ng/ml) than the inactive females (11.1±6.7 ng/ml; p<0.003). Therefore, FM and baseline leptin levels were used as covariates. The time by group interaction was significant (p=0.035; F=4.599) with no differences between groups. In both groups, fasting leptin (7.4±4.08 ng/ml) was higher at baseline fasting (6.2±1.5 ng/ml; p<0.001) and T2 (6.1±3.2 ng/ml; p<0.001). Ghrelin also differed across time (p<0.001) with no interaction between groups. In both groups combined, fasting ghrelin (744.2±503.6 ng/ml) did not differ from baseline to T1 (708.9±243.8 ng/ml).

CONCLUSION: Fasting leptin was lower in collegiate runners than inactive females due to lower levels of FM. Leptin concentrations decreased across time in both groups following food intake and exercise. Ghrelin was highest at fasting and immediately following food intake, and decreased only after exercise. Leptin and ghrelin concentrations change in a similar manner between female runners and inactive females.

1927 Board #188 May 31 2:00 PM - 3:30 PM The Effect Of Resistance Training On Morphology Of Rat Skeletal Muscle During Food Restriction

Kohei Sase, Satoru Ato, Yuma Katamoto, Satoshi Fujita. Ritsumeikan University, Kasatsu, Shiga, Japan. (No related relationships reported)

PURPOSE: Skeletal muscle is critical for muscle strength and exercise performance. Severe food restriction observed among athletes for rapid weight loss (i.e. fasting or skipping meals) activates autophagy-lysosomal pathway and protein breakdown and that causes muscle atrophy. It is well known that resistance exercise stimulates protein synthesis and muscle hypertrophy. Resistance exercise also attenuates skeletal muscle protein breakdown via the autophagy-lysosomal pathway, hence it may prevent the food restriction-induced muscle atrophy. To investigate the effect of resistance training (RT) on skeletal muscle mass and muscle fiber cross sectional area during muscle atrophy-inducing food restriction in rats.METHODS: Eleven weeks old male Sprague-Dawley rats were divided into four groups: normal fed group (C), normal fed and resistance training group (TR), 7 days of 70% food restriction group (FR) and 7 days of 70% food restriction and resistance training group (FR-RT). In training group (TR and FR-RT), rats were subjected to 6 exercise sessions and then were killed 72 hours after final exercise session. Resistance exercise was conducted by percutaneous electrical stimulation in right gastrocnemius muscle three times per week. Hematocin-eosin staining was used to measure the ganaeinnus muscle fiber cross-sectional area (CSA).RESULTS: Body weight, gastrocnemius muscle wet weight, liver wet weight, epidymal fat weight and fiber CSA were significantly reduced by 70 percent with food restriction (p<0.05). Although no significant difference in fiber CSA among normal fed groups (C and TR), FR-RT group tended to show a reduced fiber CSA.

CONCLUSION: This study suggests that resistance training during atrophy-inducing food restriction did not attenuate muscle atrophy in rat skeletal muscle.

1928 Board #189 May 31 2:00 PM - 3:30 PM Post-exercise Whole Body Cryotherapy Treatment Increases Energy Intake Among Well-trained Athletes

Chihiro Kojima1, Nobukazu Kasai1, Chika Kondo1, Yasushi Suzuki2, Kumiko Ebi1, Kazuhige Goto1. 1Ritsumeikan University, Shiga, Japan. 2Saraya Co., Ltd., Osaka, Japan. (Sponsor: Robert R Kraemer, FACSM) (No relevant relationships reported)

PURPOSE: Exercise-induced loss of energy intake during post-exercise period may delay recovery and impair exercise performance among athletes. However, the efficient procedures which can attenuate post-exercise reductions of appetite and energy intake have not been investigated. Previous studies demonstrated that cold environment was likely to promote appetite and energy intake. The aim of the present study was to investigate the effect of whole body cryotherapy (WBC) after exercise on appetite regulation.

METHODS: Thirty male athletes (20.5±0.2 years, 174.8±5.2 cm, 66.6±1.4 kg) were recruited in the present study. They conducted two trials on different days; consisting of WBC trial and CON trial. Subjects performed repeated sprint exercise initially in both trials. In WBC trial, WBC treatment for 3 min (about -140 ℃) was applied from 10 min after completing the exercise. In CON trial, subjects kept resting for identical periods of WBC trial after exercise. At 30 min following exercise, ad-libitum buffet meal test was conducted to evaluate energy intake and macronutrient intake ratio. Blood samples were obtained to measure plasma acylated ghrelin, PYY3-36, serum leptin and other metabolic hormonal concentrations before and after exercise. Subjective feeling parameters, respiratory gas samples and skin temperature were also measured after exercise.

RESULTS: Skin temperature was decreased rapidly after WBC (pre: 31.6 ± 0.2 ℃, immediately after WBC: 7.1 ± 4.1 ℃), and the temperature remained significantly lower until the onset of buffet meal test (P<0.001). Although plasma ghrelin, PYY3-36 and serum leptin concentrations were significantly changed after exercise (P<0.05), no significant differences between trials were observed at any points for these hormones. During post-exercise period, minute ventilation and heart rate were significantly lower in WBC trial than those in CON trial (P<0.05). Energy intake (during buffet meal test was significantly higher in WBC trial (1371 ± 139 kcal) that in CON trial (1106 ± 130 kcal, P=0.007).

CONCLUSIONS: Cold exposure using WBC following strenuous exercise increased energy intake in male athletes.
0% grade. Mitochondria of heart, brain and gastrocnemius were isolated to detect the changes of RCR and ROS. The content of PHB1 protein in mitochondria was detected by Western blot. ATP content in the organs and RCR in the important health outcome were measured by spectrophotometer. RESULTS: 1. Compared with resting control group, ATP content decreased in the brain (-76%, p < 0.05), heart (-77%, p < 0.01) and skeletal muscle (-55%, p < 0.05) after exercise. 2. F0F1-ATP synthase activity declined significantly in the brain (-26%, p < 0.05), heart: -58%, p < 0.01 and skeletal muscle (-55%, p < 0.01) after exercise. 3. Mitochondrial respiratory control ratio (RCR) \( r < 0.05 \) in response to exercise. 4. ROS generation in mitochondria of brain (-64%, p < 0.01), heart: (-42%, p < 0.05) and muscle (-44%, p < 0.05) decreased significantly after exhaustive exercise. 5. Exercise decreased PHB1 content in the mitochondria of muscle (-30%, p < 0.01) and brain (-37%, p < 0.05) but had no effect on PHB1 in the heart. 6. Fat oxidation and energy expenditure during the post-prandial period was positively correlated with PHB1 level in the brain (r=0.896, p < 0.05), heart (r=0.909, p < 0.05) and muscle (r=0.955, p < 0.05). 7. ROS generation was positively correlated with muscle PHB1 level (r=0.874, p < 0.05) but there was no significant correlation in the heart or brain. CONCLUSION: An acute bout of exhaustive exercise reduced the expression of PHB1 in the mitochondria of organs examined and decreased mitochondrial bioenergetics. Supported by NSFNC (No. 31470061).

The satiating effects of protein and its role in energy expenditure have been compared to carbohydrates and fats. Less data exists on the effects of a high fat ketogenic supplement consumed as part of a breakfast smoothie on metabolism, ratings of appetite and energy intake when compared to a protein based breakfast smoothie. PURPOSE: To determine the effects of whey protein (WP) vs. a ketogenic supplement (KS), added to a breakfast smoothie on energy expenditure (EE), appetite and energy intake. METHODS: Fifteen women (age, 30±11 yrs; body fat 29.3±5.7%) participated in this randomized, double blind, crossover study. After a 12-h fast, resting oxygen consumption (VO\(_2\)) and respiratory quotient (RQ) were assessed by indirect calorimetry. Ratings of appetite (hunger (H), fullness (F), desire to eat (DE) and prospective food consumption (PC)) were assessed via visual analog scales (VAS). After consuming the isocaloric (450 kcals) test meal containing either 54g WP (40% of energy), 54g KS (40% of energy) or 0kcals VAS on appetite and energy intake were assessed. RESULTS: baker: 3.7±0.5 kcals (KCAL), and relative daily energy intake of carbohydrate (%CARB), fat (%AFat) in female college students. METHOD: Daily android fat was determined via DXA using standard software. Daily weight loss was associated with improved walking distance and gait speed. Thus, this type of commercial weight loss program appears to be effective for individuals seeking weight loss, which may also result in additional function benefits in adults with obesity.

CONCLUSION: Our results suggest that carbohydrate and fat content of the diet along with MVP independently contribute to the risk for adolescent obesity whereas total caloric intake and protein content of the diet is less important in college-aged women.

### 1931 Board #192

May 31 2:00 PM - 3:30 PM

**Effects Of A Ketogenic Or A Whey Protein Supplement On Metabolism, Appetite And Energy Intake**

Isabel L. Smith, Elizabeth K. Bailey, Theresa Ramos, Tadzawu A. Madzina, Elon University, Elon, NC. (Sponsor: Paul C. Miller, FACSM)

(No relevant relationships reported)

### 1932 Board #193

May 31 2:00 PM - 3:30 PM

**Changes In 6-Minute Walk Performance Is Associated With Weight Loss Following A 6-Month Weight Loss Program**

Katherine A. Collins\(^1\), Sara J. Kovacs\(^2\), Shawn D. Raybuck\(^1\), Audrey M. Collins\(^1\), Marissa L. Marin\(^1\), Alexander L. Carne- Clark\(^1\), Alyssa M. Harris\(^1\), Gary D. Foster\(^1\), Alexis Wojtanowski\(^2\), John M. Jakicic, FACSM\(^3\), Renee J. Rogers. \(^1\)University of Pittsburgh, Pittsburgh, PA. \(^2\)Temple University, Philadelphia, PA. \(^3\)Weight Watchers International, Inc, New York, NY. (Sponsor: John Jakicic, FACSM)

(No relevant relationships reported)

There is evidence of a relationship between obesity and decrements in mobility and function, making these important targets for weight loss interventions. Within commercial weight loss programs, there is limited data to quantify changes in functional outcomes such as walking performance and whether weight loss contributes to improvements in mobility and function. PURPOSE: To examine change in body weight and walking performance in participants enrolled in a commercial weight loss program, and to examine the association between weight loss and walking performance.

METHODS: Participants (N=140; 93.3% of enrolled participants, age: 46.9±12.6 years; body mass index: 32.6±4.5 kg/m\(^2\)) who enrolled and provided complete data following a 6-month commercial weight loss program (Weight Watchers). The intervention was delivered by trained Weight Watchers staff and outcomes were evaluated by independent research staff who were not engaged in the delivery of the weight loss intervention. The intervention included weekly group sessions, instruction on behavioral strategies for weight control, and the use of a mobile app to self-monitor weight loss behaviors. Assessment of body weight and walking distance and gait speed using the 6-minute walk test occurred at baseline and 6 months.

RESULTS: Weight decreased from 88.0±16.2 kg at baseline to 81.0±15.6 kg at 6 months (weight loss = 7.0±5.6 kg) (p<0.001). Walking distance increased from 526.6±63.9 meters at baseline to 553.4±63.9 meters at 6 months (p<0.001). Gait speed during the 6-minute walk test increased from 1.46±0.17 meters per second to 1.54±0.18 meters per second from baseline to 6 months (p<0.001). Weight loss was significantly associated with improved walking distance (r=0.312, p<0.001) and gait speed (r=0.312, p<0.001) during the 6-minute walk test.

CONCLUSION: These findings indicate that this commercial weight loss program resulted in significant weight loss, and the magnitude of weight loss was associated with improved walking distance and gait speed. Thus, this type of commercial weight loss program appears to be effective for individuals seeking weight loss, which may also result in additional function benefits in adults with obesity.

### 1933 Board #194

May 31 2:00 PM - 3:30 PM

**Dietary Fat and Carbohydrate Intake and Physical Activity Independently Predict Android Fat in College Women**

I. M. Castillo-Hernández\(^1\), M. Vishwanathan\(^2\), C.D. Beck\(^2\), M.V. Fedewa\(^2\), B.M. Das\(^2\), W.J. McConnell\(^1\), E.D. Hathaway\(^4\), S.D. Higgins\(^5\), M.D. Schmidt\(^6\), E.M. Evans, FACSM\(^3\). University of Georgia, Athens, GA. \(^2\)University of Alabama, Tuscaloosa, AL. \(^3\)East Carolina University, Greenville, NC. \(^4\)University of Tennessee Chattanooga, Chattanooga, TN. \(^5\)Elon University, Elon, NC. (Sponsor: Ellen M. Evatt, FACSM)

(No relevant relationships reported)

**PURPOSE:** It is well established that abdominal or android obesity is a risk factor for numerous metabolic diseases. Dietary intake, expressed as both energy intake and quality of the diet, and physical activity (PA) are known to influence risk for android obesity. Specifically, the role that relative macronutrient intake (% energy intake) plays in risk for android obesity is of interest. Although college students are relatively healthy, their dietary and PA habits can predispose them to an increased risk for abdominal obesity. These health behaviors are of special interest given the transition to college and the establishment of health behaviors at this time of life. The aim of this study was to examine the contributions of energy intake, relative macronutrient intake (i.e., % of energy intake), and moderate-vigorous PA (MVPA) relative to android fat (%AFat) in female college students. METHODS: Female college students (n=336; 18.7±1.2 yo; BMI = 24.4±4.7 kg/m\(^2\); %AFat = 38.6±11.7%) were assessed for dietary intake using 3-day dietary records. Outcomes of interest included daily energy intake (KCAL), and relative daily energy intake of carbohydrate (%CARB), fat (%FAT) and protein (%PRO). MVPA was measured using accelerometry (NL-1000; 4 valid, 10-h days of wear). %FAT was determined via DXA using standard software definitions (DXA, Lunar, GE). A multiple linear regression model was utilized to predict %FAT from the dietary and MVP variables.

RESULTS: Daily MVPA (β = -0.25, p<0.001), %CARB (β = -0.57, p<0.001), %FAT (β = 0.64, p<0.001) significantly predicted %FAT, explaining 92.1% of the variance (p<0.001). Neither KCAL (β = -0.07, p = 0.21) nor %PRO were significant predictors of %FAT (β = 0.05, p = 0.41).

CONCLUSIONS: Our results suggest that carbohydrate and fat content of the diet along with MVP independently contribute to the risk for abdominal obesity whereas total caloric intake and protein content of the diet is less important in college-aged women.
**1934 Board #195 May 31 2:00 PM - 3:30 PM Weight Gain and Changes in Cardiovascular and Metabolic Risk Factors Throughout the First Year of College**

Krystle K. Sanders,1 Nuo Thao,2 Yi-Hung Liao,2 Jeffrey R. Bernard.1 1California State University-Stanislaus, Turlock, CA. 2National Taiwan University of Nursing and Health Sciences, Taipei, Taiwan.

(No relevant relationships reported)

**PURPOSE:** It is well documented that the first year of college is associated with many physical changes. Of these, it is common for students to gain weight, which is often times referred to as the “Freshman 15.” Although most “Freshman 15” studies report weight gain, it is typically much less than 15 lbs. Despite some weight gain it is not well known if these changes in body weight are also associated with changes in both cardiovascular and metabolic risk factors. Thus, the purpose of this study was to evaluate morphological and physiological changes in students throughout their first year of college. METHODS: Twenty-seven freshman college students (female n = 15, males n = 12) were recruited for this repeated measures design study. Throughout the 10 month study participants logged their eating and exercise habits and were tested on four separate occasions (each approximately 2.5 months apart). Each testing session consisted of body composition screening, oxygen consumption test (VO2max), fasting blood analysis, and an oral glucose tolerance test (OGTT). Repeated measure ANOVA was used on all data sets. All values were expressed as the mean ± SE and p < .05 set for statistical significance. RESULTS: There was no difference in exercise (118 ± 101 min/wk) over the 10 months, but there was a non-significant decrease (2.5 ± 2.2 ml/kg/min) in VO2max by the end of the study. Compared to the start of their Freshman year, weekly caloric intake was significantly increased each testing session thereafter (1,268 ± 677, 1,702 ± 972, and 1,091 ± 608 kcals respectively). At the conclusion of the study, although the blood glucose and plasma insulin response to an oral glucose challenge did not change throughout the study, nor did fasting triglycerides, total cholesterol, and high density lipoprotein (HDL cholesterol). CONCLUSION: Although participants did not change throughout the study, nor did fasting triglycerides, total cholesterol, and high density lipoprotein (HDL cholesterol). The top helpful experiences with dietitians included new information being provided especially for obese women seeking weight management advice before pregnancy. Physicians (n=25) and receiving nutritional information (n=6) as important factors. Of 206 women, 147 saw a physician (n=80) or dietitian (n=67). The affect of exercise on hypothalamic kiss-1 and GPR54 in the puberty development of male rats

**1936 Board #197 May 31 2:00 PM - 3:30 PM The Affect Of Exercise On Hypothalamic Kiss-1 And Gpr54 In The Puberty Development Of Male Rats**

Rui Xu1, Yi Yan1, Minhao Xie2. 1Beijing Sport University, Beijing, China. 2Sports Medicine Institute, General Administration of Sport of China, Beijing, China.

(No relevant relationships reported)

**PURPOSE:** To explore the moderate-intensity treadmill training (MIT) in modulating the hypothalamic expression of kiss-1 and its G protein coupled receptor -GPR54 mRNA relative expression in the different time of puberty. **METHODS:** 3 weeks male Sprague-Dawley rats (weight:62.0±3.13) were randomly assigned to two experimental groups (n=36): control group (n=18) and the MIT group (n=18). MIT group did the 60%-70%VO2max treadmill training (5 days/week, 1 hour/day). All the rats were weaned to detect the hypothalamic expressions of kiss-1 and GPR54 mRNA, animals in the both groups were sacrificed, which on the week of 5 weeks, 6 weeks, and 8 weeks. **Result:** Compared with C group, every weeks of the rats’ MIT group had lower hypothalamic expression of kiss-1 mRNA and GPR54 mRNA. Especially kiss-1 mRNA. After moderate-intensity treadmill training, compare with the control groups , the 5 week2(22.0±09) vs 2.28.1(0.49), p<0.01), 6 weeks(1.90±0.13 vs 1.73±0.18,p<0.01), 8 weeks(0.69±2.21 vs 2.82±0.79 kiss-1 mRNA had significant reduced. All the MIT groups’ hypothalamic expression of GPR54 mRNA had lower than C groups, especially at the age of 6 weeks(0.58±0.1 vs 0.79±0.23,p<0.05). **Conclusions:**MIT could reduce the hypothalamic expression of kiss-1 and its receptor GPR54mRNA in the puberty development of male rats, and kiss-1mRNA are more affected.
The relationship between cognition and aerobic fitness is well studied in breast cancer survivors (BCS); however, there is a lack of research evaluating the relationships between cognition and anaerobic fitness. **PURPOSE:** This study examined the relationship between cognition, muscle power, strength, and the 6-min walk (6MW) in BCS. **METHODS:** Forty-four BCS (60.8 ± 6.5 yr; BMI: 29.9 ± 5.6 kg/m²) completed Trail-Making Test A and B (TMTA processing speed), TMTB (executive function), Digit Span Forward (attention) and Backward (working memory), and Controlled Oral Word Association Test (COWAT (executive function)) to assess cognitive domains. Lower body isokinetic (ISK) power and strength were assessed by the Biodex™. Endurance was assessed by the 6MW. Pearson product-moment correlations were used to evaluate relationships between cognition and aerobic fitness. Significance was accepted at p < 0.05. **RESULTS:** Faster TMTA and TMTB scores were correlated with greater ISK average power for extension at 60 degrees/sec (TMTA: r = 0.40; TMTB: r = 0.31) and 180 degrees/sec (TMTA: r = 0.45; TMTB: r = 0.30) while TMTA was correlated with greater ISK average power for extension at 120 degrees/sec (r = 0.34). A subcategory of the COWAT was correlated with greater 6MW distance (r = 0.31) and greater ISK average power for extension at 180 degrees/sec (r = 0.30). **CONCLUSION:** Higher cognitive functioning, specifically processing speed and executive function domains, may be correlated to greater average power. These findings warrant more research on the benefits of power and strength training on cognition in BCS.

**1938** Board #199 May 31 3:30 PM - 5:00 PM The Relationship Of Cognitive Scores With Muscle Power, Strength, And 6-Minute Walk In Breast Cancer Survivors Rachael Hunt, Ashley Artez, Jeong-Su Kim, Lynn Panton, FACSM. Florida State University, Tallahassee, FL. (Sponsor: Lynn Panton, PhD, FACSM)

There are 12 million cancer survivors in the United States. Nearly all of them have experienced physical, emotional, and psychological symptoms including fatigue, insomnia, and depression. This can contribute to the erosion of overall quality of life. While exercise is commonly prescribed to mitigate these symptoms, the optimal dose and characteristics of its prescription require further investigation. **PURPOSE:** To evaluate the effect of structured exercise on fatigue, insomnia, and depression in cancer survivors. **METHODS:** We enrolled 157 cancer survivors in a 10-week exercise intervention that included aerobic, resistance, and flexibility training. At baseline, patients completed the Fatigue Symptom Index, Athens Insomnia Instrument, and Zung-Self Rating Depression Scale to assess fatigue, insomnia, and depression, respectively. Upon completion of the program, follow-up data were collected. Paired-samples t tests were conducted on patients who completed the intervention. Logistic regression tested the effect of fatigue, insomnia, and depression on odds of completion. Linear regression evaluated predictors of fatigue, insomnia, and depression. **RESULTS:** Among patients who completed the intervention (n = 58), fatigue decreased (p < 0.001); insomnia (p = 0.673) and depression (p = 0.675) were unchanged. Fatigue (p = 0.432), insomnia (p = 0.759), and depression (p = 0.932) did not predict program completion. Patients who were more fatigued at baseline experienced greater reductions in fatigue at follow-up, assessed by score (r = -0.677, p < 0.001) and category (r = -0.685, p < 0.001). Patients with worse insomnia at baseline reported greater improvements at follow-up (r = 0.761; p = 0.079); elevated depression did not facilitate greater improvement (p = 0.228). **CONCLUSIONS:** Fatigue, insomnia, and depression are often indissoluble from the daily experience of a cancer survivor. A biweekly exercise intervention improved fatigue and insomnia after 10 weeks, with greater improvements among the more severely affected; however, we did not find significant alleviation of depression symptoms. These findings suggest exercise is a safe, effective strategy to relieve some symptoms associated with cancer. Further research is required to address potential bias owing to the high rate of attrition in our study.

**1939** Board #200 May 31 3:30 PM - 5:00 PM Perception of Exercise is Associated with Self-Reported Physical Activity in Hematopoietic Stem Cell Transplant Patients Melanie Potiaumpai, Tamia Medina, Stacy E. Cutrono, Denise Pereira, William F. Pirl, Krishna V. Komanduri, Joseph F. Signorile. University of Miami, Miami, FL. (Sponsor: Kevin Allen Jacobs, FACSM)

Hematopoietic stem cell transplant (HSCT) treatment, used to treat an array of hematological cancers, significantly impacts patients’ physical, psychological, and psychosocial stress before, during, and after treatment. HSCT is associated with severe symptomology, including nausea, pain, and fatigue, which may discourage movement and significantly increase sedentary behavior. Patients are advised of the benefits of increased physical activity during HSCT, including attenuation of the severity of their symptoms. However, there is a paucity of research on patients’ perceptions of the benefits of exercise and how that translates to their participation in physical activity. **Purpose:** To evaluate the relationship between perceived benefits and barriers of exercise and self-reported physical activity levels in patients undergoing HSCT. **Methods:** Twenty-three subjects (13M, 10F; 58.1 ± 8.4 years), enrolled in an in-patient transplant program at a university medical center, served as participants. Nine subjects (3M, 6F; 55.1 ± 8.3 years) were imputed to the sample. **Results:** Of the 23 respondents, 75.0% indicated that they experienced fatigue, 73.9% indicated they experienced pain, and 56.5% indicated they experienced sleep disturbance. The majority of the study sample was administered the Exercise Barriers and Benefits Survey (EBBS) and the International Physical Activity Questionnaire—Short Form (IPAQ) prior to their admission for HSCT. The benefits and barriers scale were scored separately. Higher scores on the Benefits Scale indicate a more positive perception of exercise while a higher score on the Barriers Scale indicates greater perception of barriers to exercise. Time spent walking (WALK) and time spent sitting (SIT), recounted in minutes, were reported on the IPAQ for the seven days prior to admission. A Pearson correlation coefficient was computed to assess: the relationship between the EBBS Benefits scale, WALK, and SIT, and the relationship between the EBBS Barriers scale, WALK, and SIT. **Results:** Results of the Pearson correlation indicated that there was a significant positive correlation between the benefits score and patient-reported WALK (r(21) = .44, p < .04). There was also a significant negative correlation between the benefits score and patient-reported SIT (r(21) = -.49, p < .02). There was no significant correlation between the Barriers scale and WALK (r(21) = -.23, p = .30) or SIT (r(21) = .18, p = .42). **Conclusion:** These preliminary results indicate that HSCT patients who report higher benefits to exercise are more likely to spend more time walking and less time sitting.

**D-69** Free Communication/Poster - Exercise Psychology- Cancer

**D-70** Free Communication/Poster - Perception of Effort, Pain and Fatigue

**1940** Board #201 May 31 3:30 PM - 5:00 PM Structured Exercise in the Cancer Patient Improves Insomnia and Fatigue, but Not Depression Chandee L. Pressnall, Cynthia Villalobos, Justin C. Brown, Paul D. Vosti, Courtney D. Jensen. University of the Pacific, Stockton, CA. "Harvard University, Cambridge, MA. "St. Joseph’s Medical Center, Stockton, CA. (Sponsor: Kathryn H. Schmitz, FACSM)

**PURPOSE:** To evaluate the effect of structured exercise on fatigue, insomnia, and depression in cancer survivors. **METHODS:** We enrolled 157 cancer survivors in a 10-week exercise intervention that included aerobic, resistance, and flexibility training. At baseline, patients completed the Fatigue Symptom Index, Athens Insomnia Instrument, and Zung-Self Rating Depression Scale to assess fatigue, insomnia, and depression, respectively. Upon completion of the program, follow-up data were collected. Paired-samples t tests were conducted on patients who completed the intervention. Logistic regression tested the effect of fatigue, insomnia, and depression on odds of completion. Linear regression evaluated predictors of fatigue, insomnia, and depression. **RESULTS:** Among patients who completed the intervention (n = 58), fatigue decreased (p < 0.001); insomnia (p = 0.673) and depression (p = 0.675) were unchanged. Fatigue (p = 0.432), insomnia (p = 0.759), and depression (p = 0.932) did not predict program completion. Patients who were more fatigued at baseline experienced greater reductions in fatigue at follow-up, assessed by score (r = -0.677, p < 0.001) and category (r = -0.685, p < 0.001). Patients with worse insomnia at baseline reported greater improvements at follow-up (r = 0.761; p = 0.079); elevated depression did not facilitate greater improvement (p = 0.228). **CONCLUSIONS:** Fatigue, insomnia, and depression are often indissoluble from the daily experience of a cancer survivor. A biweekly exercise intervention improved fatigue and insomnia after 10 weeks, with greater improvements among the more severely affected; however, we did not find significant alleviation of depression symptoms. These findings suggest exercise is a safe, effective strategy to relieve some symptoms associated with cancer. Further research is required to address potential bias owing to the high rate of attrition in our study.

**1941** Board #202 May 31 3:30 PM - 5:00 PM Perceived Exertion Responses While Wearing Tight-and Loose-Fitting Powered Air-Purifying Respirators Edward J. Sinkule, FACSM, Jeffrey B. Powell, Tyler D. Quinn. Centers for Disease Control & Prevention/NIOSH, Pittsburgh, PA. "University of Pittsburgh, Pittsburgh, PA. (No relevant relationships reported)

**PURPOSE:** This study compared ratings of perceived exertion (RPE) among participants performing the same energy expenditures while wearing NIOSH-approved powered air-purifying respirators (PAPRs) from different manufacturers: one tight-fitting (PAPR-T) and three different models of loose-fitting PAPRs (small hood (PAPR-S), medium hood (PAPR-M), and large hood (PAPR-L)). **METHODS:** The study consisted of six trials: Initial exercise evaluation to determine treadmill speed and elevation to achieve three absolute energy expenditures, labeled LOW (VO2 1.0 L/min, STPD), MODERATE (VO2 2.0 L/min, STPD), and HIGH (VO2 3.0 L/min or maximum, STPD); a baseline evaluation wearing no respirator; and four PAPR evaluations randomly assigned between two visits. Eleven men and 11 women provided informed consent approved by the NIOSH IRB (#12-NPPTL-01). Baseline and PAPR evaluations consisted of four minutes each during standing rest and the three energy expenditures. All PAPRs used HEPA filters. RPE using the 6-20 Borg scale were obtained during the last 15 seconds of each energy expenditure. **RESULTS:** RPE results for the men and women were not statistically different. Table 1 provides the average RPE for men and women by experimental trial. Table 1. Average RPE for each study trial by energy expenditure (n=22).

Abstracts were prepared by the authors and printed as submitted.
The ability to use an alternative (i.e., walking) to running would provide great benefit to those who are uncomfortable running or can’t run, in order to meet minimum activity recommendations. PURPOSE: We compared two exercise modalities (Run, Walk) matched for VO2, on HR, RPE, and a visual analog scale (VAS). METHODS: Active, college-aged males (n=7; weight = 72.5 ± 3.9 kg; BMI = 17.9 ± 1.2; VO2max = 45.1 ± 1.36 mL/kg/min) participated in a crossover-designed study, and studied on each of 2 occasions: Walk (W) and Run (R). Subjects completed a body composition and VO2max test. (R) = 60-min on a treadmill at 0%grade and speed equal to 65% VO2max (694.4 ± 26.1 kcal). (W) = 60-min at 3.3mph and a steep incline equal to 65% VO2max (677.9 ± 20.9 kcal). Pulmonary gas exchange (VO2, RER, respiratory rate (RR)) was assessed within the first 10 min of exercise, with HR and RPE recorded every 15 min. A VAS was used to assess overall perceived effort (0-100mm). RESULTS: There was no significant difference in the amount of sleep (R, 6.6; W, 6.8hr) between the two groups. A significant difference in the amount of sleep (R, 6.6; W, 6.8hr) between the two groups (p=0.68). 5 out of 7 subjects complained about their legs “burning” or “hurting” during the W trial. CONCLUSION: Walking and Running, even when matched for intensity, can enhance psychological responses during exercise. The current findings may help address common exercise barriers and inform exercise practitioners on music selection to improve exercise adherence.

1945 Board #206 May 31 3:30 PM - 5:00 PM
Concurrent Validity Of The Children’s Omni Scale Of Perceived Exertion In A Field Setting
Timothy J. Michael, FACSM, Erin Berner, Carol Weideman, Nicholas Hanson, Sangwoo Lee, Michael Miller. Western Michigan University, Kalamazoo, MI.
(No relevant relationships reported)

The children’s OMNI RPE Scale was developed because of a need and want to measure perceptions of physical exertion in children and adolescents. The term OMNI is from the word omnibus, referring to its wide encompassing properties. The OMNI RPE Scale contains a pictorial, narrative, and verbal descriptors position along an inclined line. Previous research with children and the OMNI RPE Scale were validated in controlled lab settings using exercise equipment. PURPOSE: The purpose of this study was to determine if the Children’s OMNI RPE Scale is valid in a field setting (at school during recess and Physical Education Class (PE)). METHODS: 93 healthy children (male (n=44) and female (n=49) age 8.5±1.4 years volunteered as subjects. Subjects were recruited from a local public elementary school with parental consent. All subjects demonstrated sufficient ability to read out loud and understand each verbal descriptor on the OMNI RPE Scale. The instruments that were used during this study consisted of a Polar Heart Rate Monitor and a copy of the Children’s OMNI-walk/run Scale. A definition of perceived exertion specifically written for children and a standard set of instructions regarding the use of the OMNI-walk/run Scale to rate perceptions of exertion were explained to the subjects immediately before the testing. Data was collected during 30-minute testing sessions, one week apart, during recess and PE class. Heart rate was recorded every 5-minutes for a thirty-minute period, along with perceived exertion. RESULTS: Repeated measure ANOVA procedure identified
that Heart Rate and RPE each had a significant (p<0.01) change over time during both recess and PE. **Recess:** HR±SE: (157.9±2.8; 170.1±2.2; 173.8±2.2; 173.9±2.4; 179.7±2.1; 185.0±2.2; RPE±SE (4.3±0.2; 5.2±0.2; 5.8±0.2; 6.3±0.2; 8.8±0.2; 7.4±0.2). **PE:** HR±SE: (148.8±2.4; 153.9±1.8; 160.3±1.7; 164.9±1.9; 167.3±1.9; 168.3±1.9). RPE±SE: (3.6±0.2; 4.2±0.2; 4.9±0.2; 5.2±0.2; 5.3±0.2; 5.6±0.2). Pearson correlation analysis indicates a significant relation between Heart Rate and RPE during recess (r=−0.38; p<0.001) and PE (r=−0.35; p<0.001). **CONCLUSION:** Data from the present study suggests that the Children’s OMNI RPE Scale is a valid indicator of children’s physical effort during structured and unstructured physical activity.

**Exercise** has tremendously beneficial effects on human psychological and physical health, yet many people still choose not to exercise. **PURPOSE:** Our study investigated how girls’ responses to exercise intensity and exercise environment as they age through adolescence. METHODS: We recruited female runners of different ages (middle school, high school, college) to perform running sessions on a treadmill and in an outdoor environment. Each participant ran at three different intensities, 6 minutes per intensity, for both the treadmill and outdoor environment. Data were collected on how the runners thought about while running (Thoughts During Running Inventory), how they felt (Feeling Scale), how their bodies physiologically responded to the running (blood lactate, heart rate), and how fast they ran (speed). RESULTS: Participants ran faster and harder, indicated by speed (ANOVA, p<0.0001), blood lactate levels (ANOVA, p=0.008), and heart rate (ANOVA, p=0.044), in the outdoor environments, and younger participants were more likely to feel worse after exercise (ANOVA, p<0.0001). CONCLUSIONS: We extended the work of Reich and Quaethem (in review) to females, demonstrating that despite their very different hormonal milieu as they age through adolescence, female endurance runners respond to environment and exercise intensity in much the same way as male endurance runners of similar ages. Our study suggests that outdoor running may confer greater health benefits than treadmill running because exercisers push themselves harder in outdoor conditions. In addition, we surmise that either girls acquire more positive affective response to exercise as they mature, or only those girls who respond positively to exercise continue to run competitively as they age.
Arousal levels are affected by activity levels such that increased sedentary behavior is associated with lower levels of vigor and higher levels of fatigue. Individuals who meet minimum physical activity guidelines have higher levels of vigor and vitality regardless of prolonged sedentary behaviors; however, the assessment of feeling states during prolonged sitting have not been explored. PURPOSE: To determine if there is a difference in affective states of fit vs unfit individuals and if fitness influences affective states during prolonged periods of sitting. METHODS: A total of 9 females and 5 males (age = 19.9±1.9 yr; body mass index 23.2±2.7 kg·m²) underwent submaximal exercise testing to determine maximum oxygen uptake (VO₂max) and to include a heterogeneous group relative to fitness (range: 30.7 to 55.9 ml·kg⁻¹·min⁻¹). Affective states were assessed hourly using the Activation Deactivation Adjective Check List (ADACL) which subscales of energy, tired, tension, and calmness. Each group completed two separate 4-h sitting bouts whereas one bout was continuous and the other was interrupted by 13 min of standing. RESULTS: In both conditions, a decline in energy levels occurred from baseline (~2:01±1:0) to 2 h (~1:40±0:8) (main effect for time, p < 0.05), whereby the metrics of tiredness, tension, or calmness were neither altered by time nor by allowing subjects to interrupt sitting (p > 0.05). With no standing permitted, significant inverse correlations were observed between energy and VO₂max, the second (r = -0.56, p = 0.009) and third hour of sitting (r = -0.49, p = 0.028). With fitter participants, decline in energy occurred over time regardless of the interruption. CONCLUSION: Fit compared to less fit individuals experience greater declines in energy levels as a result of prolonged sitting. Standing 13 min h⁻¹ is insufficient to attenuate the declines in energy levels associated with bouts of sitting 2 h and beyond.

Coffee (CAF) is commonly ingested as an ergogenic aid among cyclists, in part, due to its effect on pain perception. CAF also may improve exercise performance by altering the perceptions related to ventilatory work and dyspnea. PURPOSE: To estimate the overall population effect size of exercise on depression and anxiety symptoms, fatigue, and pain derived from available RCTs. METHODS: Twelve articles published between September 2017 and were located using Google Scholar, PsycINFO, PubMed, and Web of Science. Trials involved 1,031 participants and included both randomization to exercise and non-exercise control and validated measures of depression, anxiety, fatigue, and/or pain assessed at baseline and post-intervention. Hedge’s d effect sizes (95% CI) were computed and random effects models were used for all analyses. RESULTS: Participants were aged 49.9±9 years and 82%±14% female. Exercise training consisted on average of 50.1±17 minutes per session, and 11.5 weeks in duration. Mean reported adherence was 87%±11%. For depression, 18 of 20 effects (90%) were >0. The mean effect size Δ was 0.20 (0.10-0.31; p < 0.001). No significant heterogeneity was observed (Q$_{1}$=26.72; p > 0.10), and consistency was low across effects (I²=32.63%). For anxiety, seven of seven effects (100%) were >0. The mean effect size Δ was 0.20 (0.10-0.31; p < 0.001) and consistency was low across effects (I²=32.63%). For fatigue, six of 11 effects (54.5%) were >0. The mean effect size Δ was 0.20 (0.10-0.31; p < 0.001). No significant heterogeneity was observed (Q$_{2}$=36.43; p > 0.10), and consistency was low across effects (I²=32.63%). For pain, seven of seven effects (100%) were >0. The mean effect size Δ was 0.20 (0.10-0.31; p < 0.001). No significant heterogeneity was observed (Q$_{1}$=26.72; p > 0.10), and consistency was low across effects (I²=32.63%). CONCLUSION: Exercise resulted in significant small-to-moderate reductions in depressive and anxiety symptoms. However, pain and fatigue were not significantly changed. Further investigation of sources of variability in the effects of exercise on pain and fatigue among adults with RA is warranted.

Neuromuscular electrical stimulation (NMES) is commonly used to improve muscle function in physical rehabilitation settings. However, reasons for limited use as an alternative to voluntary exercise may be due to lack of familiarity and perceived discomfort during treatment. PURPOSE: The purpose of this study was to determine attitude toward NMES exercise and perceived pain and muscle soreness experienced from NMES exercise with increasing stimulation intensity. METHODS: Thirty healthy adults (age: 23.6±0.5 years) who had not experienced electrical stimulation within the last year completed the study. Repetitive, intermittent stimulation of 10 seconds on and 15 seconds off was applied to the quadriceps muscles for 60 minutes with the stimulation frequency set at 60 Hz. Stimulation intensity was increased every 5 min throughout the course of the intervention to achieve a target torque of 15% maximal voluntary contraction as measured by an isokinetic dynamometer. During the NMES application, participants rated the pain they experienced using a standard pain scale (0-10 scale: 0 = no pain; 10 = most pain possible) at minute 0, 15, 30, 45, and 55 of the treatment. Participants were also asked to rate muscle soreness felt 48 hours after exercise (0-10 scale: 0 = no soreness; 10 = greatest soreness possible). A survey on attitude toward NMES exercise (e.g., useful, pleasant, beneficial) was administered pre and post NMES on a 1-7 scale (e.g., 1 = useless; 7 = useful). Repeated measures analysis of variance (ANOVA) was used to test statistical differences between scores over time. Data are reported as mean ± SE. RESULTS: Attitude toward NMES exercise was high and did not change post-exercise (pre: 6.2±0.1, post: 6.1±0.2, p = 0.21). Reported pain during NMES was low and was not different across time points (0 min: 2.1±0.4, 15 min: 2.7±0.4, 30 min: 2.6±0.4, 45 min: 2.9±0.4, 55 min: 2.5±0.4, p = 0.126). Muscle soreness remained elevated 48-hours post-NMES (3.5±0.593, p < 0.001). CONCLUSION: Pain reported during NMES was low and did not increase as stimulation intensity increased. Attitudes toward NMES sessions were relatively high and were unchanged after exercise, indicating that any pain and soreness experienced did not change participants’ attitude regarding the benefits of NMES exercise.
The cortisol awakening response (CAR) describes the initial rise in cortisol following waking, and has been suggested to be a potential biomarker for monitoring exercise training stress. However, it is currently unknown if CAR is sensitive enough to track changes in daily physical activity (PA). PURPOSE: Therefore, the purpose of this study was to assess the impact of daily PA on CAR and associated derived measures.

METHODS: Male (n = 24) and female (n = 71) college-aged students (19.0±1.8y, 72.1±19.5kg) wore wrist-worn accelerometers (ActiGraph) for four consecutive days (24-hour protocol). Actigraph data were analyzed using six custom activity bands as totals (Bands) and percentage of total time (Bands/s), since moderate-vigorous PA was minimal in this sample. Salivary samples were collected each morning, immediately after waking (C0) and 30 mins later (C1) and were analyzed for cortisol (ng/ml) using DELFINIA. CAR and CAR were calculated as the difference between C1 and C0, and the percentage increase from C0, respectively. Only subjects with two complete days of data were included in the current analysis. Differences between PA and CAR variables between days were assessed via paired-sample t-tests. Multivariate multiple linear regression with univariate follow-up tests fit CAR variables by PA. Models were computed for each day individually, as well as ratio (Q) values between days (Day2/Day1).

RESULTS: No differences were observed between days for CAR or derived measures, or activity bands (all p>0.05). Day 1 showed a significant model for CAR by Bands, (R² = .13, p = 0.04), while the Day 2 CAR by Band model was significant (R² = 0.15, p = 0.02). Ratio models further elucidated these relations, with a significant model for Q•CAR by Q•Band, (R² = 0.15, p = 0.02).

CONCLUSION: These results suggest that CAR and its derived measures are relatively stable across days. Also, CAR does appear to be sensitive to the degree of PA or sedentary behaviors during the preceding day in college-aged persons, such that change in CAR is partially accounted for by changes in PA. Therefore, PA should be considered in future CAR research and interventions that specifically manipulate PA (i.e., exercise interventions) are needed to confirm the usefulness of CAR for tracking changes in exercise training stress.

**Purposes:**

1. To examine hormonal, steroidal and inflammatory responses in college male soccer players (M) and female cross-country runners (F) over the course of a competitive season.

2. METHODS: All subjects provided written informed consent. Prior to the season, all subjects provided blood samples in the pre-game period to obtain baseline hormone levels. In the pre-game of the luteal phase, all subjects provided blood samples to determine baseline hormone levels (M: n = 24; F: n = 71). Blood samples were collected each morning, immediately after waking (C0) and 30 mins later (C1) and were analyzed for cortisol (ng/ml) using DELFINIA. CAR and CAR were calculated as the difference between C1 and C0, and the percentage increase from C0, respectively. Only subjects with two complete days of data were included in the current analysis. Differences between PA and CAR variables between days were assessed via paired-sample t-tests. Multivariate multiple linear regression with univariate follow-up tests fit CAR variables by PA. Models were computed for each day individually, as well as ratio (Q) values between days (Day2/Day1).

3. RESULTS: No differences were observed between days for CAR or derived measures, or activity bands (all p>0.05). Day 1 showed a significant model for CAR by Bands, (R² = .13, p = 0.04), while the Day 2 CAR by Band model was significant (R² = 0.15, p = 0.02). Ratio models further elucidated these relations, with a significant model for Q•CAR by Q•Band, (R² = 0.15, p = 0.02).

4. CONCLUSION: These results suggest that CAR and its derived measures are relatively stable across days. Also, CAR does appear to be sensitive to the degree of PA or sedentary behaviors during the preceding day in college-aged persons, such that change in CAR is partially accounted for by changes in PA. Therefore, PA should be considered in future CAR research and interventions that specifically manipulate PA (i.e., exercise interventions) are needed to confirm the usefulness of CAR for tracking changes in exercise training stress.
Optimal T cell activation requires a two-signal process. The first signal is engagement of the TCR-CD3 complex and the second, or costimulatory, signal is the classical binding of a T cell CD28 receptor with an APC-bound CD80 or CD86. A marker of senescent T cells is a lack of CD28 expression and it has been posited that CD28 expression may decrease following strenuous exercise. **PURPOSE:** To quantify exercise induced changes in CD28 expression on CD4+ cells obtained from human subjects. **METHODS:** Utilizing a cross over design, untrained subjects completed a control and exercise visit. The control visit consisted of 30 min of seated rest while the exercise session entailed 3 sets x 10 reps squat at 70% 1-RM, 3x10 leg press at 70% 1-RM, and 3x10 leg extensions at 70% 1-RM with 2 min rest between sets. Venous blood samples were obtained pre and post each visit. CD4+ T cell isolation from peripheral blood was carried out through negative selection using a Human CD4+ T cell enrichment kit. CD4+ T cells were plated at 1.5 x 10^5 cells/ml in 200 μl of ImmunoCult T-cell expansion media directly after isolation and costimulated through CD3/CD28 or no stimulation. Cells were incubated for 1 and 3 d at 37°C in a humidified incubator with 5% CO_2 and then analyzed by flow cytometry. Data were analyzed using two-way RMANOVA. **RESULTS:** There were no significant differences in CD28 expression between the exercise and control conditions in either the stimulated (p = .27) or non-stimulated (p = .62) samples. These data suggest that suppression of CD4+ cell activation following strenuous exercise is likely not a result of dysfunction in CD28, a major costimulatory receptor. **CONCLUSIONS:** Changes in T cell activation following strenuous exercise are likely derived from a plurality of sources, but without direct assessment of discrete elements of the activation cascade we will be unable to understand how exercise changes immune function. Future work should focus on elements upstream of T cell clonal expansion in order to identify mechanisms for exercise induced changes in immune homeostasis.

Supported by an award through the Dr. George F. Haddix President’s Faculty Research Fund at Creighton University.

There is robust evidence that strenuous exercise is pro-inflammatory and inclined to impair the function of innate immunity. Neutrophil extracellular traps (NETs) is a novel cell death pathway through which neutrophils release chromatin and granule enzymes to capture and kill invaders. However, the components of NETs can also be harmful to host cells. Overproducing cell-free DNA (cf-DNA) and reactive oxygen species (ROS) through strenuous exercise are commonly proved. Much less is known about the origin of cf-DNA and whether ROS participate in strenuous exercise induced NETs formation. **Purpose:** Based on the doubt, we hypothesize that 1) strenuous exercise increase NETs formation and the high level of NETs is related to the imbalance of immunity function; 2) mitochondrial antioxidants suppress strenuous exercise induced NETs formation and reduce the adverse consequences to host. **Methods:** 24 C57/bl mice were divided into three groups: Control group (C, n=8), strenuous exercise group (E, n=8) and mitoTempoΔ± strenuous exercise group (ME, n=8). E group and ME group were adapted to the treadmill for three days with a low speed. 30 minutes before formal experiment, ME group were injected with mitochondrial antioxidant mitoTempo (0.7mg/kg), then E group and ME group perform 90 minutes 85% VO2max speed running exercise. Immediately after exercise, 3 groups of mice were anesthetized and the circulating blood was collected into anticoagulant tube. Plasma cf-DNA, MPO-DNA complexes, IL-6, IL-10 and TNF-α were tested according to the manufacture introduction of Elisa Kit; innate immunity cell function, such as phagocytosis and oxygen burst were test by flow cytometry. **Results:** Plasma cf-DNA and MPO-DNA complexes were two-fold increase in E group compared to C group (P<0.05), while there is no difference between C group and ME group. IL-6 and TNF-α in E group were higher than C group and ME group. IL-10 level show the adverse result. Monocytes and neutrophils in E group show a stronger phagocytic and ROS production function than C group and ME group. **Conclusion:** An acute single bout of strenuous exercise increases NETs formation and cause hyper-function of innate immunity function. Mitochondrial antioxidants suppress strenuous exercise induced NETs formation and balance innate immunity cells function.

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

**1958 Board #219**

**May 31 3:30 PM - 5:00 PM**

**Cd28 Expression On Cd4+ T Cells Is Not Affected By Strenuous Exercise In Untrained Individuals**

Samantha A. Bianchi, Alexander K. Holbrook, Allyson Ihlenfeldt, Brad W. Macdonald, Hunter D. Peterson, Eric C. Bredahl, Michael A. Belshan, Jacob A. Siddlik. Creighton University, Omaha, NE. (Sponsor: Joseph P. Weir, FACSM) (No relevant relationships reported)

**1960 Board #221**

**May 31 3:30 PM - 5:00 PM**

**Effects Of Exercise On The Expansion Of Myeloid-derived Suppressor Cells**

Jacob Garrisson, James M. Haughian, Nicholas A. Pullen, Reid Hayward. University of Northern Colorado, Greeley, CO. (No relevant relationships reported)

Myeloid-derived suppressor cells (MDSCs) are a heterogeneous population of immune cells that expand in response to cancer and various other pathologic conditions. MDSCs are characterized by their suppression of T-cells and their involvement in metastasis. Aerobic exercise protects against tumor growth and metastasis, yet the mechanisms behind this protection are still largely unknown. **PURPOSE:** To examine the effects of exercise on the expansion of MDSCs and suppression of immune function in a murine breast cancer model. **METHODS:** Female, 8 weeks of age, were randomly assigned to one of the following groups: exercise tumor (EX+TUM), sedentary tumor (SED+TUM), exercise control (EX) or sedentary control (SED). Animals in both TUM groups were inoculated with 1x10^4 4T1 murine mammary carcinoma cells in the mammary fat pad. Both EX groups were given access to running wheels for 3 weeks, beginning on the day of inoculation, and SED groups were restricted to normal cage activity. Following completion of the 4-week training period, blood and spleen samples were collected for analysis via flow cytometry. MDSC expansion was measured as the percentage of CD11b Ly6C/D and CD11b Ly6G cells in the population. Spleen cytotoxic T-cells were measured as the number of CD8+ cells and expressed as a percentage of the total population. **RESULTS:** MDSCs in the blood of SED+TUM (15.3% ± 7.1%) were significantly higher (p < 0.05) than SED (8.0% ± 2.2%) indicating tumor-dependent expansion of MDSCs. **CONCLUSION:** Exercise (10.1% ± 0.7%) was not significantly different from EX (0.5% ± 1.1%) or SED (0.8% ± 0.2%) suggesting MDSC expansion did not occur to the same extent in the blood of exercised animals. The percentage of CD8+ T-cells in SED+TUM (5.6% ± 1.7%) was significantly lower (p < 0.05) than EX (13.1% ± 1.1%) and SED (13.4% ± 0.9%) indicating a tumor-induced suppression of immune function. In contrast, EX+TUM (7.7% ± 1.0%) was not significantly different from EX (13.1% ± 1.1%) or SED (13.4% ± 0.9%). **CONCLUSION:** These data suggest that exercise may have a protective effect against the immunosuppression that results from expansion of MDSCs in tumor bearing animals. MDSCs have been shown to create a premetastatic niche at the site of metastasis and exercise may protect against distant metastases by attenuating increased numbers of MDSCs in the blood.

**1961 Board #222**

**May 31 3:30 PM - 5:00 PM**

**Acute Effects Of Exhaustive Exercise And Cardio-respiratory Fitness on Regulatory T Cell Homeostasis.**

Christina Koliarmitra, Philipp Zimmer, Alexander Schenk, Wilhelm Bloch. Cardiovascular Research and Sports Medicine, Cologne, Germany. (Sponsor: Prof. Dr. Steinacker Jürgen Michael, FACSM) (No relevant relationships reported)

Regulatory T (Treg) cells are central anti-inflammatory regulators of the immune response and crucial for the maintenance of immune homeostasis. They exert anti-inflammatory effects and are central regulators of the immune responses to self- and foreign antigens. Increased Treg cell populations can result in a state of immunosuppression, as has been shown in tumor-induced immunosuppression, whereas dysfunction of Treg cells can result in autoimmune diseases. Acute physical exercise is known to have immune modulatory properties and has been previously described in professional athletes. **Purpose:** The aim of this investigation was to examine the immune modulatory properties of acute exhaustive exercise on Treg cell homeostasis and to examine whether there is a direct link between cardiovascular fitness status (VO_2peak) and Treg cell population. **METHODS:** A total of 20 middle-aged healthy female subjects (age of 55, 2 ± 5, 7) were asked to perform a spiroergometry on a cycle ergometer. The spirometry protocol (1 minute rest measurement, 3 minutes warm-up with 50 Watts, increase of 25 Watts every 2 minutes) was performed until exhaustion of the subject. The evaluation of VO_2peak served as a parameter of the healthy subjects’ cardiovascular fitness. Before (TO) and after (T1) spiroergometry test, venous blood was collected. The Treg cell evaluation was assessed using antibodies against CD3, CD4, CD25 and CD127 through multicolor flow cytometry. **RESULTS:** The Treg cell population significantly decreased after single exercise load (TO vs T1, p<0.001). There was a positive correlation found between VO_2peak and Treg cell frequency (p<0.005).
Conclusion/Significance: The $T_{\text{max}}$ proportion decrease indicates an acute effect of intense physical exercise on $T_{\text{max}}$ cell homeostasis. This could represent a rapid distribution to other tissue compensatory attempt to restore immune homeostasis and limit excessive damage. The correlation between peak oxygen uptake and $T_{\text{max}}$ proportions could be seen as a chronic response of the anti-inflammatory capacity of healthy subjects to repeated bouts of exercise (short-term inflammatory stimuli).

D-72 Free Communication/Poster - Concussion II
Thursday, May 31, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

1962 Board #223 May 31 3:30 PM - 5:00 PM
Fatigue Influence On King-Dvick Test
Adrian Aron, Rachel Andrews, Erica Boggs, Andrea Stanley, Olivia Willson, Brent Harper, Radford University, Radford, VA.
(Sponsor: Trent Hargens, FACSIM)
(No relevant relationships reported)

One of current sideline, post-injury assessment tools used for screening concussion include the King-Dvick Test (K-D) which measures cognitive processing speed, rapid eye movement, and visual tracking. As a post-exercise test it is unclear if the K-D is truly sensitive enough or can be used to screen for concussion in the presence of fatigue. PURPOSE: To examine the impact of whole-body fatigue on King-Dvick test performance.

METHODS: The test was administered to 24 subjects (age = 23.2 ± 1.7 years, BMI = 24.9 ± 2.2 kg/m²) at baseline, after a fatigue protocol and on ensuing time at least 3 weeks later. The fatigue protocol was performed on a Concept 2 rower at an initial metronome pace of 26. With increasing intensity of one breath, two minutes until the subject reached fatigue. Fatigue was determined when three of four criteria were met: 90% or higher of predicted MaxHR, inability to maintain metronome pace for three consecutive pulls to the abdomen, 17/20 or higher on the RPE scale, and inability to maintain proper form. RESULTS: Pre-fatigue, 41.7% of the subjects were positive on the K-D test. Among subjects that reported a history of dizziness, 57.1% were positive on the post-fatigue K-D test compared to 35.3% who did not report dizziness (P = 0.2). The time spent on the rower was not different (P = 0.2) between subjects that were positive on the K-D test (14.8 ± 12.0 minutes) and the ones that were negative (44.8 ± 32.2 minutes). A positive K-D test is determination when the time to complete the test increases on a posttest or an error is recorded. Follow-up testing (3 weeks) showed that 20.8% of subjects had K-D scores indicative of further evaluation (P = 0.09). Of these, 60% K-D scores were positive by less than 1 second (0.64 sec.).

If a positive K-D was defined as a score ≥1 second, only 8.3% of subjects will be categorized as positive for K-D (P = 0.01 compared to baseline). CONCLUSIONS: The present data demonstrate that whole-body fatigue may worsen the K-D scores, questioning its construct validity and limiting its use as a sideline screening for concussion. Scoring definitions can also be improved to better depict the positive test results. The K-D test can show an improved validity when used in conjunction with pre-concussion symptom history.

1963 Board #224 May 31 3:30 PM - 5:00 PM
Differences in Reporting: The Concussed Student Versus the Concerned Parent
Gianna D. Maragliano1, Heoma C. Agwuenu1, Margaret E. Bristow1, Vincent C. Nitto1, Adam W. Shunk1, Courtney D. Jensen1. 1University of the Pacifi, Stockton, CA. 2Saint Vincent Hospital, Indianapolis, IN.
(No relevant relationships reported)

In the last decade, incidence of sport-related concussion has doubled. Optimal care requires an accurate diagnosis of symptoms and severity. Many student-athletes attempt to disguise symptoms and downplay severity to hasten their return to play. A concerned parent is less likely to participate in the downplaying an accurate portrayal of symptoms may require both perspectives. Data comparing the reporting by parents and students are needed and limited. PURPOSE: To evaluate differences in the reporting of concussion symptoms between those who suffer them and the parents who observe them. METHODS: Over a 7-year period, 80 student athletes admitted to the subject reached fatigue. Fatigue was determined when three of four criteria were met: 90% or higher of predicted MaxHR, inability to maintain metronome pace for three consecutive pulls to the abdomen, 17/20 or higher on the RPE scale, and inability to maintain proper form. RESULTS: Pre-fatigue, 41.7% of the subjects were positive on the K-D test. Among subjects that reported a history of dizziness, 57.1% were positive on the post-fatigue K-D test compared to 35.3% who did not report dizziness (P = 0.2). The time spent on the rower was not different (P = 0.2) between subjects that were positive on the K-D test (14.8 ± 12.0 minutes) and the ones that were negative (44.8 ± 32.2 minutes). A positive K-D test is determination when the time to complete the test increases on a posttest or an error is recorded. Follow-up testing (3 weeks) showed that 20.8% of subjects had K-D scores indicative of further evaluation (P = 0.09). Of these, 60% K-D scores were positive by less than 1 second (0.64 sec.).

If a positive K-D was defined as a score ≥1 second, only 8.3% of subjects will be categorized as positive for K-D (P = 0.01 compared to baseline). CONCLUSIONS: The present data demonstrate that whole-body fatigue may worsen the K-D scores, questioning its construct validity and limiting its use as a sideline screening for concussion. Scoring definitions can also be improved to better depict the positive test results. The K-D test can show an improved validity when used in conjunction with pre-concussion symptom history.

RESULTS: Student/parent differences were found in atypicality (p=0.002), depression (p=0.012), anger control (p=0.006), and internalizing problems (p=0.017); students reported lower scores in each category. Averaging all 7 categories, parents reported 6.7% higher scores (p=0.031). Sex did not explain this difference (p=0.184), but grade in school was a trending predictor: each additional grade associated with a 1.2-point reduction in parental overestimation (p=0.064). CONCLUSIONS: Following a concussion, adolescents are likely to perceive the severity of emotional, social, and behavioral symptoms more severely than their parents. The discrepancy was widest among elementary school students, it narrowed in middle and high school, and college students reported symptoms more severely than their parents.

PURPOSE: Concussions are a growing concern in adolescent sports medicine. However, there is no prospective data demonstrating an association between sustaining a sports-related concussion (SRC) and depression in adolescents. This study prospectively assessed changes in depressive symptoms in high school athletes following an SRC. METHODS: This longitudinal cohort study consisted of 1701 adolescent athletes (grades 9-12) who were monitored for SRC. 99 athletes sustained a concussion during the study period (38 females, 61 males). Participants completed the Patient Health Questionnaire-9 (PHQ-9) survey to measure depressive symptoms at baseline (enrollment, pre-SRC), 24-72 hours post-SRC, and 7 days, 3 months, and 6 months post-SRC. Clinically relevant depressive symptoms were defined as a PHQ-9 score ≥14, or some depressive symptoms most days and most of each day. To evaluate changes in PHQ-9 scores from baseline, linear mixed-effect models adjusting for sex and time were used; least-squares means and standard errors are reported. GEE models assuming a binomial distribution and logit link were used to model the association between depressive symptoms and time since concussion, stratified by sex. RESULTS: When compared to baseline, females reported PHQ-9 scores that were on average, 1.5(0.56) points higher at 24-72 hours post-SRC and 1.6(0.57) points higher at 7 days post-concussion than at baseline (p=0.007; p=0.004). PHQ-9 scores were lower (i.e. better) than baseline for both males and females at 3 months post-SRC (M: -1.19(0.48); p=0.01, F: -1.14(0.66); p=0.09). Females were 7.6 times more likely to have a PHQ-9 ≥14 at 24-72 hours post-concussion (95% CI: 1.47, 39.08) than they were at baseline (p=0.02) and 10.36 times more likely at 7 days post-concussion (95% CI: 1.90, 56.59) than at baseline (p=0.007). By 3 months, no difference from baseline is noted. There is no evidence to suggest that males experience increased depressive symptoms post-SRC. CONCLUSIONS: In the week following an SRC, athletes experience a transient increase in depressive symptoms, with females being more likely to experience clinically relevant depressive symptoms compared to male athletes at the same time points. We found no evidence that SRCs have a long-lasting impact on depression symptoms in adolescent athletes.
memory for females and males (p = 0.97, p = 0.11; respectively) and visual memory (p = 0.30, p = 0.34; respectively). CONCLUSION: These results suggest that females that play soccer may experience a subconcussive impact can reflect changes in their education and social activities at short term in their word recognition, oral reading and reading comprehension (sequential memory) and males in their auditory processing and language skills (rapid processing). Parents, coaches, trainers, exercise physiologist, and speech-language pathologists (SLP) should receive education to take precautions after a game with children that received at least one sub concussive impact and do not perceive any notable changes.

1966 Board #227 May 31 3:30 PM - 5:00 PM
No Relationship Between Head Impact Kinematics and Concussion Clinical Assessment Performance
Thomas A. Buckley, Katherine M. Breedlove, Melissa S. DiFabio, Jessica R. Oldham.
University of Delaware, Newark, DE. 
University of Wisconsin - Eau Claire, Eau Claire, WI.
Reported Relationships: T.A. Buckley: Salary; Applied Cognitive Engineering.

Repetitive head impacts (RHI), independent of concussions, are speculated to be associated with later life neurological impairments. While football has received the majority of the attention, RHIs are commonplace in ice hockey. A multifaceted concussion clinical assessment battery assesses diverse neurological systems in clinically feasible manner.

PURPOSE: To examine relationship between head impact kinematics and performance on a multifaceted concussion assessment battery.

METHODS: Eleven male collegiate ice hockey players (age: 20.3 ± 0.8 years, Ht: 1.79 ± 0.06m, Wt: 80.9 ± 6.6 kg) wore a triaxial accelerometer (Triax Technologies, Norwalk, CT) for all home games and practices. Participants completed the clinical assessment battery twice: pre-season (PRE) and post-season (POST). The battery included the Standard Assessment of Concussion (SAC), Balance Error Scoring System (BESS), Trails A and B, Tandem Gait (TG), and Dual Task Tandem Gait (DT-TG). Independent variables were the head impact outcome measures: number of impacts, mean peak linear acceleration (PLA), and mean peak rotational acceleration (PRA). Linear regression analyzed the effects of head impact kinematics on change scores (calculated as positive is improved performance) of clinical measures.

RESULTS: Participants experienced 107.6 ± 57.8 impacts over the course of the season with mean PLA of 38.9 ± 2.5 g’s and mean PRA of 3.9 ± 0.5 krad/sec. There was no relationship between head impact kinematics and SAC (change: 0.7 ± 2.0, p=0.067), BESS (change: 4.9 ± 10.5 errors, p=0.607), Trails A (change: 9.2 ± 7.3 sec, p=0.981), Trails B (change: 13.7 ± 12.7 sec, p=0.370), TG (change: 2.0 ± 2.4 sec, p=0.986), and DT-TG (change: 3.1 ± 2.7 sec, p=0.990).

CONCLUSIONS: The results of this study suggest that ice hockey related RHI do not adversely affect neurological health if a multifaceted concussion assessment battery, Performance on all tests improved over the course of the season suggesting a learning effect secondary to repeat administration influenced the outcomes. While changes have been identified in neuroimaging studies, these results are consistent with previous studies in other collision sports which failed to identify differences on clinical measures of neurological health.

1967 Board #228 May 31 3:30 PM - 5:00 PM
Test Setting and ADHD Influence Baseline Concussion Testing Neurocognitive Performance in Collegiate Student-Athletes
Caroline A. Kelly, Caroline J. Ketcham, Kirtida Patel, Eric E. Hall, FACSM, Elon University; Elon, NC. (Sponsor: Eric Hall, FACSM)

(No relevant relationships reported)

Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) is a widely used neurocognitive test for assessing and managing concussion injuries. There is inconclusive data on how test administration and environment influence baseline results for student-athletes. It has been well established that with Attention Deficit Hyperactivity Disorder (ADHD) perform worse on the ImPACT, but little research has examined the effect of group test administration on neurocognitive performance and symptom reporting in student-athletes with ADHD. PURPOSE: To compare baseline neurocognitive performance and symptom scores in group versus individual administration settings in NCAA division 1 collegiate student-athletes.

METHODS: 260 student-athletes completed two ImPACT baseline tests, test 1 was completed when they entered as first-year students or transfers and test 2 was completed this past summer. Of these participants, 205 athletes took test 1 individually and 55 participants took it in a group setting. All student-athletes took test 2 in a group setting. 21 of the 260 student-athletes had a diagnosis of ADHD. A 2 (time) x 2 (environment) x 2 (ADHD Multivariate ANOVA) was conducted. Time (test 1 and test 2) was within subjects and Environment at test 1 (individual and group) and ADHD (yes or no) were between subject variables.

RESULTS: There was a significant increase in total number of symptoms reported when participants went from individual testing to group testing (p=0.05). Time x Environment Interaction for visual memory (p=0.05) with scores increasing from test 1 to 2 if in the group setting for both, but staying the same if in the individual setting for test 1. A similar effect was found for visual motor processing speed (p=0.05). Participants with ADHD performed worse on all measures no matter the setting (p=0.05). Symptom scores significantly differed for ADHD participants depending on the setting (p=0.05). CONCLUSIONS: A group setting has inherent distractions and seems to influence performance on visual memory, visual motor processing speed and symptom scores. Student-athletes with ADHD may be more affected by these distractions. This should be considered in baseline concussion testing and interpreting post-injury neurocognitive performance.
vascular conductance (CVC) was calculated. Mean values were obtained over 60 s intervals. Data are expressed as the mean ± SD as a change from baseline. RESULTS: Baseline HR (CA: 54 ± 6; HC: 63 ± 10 bpm; P = 0.27), MAP (CA: 87 ± 5; HC: 90 ± 11 mmHg; P = 0.75), PETCO2 (CA: 44 ± 3; HC: 47 ± 11 mmHg; P = 0.20), and CVC (CA: 0.48 ± 0.13; HC: 0.69 ± 0.09 cm/sec/mmHg; P = 0.09) did not differ between groups. Baseline MCAv was lower in CA (41 ± 11 vs. 61 ± 2 sec/mm; P = 0.04). HR did not change across time (P = 0.35) and was not different between groups (P = 0.51). MAP in CA did not differ from baseline (peak increase: 6 ± 2 mmHg; P = 0.16), whereas MAP increased in HC at the 4th (P = 0.99 mmHg; P = 0.02) and 5th min (10 ± 9 mmHg; P = 0.01) of LBPP. PETCO2 did not change across time (P = 0.57) and was not different between groups (P = 0.29). MCAv was greater in CA throughout the entire LBPP protocol (peak difference at 5th min: 11 ± 3 vs. -13 ± 7 sec/mmHg; P = 0.01). CVC was greater in CA throughout the entire LBPP protocol (peak difference at 5th min: 0.09 ± 0.09 vs. -0.19 ± 0.04 cm/sec/mmHg; P = 0.01). CVC decreased in HC at the 3rd (0.17 ± 0.03 cm/sec/mmHg; P = 0.05) and 5th min (0.19 ± 0.04 cm/sec/mmHg; P = 0.02) of LBPP. CONCLUSIONS: Despite blunted MAP responses to LBPP, CA exhibit exaggerated increases in MCAv and CVC during LBPP. These preliminary data indicate that CA who are symptomatic demonstrate abnormal cerebral blood flow regulation during central hyperventilation.

Concussion legislation has established education as the cornerstone of prevention. Georgia legislation requires guardian completion and acknowledgement of concussion education via a standardized concussion information sheet. However, the effectiveness of this standardized form has not been examined. Purpose: Examine the knowledge and understanding in guardians of Georgia High School Association (GHSA) student-athletes that completed the GHSA concussion awareness form versus additional concussion education. Methods: 102 GHSA guardians completed a 34 item paper-based survey that included demographic questions, concussion knowledge questions, and scenario questions to assess concussion understanding. Participants were divided into groups based upon concussion education (GHSA form only: n=54; Additional education: n=48). Independent sample t-tests were calculated to evaluate differences in concussion knowledge, understanding, and overall score. A Pearson correlation examined the correlation between knowledge and understanding score. All statistical analyses were conducted using SPSS 23.0. Significance levels were set a priori at p ≤ 0.05. Results: No statistically significant differences were found between groups on knowledge (t(100) = 1.74, p = 0.085), understanding (t(100) = 3.83, p = 0.05), and total scores (t(100) = 1.88, p = 0.36). The Pearson correlation revealed a non-significant weak correlation between concussion knowledge and understanding (r = 0.05; p = 0.76). Conclusions: Guardians of high school student-athletes displayed moderate knowledge and understanding of concussion regardless of additional educational experiences. Despite a clinicians’ desire for more comprehensive educational tools, the results of this study indicate that the state issued standardized form provides guardians with sufficient knowledge. This knowledge and understanding will help guardians in the recognition and management of a student-athlete with a concussion. Further, a multifaceted approach to concussion education could be utilized in order to most effectively reach every guardian regardless of education level.

While clinical assessments may aide to identify a concussion, there is no conclusive evidence of persistent concussion effects. PURPOSE: This study assessed various indices of neuromechanical responsiveness for possible identification of persisting concussion effects. METHODS: A cohort of 48 Olympic athletes (34 males: 23.8 ± 4.4 years; 14 females: 25.4 ± 4.5 years) performed 3 different 60 s visuomotor reaction time (VMRT) tests involving rapid manual contact with 64 randomly illuminated target buttons arranged in a pattern of 5 concentric rings on a height-adjustable board, and a whole-body reactive agility (WBRA) test requiring side-shuffle movements in response to 20 randomly presented left or right visual targets. An initial VMRT test trial was limited to manual button contacts, immediately followed by trials that involved 2 different dual-task conditions. A centrally located non-congruent arrow displayed (VMRT+ST) for the athlete's immediately recited while also performing the basic VMRT test. The other dual-task condition displayed the Eriksen flanker test (VMRT+FT), which required the athletes to orally state the right or left direction indicated by the center arrow of a 20 S-arrow displays (10 congruent and 10 incongruent arrow sets). Measurements of WBRA reaction time, speed, acceleration, and deceleration were derived from a motion analysis system. RESULTS: Concussion occurrence was reported by 21 athletes at 2.0 ± 2.3 years prior to testing (range: 2 weeks to 7.5 years). Strong unfavorable associations were found for VMRT+FT left minus right VMRT difference ≥15 ms (OR=7.14; 90% CI: 2.44, 20.90), VMRT+ST outmost 2-ring to innermost 3-ring average VMRT ratio ≥2.18 (OR=4.58; 90% CI: 1.51, 13.92), and WBRA speed asymmetry ≤7.7% (OR=4.67; 90% CI: 1.63, 13.36). A large VMRT+FT X VMRT+ST interaction effect was identified (OR=4.58; 90% CI: 1.63, 13.36). Wearing HG designed to prevent SRCs does not influence the likelihood of obtaining a non-concussive injury, or the severity of that injury as defined by number of days lost, both of which would be expected if players with HG were competing more aggressively.
VMRT+FT X VMRT+ST X WBRA interaction that had 100% positive predictive value (0.00001). The baseline of injury severity and the expectations of recovery. PURPOSE: To examine preliminary normative baseline data for the SCAT5 in adolescent soccer players. METHODS: In this cross-sectional study, adolescent soccer players were administered the SCAT5 prior to practice. The SCAT5 is a sport concussion sideline evaluation that contains observable signs, Maddocks questions, Glasgow Coma Scale, cervical spine assessment, background information, symptom evaluation, cognitive evaluation (Standardized Assessment of Concussion [SAC]), neurological screening and the modified balance error scoring system (mBESS). Means and standard deviations were calculated for total number of (out of 22), symptom severity (out of 132), orientation (out of 5), immediate memory (out of 30), concentration (out of 5), delayed recall (out of 10), total SAC score (out of 50) and mBESS (out of 30). RESULTS: The final sample consisted of 91 adolescent soccer players (23 males, 68 females; 13.78 ± 1.2 years old). The average total number of symptoms reported was 1.79 ± 2.9 and the average symptom severity score was 2.93 ± 6.4. The average scores of the individual components of the SAC included: an orientation score of 4.96 ± 0.2, immediate memory score of 19.97 ± 3.4, concentration score of 3.00 ± 1.2 and delayed recall score of 6.88 ± 1.7, equaling an average total SAC score of 34.80 ± 5.2. Finally, the average mBESS score was 3.21 ± 3.6 errors. CONCLUSIONS: Establishing normative baseline data for the SCAT5 may help sports medicine professionals better screen and evaluate athletes for SRC on the sideline. Future researchers should continue to collect baseline data to establish normative SCAT5 values. In addition, researchers should focus on age and sex baseline and post-injury data in high school and collegiate athletes for the SCAT5.

It is important to appreciate the enormous diversity in the presentation and prognosis of sport-related concussions (SRC) in athletes. Duration of recovery is highly variable and partly attributable to injury severity, but a comprehensive evaluation of deficits is limited. The purpose of this research is to establish normative baseline data for the SCAT5 in adolescent athletes and partly attributable to injury severity, but a comprehensive evaluation of deficits is limited. The purpose of this research is to establish normative baseline data for the SCAT5 in adolescent athletes. RESULTS: Both ST (p<0.001; F= 5.402) and DT (p<0.001; F= 8.995) TG were significantly different across the four time points following concussion. There were more pronounced changes in time to complete DT TG (BL: 12.9 ± 3.0 seconds; Acute: 15.4 ± 4.7 seconds; Asympt: 12.5 ± 2.8 seconds; RTP: 11.3 ± 2.0 seconds) compared to ST TG (BL: 10.3 ± 1.4 seconds; Acute: 10.9 ± 2.1 seconds; Asympt: 9.8 ± 1.9 seconds; RTP: 9.2 ± 1.4 seconds) across the four time points. CONCLUSION: There were significant changes in time to complete ST and DT TG from BL to RTP following concussion, with more dramatic changes seen during the DT condition. These results suggest that TG, particularly during DT, is a useful measure of post-concussion recovery.

Previous reports in the literature have identified that visual deficits are common yet often undetected after pediatric concussion. Few studies have evaluated tools available to detect visual dysfunction after concussion. PURPOSE: To investigate the association between patient-reported and physician-detected visual deficits after concussion. METHODS: We conducted a prospective cohort study of 69 subjects, ages 5-20 years old and 64% female, who reported both pre- and post-injury vision-specific symptoms on the Convergence Insufficiency Symptom Survey (CISS), a validated 15-question instrument used to assess for changes in visual symptoms in patients with convergence insufficiency, and underwent a comprehensive binocular examination in a pediatric sports medicine clinic to a median of 34 days after injury (IQR 22-48). The relationship between patient-reported symptoms on the CISS and clinical findings were examined using chi-square analysis for categorical data and Mann-Whitney analysis for nonparametric data. RESULTS: Forty-six (67%) subjects reported an abnormal CISS score of 16 or greater. However, only 31 (44%) reported the presence of visual problems when asked as one of 21 concussion-related symptoms on the Post-Concussion Symptom Inventory (PCSI). Even fewer reported symptoms on the near point of convergence (NPC) (31%) and accommodation (15.3%) testing completed as part of the viso-vestibular exam. However, those with an abnormal CISS score were significantly more likely to have abnormal clinical measures of NPC (p<0.002) and accommodation (p<0.003). Females were significantly more likely to have abnormal CISS scores than males after injury.
A common side effect from a concussion is slowed reaction time. When returning to play, reaction time should be at preinjury levels to ensure a safe return to activity and to prevent further injury. The Dynavision D2 system may be utilized as an assessment and rehabilitation tool to aid in the determination of reaction time following concussion. Previous research has demonstrated good inter-session reliability when assessed following a 24-48 hour test-rest window. Determining reliable test-rest intervals for novel reaction time protocols is necessary for future use as a diagnostic and rehabilitation tool.

**Purpose:** To investigate the test-retest (intra- and inter-session) reliability of a battery of five reaction time protocols.

**Methods:** A total of 28 nonclinical participants completed a battery of five protocols increasing in difficulty in terms of reaction speed requirement and cognitive load. Prior to the testing, participants were instructed to stand approximately 30.5 cm from the board and allowed three familiarization opportunities. All protocols required participants to hit as many lights as quickly as possible in 60 seconds. After completing the initial testing session (Time 1), participants waited an hour before completing the second session (Time 2). Between 10-14 days later, the participant completed the same battery of tasks (for the third session (Time 3)). The intraclass correlation coefficient (ICC) and repeated measures ANOVA were calculated. **Results:** The ICC values for each of the five protocols illustrated good to excellent reliability between Time 1 and Time 2 (0.66-0.90) and between Time 2 and Time 3 (0.71-0.89). There were no significant differences across time points (F<0.105, p>0.05). **Conclusion:** The one hour and two-week test-retest intervals are reliable for clinical assessment, expanding the timeframe of when assessments can be completed reliably. Although these protocols have application both as an assessment and rehabilitation tool, it is important to identify optimal intervention windows to improve reaction time post-concussion. Future research should focus on identifying optimal intervention windows and how effective the Dynavision D2 system is for rehabilitation purposes.

**1978 Board #239 May 31 3:30 PM - 5:00 PM Reliability of Five Novel Reaction Time and Cognitive Load Protocols**

Kelsey Picha, Carolina Quintana, Amanda Glueck, Nicholas Heebner, John Abt, FACS, Scott Leiphert, FACS. *University of Kentucky, Lexington, KY.*

(No relevant relationships reported)

**1979 Board #240 May 31 3:30 PM - 5:00 PM Normative Values and Effects of Fatigue on the King Devick Test in Wheelchair Athletes**

Angela Mickle, J.P. Barfield. *Radford University, Radford, VA.* (Sponsor: Hank Williford, FACS)

(No relevant relationships reported)

The King-Devick (KD) test of rapid eye movement is a common assessment of concussion in able-bodied (AB) sport but data are unavailable on disability sport athletes. **Purpose:** The purpose of this study was to establish normative KD values for wheelchair rugby and wheelchair basketball sport participants. The secondary purpose was to examine the effect of submaximal and maximal effort on baseline values. **Methods:** Fifty wheelchair rugby (n = 22) or wheelchair basketball (n = 28) players (47 males, 3 females) completed baseline KD assessments via an iPad application approximately 10 minutes before a scheduled practice or competition. Before some athletes had limited or impaired grip, iPads were placed on the wrists at a standardized height and distance from each participant. To assess the effect of submaximal effort on baseline score, 24 athletes completed a general warm-up, a sport-specific warm-up, and a 6-set sprinting session of 30 meters (15 down, 15 back) starting every 30 sec. To assess the effect of maximal effort, 18 different participants completed sprints until an RPE of 18 was reached (level between “very hard” and “extremely hard”). Final measurements of perceived exertion using the Borg RPE scale and a final KD test completed within 30 sec of the last sprint. **Results:** Mean KD baseline score was 51 sec and no significant difference on mean KD baseline score existed between sports, impairments types, or gender. Specific to submaximal effort, mean KD score decreased by 3.5% after 6 maximum effort sprints (Post-test RPE = 13; perceived between “light” and “somewhat hard” effort). Specific to maximal effort (Post-test RPE = 18), mean KD score increased by 1.7% despite the fact that 8 of 12 players demonstrated an improvement. **Conclusions:** KD normative scores were meaningfully higher than previously reported norms in AB sport. Consistent with AB sport, exertion typically caused an improvement (decrease) in KD score time.
**MEDICINE & SCIENCE IN SPORTS & EXERCISE**

**P R O O F S T R A N S C R I P T**

**Alt Text:**

**Title:** Long-term Effects of Tai Chi on Muscle Strength and Physical Function in Patients with Peripheral Neuropathy

**Authors:** Arturo A. Arce-Enquist, Joyce E. Ballard, FACSM, Melinda L. Hermanns, Linda R. Rath, Brittany Murley, Yong T. Wang, FACSM, Barbara K. Haas. The University of Texas at Tyler, Tyler, TX. (Sponsor: Joyce E. Ballard, FACSM)

**Keywords:** Tai Chi, chronic disability, peripheral neuropathy, exercise intervention, muscle strength, physical function, neuromuscular training.

**Abstract:**

The study aimed to evaluate the long-term effects of a Tai Chi exercise program on muscle strength and physical function in patients with Peripheral Neuropathy. A total of 26 individuals with NF1 (14 male), aged 18-45 years, were compared to 20 healthy controls. The program included 12 weeks of Tai Chi training. The results showed significant improvements in leg muscle strength (pre = 29.81±16.50 kg; post = 37.81±16.46 kg, p<0.05) and leg extension strength (pre = 24.33±16.88 kg; post = 34.71±18.66 kg, p<0.05). The authors concluded that Tai Chi may be an effective intervention for improving muscle strength and physical function in patients with Peripheral Neuropathy.

**Results:**

- Significant improvement in leg muscle strength (pre vs. post: p<0.05)
- Significant improvement in leg extension strength (pre vs. post: p<0.05)

**Conclusions:**

Tai Chi appears to be a feasible and effective intervention for improving muscle strength and physical function in patients with Peripheral Neuropathy.

**References:**


CONCLUSIONS: With the use of body weight support treadmill (BWST) training for rehabilitation of patients with brain injuries, as well as muscle-skelatal and neuromuscular impairments, is an emerging clinical treatment method. Because of the limited evidence of physiological stress of BWST training, the purpose of this study was to describe the metabolic and cardiovascular response to varying levels of BWST walking in healthy adult subjects.

METHODS: A total of 21 subjects (10 females, 34.6 ± 6.7 yr; 74.6 ± 14.3 kg; 170.8 ± 6.9 cm; 26.1 ± 3.5 kg/m²) provided their informed consent to participate in three 5-minute walking trials at a self-selected treadmill speed, with body weight support (BWS) of 0, 15, and 30%. Test order was randomized for each subject. Subjects rested for a minimum of 15 min between trials, and did not begin a subsequent trial until HR was verified to be <5 bpm of HR rest. Mean HR (12-lead ECG), BP (auscultation), oxygen uptake (continuous indirect calorimetry), and RPE (Borg rating scale) were determined from the last 3 minutes of each trial. Mean values for all variables were assessed for difference between trials using repeated measures analysis of variance (Bonferroni post hoc, 24, New York, NY).

RESULTS: At rest, HR was 78 ± 11.5 bpm and BP was 121 ± 27/79 ± 8.0 mmHg. Mean walking speed of subjects was 64.2 ± 5.8 cm/s. HR and systolic BP significantly increased from rest to exercise at all BWS levels, with no significant difference in diastolic BP seen from rest to exercise at all BWS levels. There was no significant difference among levels of BWS for HR, BP, RPE, oxygen uptake, respiratory exchange ratio, respiratory rate, tidal volume, and METs.

CONCLUSIONS: Metabolic and cardiovascular responses to treadmill walking at 3 levels of BWS (0, 15, 30%) were similar in apparently healthy adult subjects.
D-74 Exercise is Medicine®/Poster - EIM: Exercise and Various Health Conditions
Thursday, May 31, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

PurpoSe: To evaluate how BIS measurements are affected by metal electrodes and different body positions (sitting and standing) compared to the traditional supine, gel-backed electrode method. METHODS: Forty-nine subjects (m=24, w=25) participated in the study (24 +/- 6 years, 172 +/- 11 cm, 74.2 +/- 15.4 kg). Whole body, right side measurements were taken with metal electrodes (SIM), standing with metal electrodes (SIM), and supine with gel-backed electrodes (SuG). Supine measurements were taken with a traditional lead-based device while standing and sitting measurements were taken using a fixed metal electrode device. Both devices independently calculated R0 and Rinf. RESULTS: Significant correlations were identified between all measurements (r > 0.88, p < 0.001). The highest correlations were observed between SIM and SIM as well as SIM and SuG for Rinf in the women (r > 0.949, p < 0.001) and between SIM and R0 as well as SIM and Rinf for the men (r > 0.973, p < 0.001). Significant differences (p < 0.05) were observed in both R0 and Rinf between the devices for the women compared to all measurements apart from R0 between SIM (764.95 ohms) and SIM (773.18 ohms, p = 0.116) and R0 between SIM (764.95 ohms) and SuG (755.2 ohms, p = 0.172) in women. Compared to SuG, (women: R0 = 755.20, Rinf = 517.43 ohms; men: R0 = 590.30, Rinf = 384.70 ohms) SIM (women: R0 = 764.95, Rinf = 553.61 ohms; men: R0 = 613.31, Rinf = 417.54 ohms) was less affected than SIM (women: R0 = 773.18, Rinf = 572.06 ohms; men: R0 = 623.58, Rinf = 434.40 ohms). CONCLUSIONS: Successful BIS measurements and calculations using complex Cole models were obtained from all measurements (sitting with metal electrodes, standing with metal electrodes, and lying supine with gel-backed electrodes). High (significant) correlations were observed between each measurement. Compared to the traditional supine measurements using gel-backed electrodes, both standing and sitting measurements taken with metal electrodes resulted in slightly (> 55 ohms) higher R0 and Rinf values. An R0 and Rinf correction factor should be applied when utilizing standing or sitting BIS measurements using metal electrodes for the calculations of fluid volumes or tissue masses when using the same calculations and resistivity coefficients as traditional supine measurements using gel-backed electrodes.

1990 Board #251
May 31 2:00 PM - 3:30 PM
Predicting Basal Metabolic Rate After Spinal Cord Injury
Ashraf S. Gorjee, FACSM, Thomas E. Nightingale, Hunter Holmes McGuire VA Medical Center, Richmond, VA.

Purpose: To determine the impact of superimposed resistance training (RT) in aerobically trained coronary patients on systolic blood pressure (SBP), heart rate (HR), rating of perceived exertion (RPE; 6-20 scale), and rate pressure product (RPP) at fixed submaximal workloads following a 12-week RT intervention. Additionally, pre and post RT measures of brachial artery reactivity, an index of endothelial function, were obtained. Methods: Fifteen low risk coronary patients (13 men, 2 women; mean ± SD age = 66 ± 5.1 yrs) completed a progressive 12-week RT program that complemented their regular aerobic training regimen. Prior to testing, SBP, HR, RPP, and RPE were obtained while subjects performed 1 set (10 repetitions) of 3 different exercises (bicep curl [BC], shoulder press [SP], leg press [LP]) at an intensity = 60-80% of 1-repetition maximum. After the training period, testing was repeated while subjects lifted the identical pre-training loads for each exercise following a standardized protocol. Vascular function was assayed by flow-mediated vasodilation (FMD) testing prior to and immediately following the 12-week RT training intervention. Results: Lifting the same pre-training loads evoked attenuated responses for all variables (HR, SBP, RPE, RPP). A statistically significant decrease was shown for RPP [HR × SBP]/100 during BC (106 ± 27 to 91 ± 22, P < 0.007) and SP (102 ± 24 to 86 ± 17, P < 0.007). The WB difference was not statistically significant (0.3 ± 0.18). RPE for all 3 exercises decreased significantly (P < 0.0001) following RT intervention: BC (14.3 ± 2.3 to 9.7 ± 1.6), SP (13.9 ± 1.6 to 9.2 ± 1.5), LP (14.3 ± 1.4 to 10.3 ± 1.6). Pre versus post RT measurements for resting HR and resting SBP were unchanged. Peak FMD responses for the 15 subjects were 12.8% and 10.3% dilation pre- and post-training, respectively (P = 0.332). However, 5 of the 15 subjects showed modest improvements in their post-training time to achieve maximum dilation from a mean of 117 seconds to 81 seconds (P = 0.156). Conclusion: Among aerobically trained coronary patients, a superimposed resistance training program resulted in decreased hemodynamic and RPE responses to lifting fixed submaximal workloads and improved FMD responses in 5 of the 15 participants.

1991 Board #252
May 31 2:00 PM - 3:30 PM
Effects of Resistance Training on Vascular and Hemodynamic Responses to Standardized Workloads in Coronary Patients
Kerstin Grafe, Phillip Hendick, Margaret Burr, Judy Boura, Diedre Brunke, Barry Franklin, FACSM, Beaumont Health, Royal Oak, MI. (Sponsor: Barry Franklin, PhD, FACSM)

Purpose: To evaluate how BIS measurements are affected by metal electrodes and various health conditions. MEDICINE & SCIENCE IN SPORTS & EXERCISE®

1991 Board #253
May 31 2:00 PM - 3:30 PM
The Effects Of Multi-directional Exercise Training On Body Composition, Physical Fitness, And Mobility In Stroke Patients
Eunyung Park1, Younsun Son2, James Johnson3, Kyungock Yi3, Jung-II Oh4.1. University of Texas Rio Grande Valley, McAllen, TX. 2University of Houston, Houston, TX. 3Baylor College of Medicine, Houston, TX. 4Ewha Womans University, Seoul, Korea, Republic of.

Purpose: The aim of this study was to compare the effects of multi-directional exercise training with conventional uni-directional stroke rehabilitation training on body composition, lower body strength and endurance, flexibility, balance, and mobility in stroke patients.

Methods: Twenty-three male patients with chronic stroke were randomly assigned either a multi-directional exercise training group (MET) or a uni-directional exercise training group (UET). All participants in both groups underwent 12 weeks of exercise training (3 times/week, 60 mins/day). The MET group utilized a half-ball balance device and the UET group utilized a treadmill. The following tests were administered pre- and post-intervention: chairstand test, sit and up and down test, single-leg balance test, sit and reach test, 6m walking test, and functional walking test. Data were analyzed using T-test and ANCOVA with a significance level of 5%.

Results: Twenty participants completed the exercise regimen (MET, n=10, 53.9 ± 8.3 yrs; UET, n=10, 58.3 ± 12.1 yrs). There was a significant increase between pre- and post-intervention values in the sit and reach test (-6.50 ± 9.52 vs -4.45 ± 11.06, t=-2.13, P<0.05) and up and down test (30.2 ± 12.1 vs 27.9 ± 12.0, t=-2.60, P<0.05) in MET, and although up and down values did improve in the UET the results did not meet criteria for statistical significance. Significant increases of single-leg balance test (F1, 17 = 0.69). Using anthropometric variables, without FFM, explained less of the variance in BMR (Model 4; r² = 0.57). However, all the developed prediction models demonstrated acceptable mean absolute error ≤ 6%.

Conclusions: BMR can be more accurately estimated when DEXA derived FFM is incorporated into prediction equations. Utilising anthropometric measurements provides a promising alternative to improve the prediction of BMR, beyond that achieved by existing equations in persons with SCI.

No relevant relationships reported.
Impaired glucose tolerance (IGT) elevates type 2 diabetes and vascular disease. However, little is known about their effects on blood pressure (BP) of this population. Our purpose was to assess the role of physical activity on BP of subjects under treatment for knee OA submitted to an interdisciplinary educational program.

**METHODS:** One hundred and thirty six sedentary subjects (25/111 men/women; age = 67.6 ± 9.6, BMI = 30.6 ± 4.4 kg/m²), under treatment for primary knee OA, were submitted to an interdisciplinary educational program emphasizing the recommendation for regular practice of physical exercise, and have their BP, six minute walking test (6MWT), body mass index (BMI) and daily living physical activity (IPAQ; short version) measured before (pre) and after 12 months of follow-up. Subjects were then classified, according to their physical activity status during follow-up, in sedentary-to-sedentary (SED-SED), sedentary/insufficiently active at pre and post follow-up), sedentary-to-active (SED-ACT, sedentary/insufficiently active at pre follow-up and active/very active at post follow-up), active-to-sedentary (ACT-SED, active/very active at pre follow-up and sedentary/insufficiently active at post follow-up) and active-to-active (ACT-ACT, active/very active at pre and post follow-up) groups and have their BP and physical 6MWT compared.

**RESULTS:** Systolic BP increase (11.3 mmHg; P < 0.01) and maintenance in diastolic BP were found in SED-SED, whereas tendency toward increase in systolic BP (12.6 mmHg; P = 0.07) and increase in diastolic BP (5.1 mmHg; P = 0.01) were found in ACT-SED during follow-up. On the other hand, maintenance in systolic BP and reduction in diastolic BP (5.2 mmHg; P = 0.01) were found in SED-ACT, whereas maintenance in systolic BP and tendency toward reduction in diastolic BP (3.2 mmHg; P = 0.07) were found in ACT-ACT, whereas maintenance in systolic BP and tendency toward decrease in diastolic BP (3.2 mmHg; P = 0.07) were found in ACT-ACT during follow-up. The positive effects on BP in SED-SED and ACT-ACT were accompanied by improvements (P < 0.05) on 6MWT (SED-SED = 8.5 ± 2.7 %; ACT-ACT = 9.3 ± 3.6 %) and BMI (SED-SED = 2.9 ± 0.9; ACT-ACT = 3.8 ± 2.0 %), whereas no changes were found in SED-SED and ACT-ACT.

**CONCLUSIONS:** This results suggest that high levels of physical activity may have a positive role on prevention /management of high BP in subjects under treatment for knee OA.

**PURPOSE:** Research from our laboratory indicates that six weeks of aerobic exercise alters the gut microbiota and microbial-derived short chain fatty acids (SCFAs) in both lean and obese humans. SCFAs directly modulate inflammation, insulin sensitivity and gut barrier function. Thus, the objectives of the present study were to (1) determine the effects of aerobic exercise training on circulating metabolic and inflammatory parameters indicative of inflammation, insulin sensitivity, and gut barrier function and (2) determine whether changes in these parameters paralleled shifts in the microbiota and its metabolites.

**METHODS:** Previously sedentary but otherwise healthy adults (n=16 lean; n=11 obese) underwent a six-week aerobic exercise intervention. Blood samples collected before and after the intervention were analyzed for C-reactive protein (CRP), lipopolysaccharide binding protein (LBP), and insulin resistance by the homeostatic model assessment (HOMA-IR). Fecal samples were analyzed for microbiota composition (16S rRNA gene sequencing) and SCFA concentrations (gas chromatography).

**RESULTS:** At baseline, obese individuals had significantly higher CRP, LBP, insulin, and HOMA-IR compared to lean individuals (p < 0.05). There were no changes in CRP as a result of exercise training. However, LBP and HOMA-IR were significantly reduced by exercise in the obese group (p < 0.05). Change in CRP over the 6-week intervention positively correlated with change in abundance of Erysipelotrichaceae (r = 0.610, p = 0.009), a microbe previously shown to be associated with metabolic syndrome. Change in abundance of Anaerostipes, a genus of known butyrate-producers, negatively correlated with change in LBP (r = 0.727, p = 0.007) and HOMA-IR (r = 0.471, p = 0.036). Both CRP and LBP levels after the intervention were negatively correlated with post fecal acetate, butyrate, and propionate levels (p < 0.01).

**CONCLUSIONS:** Six weeks of aerobic exercise improved markers of insulin sensitivity and metabolic endotoxemia in obese individuals. These improvements may be related effects on the gut microbiota, as metabolic and inflammatory markers correlated with changes in several important microbial genera and post-intervention SCFAs.

Diabetes is known to amplify the vascular comorbidities that result in arterial stiffening. Individuals with type 1 diabetes (T1D) may also have impaired cardiorenal fitness which may influence their leisure-time physical activity (LTPA). Cardiac-Ankle Vascular Index (CAVI) is a noninvasive method used to assess arterial stiffness. Currently there are few studies investigating the relationship between arterial stiffness and LTPA in individuals with T1D. **PURPOSE:** To determine CAVI and its associations with LTPA and cardiorenal fitness (VO₂max) in young adults with T1D. **METHODS:** As a part of a larger study investigating early signs of cardiovascular disease in T1D 12 men with T1D (33.7 ± 7 y, 181.7 ± 8 cm, 81.1 ± 11 kg, T1D duration 13.7 ± y) and 17 healthy age- and anthropometry-matched men (CON) (33.6 ± 8 y, 181.5 ± 6 cm) were studied.
cm, 83:10 kg) participated in the study. CAVI was assessed using VaSera VS-1500 (Fukuda Denshi Co., Ltd., Tokyo, Japan). Self-reported LTPA (min/wk) was obtained through a questionnaire. The subjects also performed incremental cycling exercise test until volitional fatigue to determine maximal oxygen uptake (VO\textsubscript{2max}). Group comparisons were made using independent samples t-test and relationships were determined using Pearson correlation coefficient. All parameters are presented as mean ± SD. RESULTS: CAVI was higher in T1D (71.0±5.0 for right, 71.0±4.0 for left) compared to CON (65.1±6.0 for right, 64.0±6.0 for left) (P<0.01). LT 40% was lower in the mild apnea group 39.9% lower in the moderate group (P<0.001), and 57.7% lower in the severe apnea group (P<0.001). There was no negative association between PA level and hemoglobin A1C was only observed in non-apneic subjects (P=0.027, P=0.002) but there was no association between PA level and CRP and insulin when apneic individuals only were analyzed.

CONCLUSIONS: A high PA level is negatively associated with OSA severity. Although PA level was negatively associated with CRP and insulin in the whole sample, this association was not found when only OSA individuals were considered. Supported by CPED/SONO-FAFESP (19/14303-3), CAPES

**METHODS:**

A cross-sectional study, the Sao Paulo Epidemiologic Sleep Study, assessed 1042 individuals aged between 20 and 80 years of age through polysomnography, self-report PA level (MET’s/week) and cardiometabolic profile such as C-reactive protein (CRP), homocysteine, folie acid, vitamin B12, tumor necrosis factor-alpha (TNF-a), interleukin-6 (IL-6), leptin, ghrelin, insulin and blood glucose. RESULTS: In the 993 individuals included in the analyses, PA level had a negative association with apnea and hypopnea index (B=-0.016, P<0.001). Compared to the non-apneic group PA level was 20.13% lower in the mild apnea group 39.9% lower in the moderate group (P<0.001), and 57.7% lower in the severe apnea group (P<0.001). There was no association between PA level and CRP (P=0.34, P=0.001), and insulin (P<0.01, P=0.023) when analyzed whole sample. A negative association between PA level and hemoglobin A1C was only observed in non-apneic subjects (P=0.027, P=0.02). There was no association between PA level, CRP and insulin when apneic individuals were analyzed.

CONCLUSIONS: A high PA level is negatively associated with OSA severity. Although PA level was negatively associated with CRP and insulin in the whole sample, this association was not found when only OSA individuals were considered. Supported by CPED/SONO-FAFESP (19/14303-3), CAPES

**Subjects categorized to type 2 diabetes risks according to FINDRISC**

<table>
<thead>
<tr>
<th>FINDRISC</th>
<th>Frequency</th>
<th>%</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (&lt;7 points)</td>
<td>34</td>
<td>24.1</td>
<td>18</td>
<td>16.2</td>
</tr>
<tr>
<td>Slightly elevated (7-11 points)</td>
<td>61</td>
<td>43.3</td>
<td>36</td>
<td>32.4</td>
</tr>
<tr>
<td>Moderate (12-14 points)</td>
<td>22</td>
<td>15.6</td>
<td>29</td>
<td>26.1</td>
</tr>
<tr>
<td>High (15-20 points)</td>
<td>19</td>
<td>13.5</td>
<td>21</td>
<td>18.9</td>
</tr>
<tr>
<td>Very high (&gt;20 points)</td>
<td>5</td>
<td>3.5</td>
<td>7</td>
<td>6.3</td>
</tr>
</tbody>
</table>

**Association Between Cardiovascular Markers And Physical Activity In Patients With Obstructive Sleep Apnea**

Marcos Mónico-Neto, MSc, Hanna Karen Moreira Antunes, PhD, Ronaldo Vagner Thomalei dos Santos, PhD, Vânia D’Almeida, PhD, Lia Rita Azeredo Bittencourt, PhD, Sergio Tufik, PhD, Federal University of Sao Paulo, Sao Paulo, Brazil.

(No relevant relationships reported)

**TRENCHER, ANDRE J ORLANDI, CLAUDIJA D’AMARAL, LUIZA ALDKOVSKA,** Brazil, Brazil. (No relevant relationships reported)
Exercise training may reduce cardiovascular disease (CVD) risk among at-risk populations. Firefighters are a high-stress occupational group at increased risk for CVD. However, the effects of exercise training on risk factors of CVD among firefighters remain unclear. PURPOSE: To estimate the population effect size of aerobic exercise, fitness, and physiological/biological risk factors for CVD among firefighters. METHODS: Eleven randomized controlled trials and seven experimental studies published before August 2017 were located using Google Scholar, MEDLINE, PsycINFO, PubMed, and Web of Science. Trials involved 1,428 (27 females) firefighters. Exercise interventions included aerobic exercise training, resistance exercise training, and combined training that varied in frequency (3±1 sessions/wk), intensity (moderate to intense), supervision (n=10), and relevant measures of fitness (i.e., aerobic capacity, endurance, strength, and occupational fitness). Data were analyzed using a Paired t-test and Wilcoxon signed-ranks test. RESULTS: Over all differences between two groups was determined by independent sample t-test and relevant measures of fitness were compared using paired sample t-test. Exercise training resulted in small-to-medium effects for fitness (Δ=0.85, p≤0.001, r=0.58), body fat percentage (Δ=0.53, p=0.01), body fat percentage (Δ=0.53, p=0.01), body fat percentage (Δ=0.53, p=0.01), body fat percentage (Δ=0.53, p=0.01), body fat percentage (Δ=0.53, p=0.01), body fat percentage (Δ=0.53, p=0.01), body fat percentage (Δ=0.53, p=0.01), and occupational fitness (Δ=0.59, p<0.001). Significant, large effects were found for fitness (Δ=0.85, p=0.001, r=0.58), body composition (Δ=0.34, p<0.001, r=0.58), body composition (Δ=0.34, p<0.001, r=0.58), body composition (Δ=0.34, p<0.001, r=0.58), body composition (Δ=0.34, p<0.001, r=0.58), and body fat percentage (Δ=0.53, p=0.01). Together, these findings support the hypothesis that exercise training can improve fitness, body composition, and occupational fitness among firefighters.

CONCLUSIONS: Exercise training may reduce cardiovascular disease (CVD) risk among at-risk populations. Firefighters are a high-stress occupational group at increased risk for CVD. However, the effects of exercise training on risk factors of CVD among firefighters remain unclear. PURPOSE: To estimate the population effect size of aerobic exercise, fitness, and physiological/biological risk factors for CVD among firefighters. METHODS: Eleven randomized controlled trials and seven experimental studies published before August 2017 were located using Google Scholar, MEDLINE, PsycINFO, PubMed, and Web of Science. Trials involved 1,428 (27 females) firefighters. Exercise interventions included aerobic exercise training, resistance exercise training, and combined training that varied in frequency (3±1 sessions/wk), intensity (moderate to intense), supervision (n=10), and relevant measures of fitness (i.e., aerobic capacity, endurance, strength, and occupational fitness). Data were analyzed using a Paired t-test and Wilcoxon signed-ranks test. RESULTS: Over all differences between two groups was determined by independent sample t-test and relevant measures of fitness were compared using paired sample t-test. Exercise training resulted in small-to-medium effects for fitness (Δ=0.85, p≤0.001, r=0.58), body fat percentage (Δ=0.53, p=0.01), body fat percentage (Δ=0.53, p=0.01), body fat percentage (Δ=0.53, p=0.01), body fat percentage (Δ=0.53, p=0.01), body fat percentage (Δ=0.53, p=0.01), body fat percentage (Δ=0.53, p=0.01), and occupational fitness (Δ=0.59, p<0.001). Significant, large effects were found for fitness (Δ=0.85, p=0.001, r=0.58), body composition (Δ=0.34, p<0.001, r=0.58), body composition (Δ=0.34, p<0.001, r=0.58), body composition (Δ=0.34, p<0.001, r=0.58), body composition (Δ=0.34, p<0.001, r=0.58), and body fat percentage (Δ=0.53, p=0.01). Together, these findings support the hypothesis that exercise training can improve fitness, body composition, and occupational fitness among firefighters.
Mechanical loading of differentiated myotubes mimics the loading pattern of mature skeletal muscle and alterations in signaling and gene expression responses have been reported upon mechanical loading applied on skeletal muscle myotubes.

**Purpose:** This study investigated the effects of the mechanical loading of terminally differentiated myotubes (myotubes) on signaling and gene expression responses associated with the progression of their myogenic lineage.

**Methods:** C2C12 myotubes were cultured on elastic membranes up to the day 10 of their differentiation and then underwent a passive, cyclic stretching (2.2% elongation, at a frequency of 0.25Hz, for 12h). Cells were harvested and lysed 24 hours after the completion of the stretching protocol. Phosphorylation of signaling proteins (Akt and ERK1/2) and their expression were assessed using western blots.

**Results:** Mechanical loading of the myotubes resulted in significantly increased activation of Akt and of MyoD protein levels (42%; p<0.05), while no significant differences were found in ERK1/2 phosphorylation. Gene expression levels of IGF-1 isoforms (IGF-1A: 2.1-fold, IGF-1B: 1.2-fold) and MRFS (MyoD: 5.8-fold, Myogenin: 3.3-fold, MRF4: 2.3-fold) increased significantly (p<0.05), while the apoptotic (BAX: 0.3-fold, FUC1: 0.3-fold) and atrophy factors (Atrogin: 0.09-fold, Myostatin: 0.7-fold, Myr3: 0.09-fold) decreased (p<0.05). On the contrary, upregulation of the inflammatory factors (IL-1β: 4.6-fold, IL-6: 7.5-fold) was detected (p<0.05), along with a downregulation of the (INSR: 0.5-fold) levels (p<0.05).

**Conclusions:** It was demonstrated that mechanical loading of myotubes can further promote the progression of their myogenic lineage by upregulating myogenic and anabolic factors and signaling, and downregulating apoptotic and atrophy genes.

**References:**

Autophagy is an anciently conserved pathway responsible for the degradation of long-lived proteins, protein aggregates, and organelles, thereby contributing to efficient protein homeostasis. Autophagy is stimulated by nutrient deprivation and is required for certain beneficial adaptations of exercise. Insufficient autophagy is a common feature of muscle diseases, obesity, type 2 diabetes, and aging. However, regulation of autophagy is incompletely understood at the molecular level. PURPOSE: Define the role of unc-51 like autophagy activating kinase 2 (ULK2), and contrast with that of its close homolog ULK1, in regulation of autophagy and contractile function in skeletal muscle. METHODS: 1) DNA plasmids encoding either Ulk1 or Ulk2 pre-micro RNAs (miR) were electroporated into the tibialis anterior (TA) muscle of one leg, and a control miR plasmid into the contralateral leg of wild type mice. Muscles were harvested 7-8 days afterwards, either at basal conditions or after 24h of starvation. 2) ULK2fl/fl differentiated primary mouse myotubes were infected with Ad-Cre-GFP or Ad-GFP (control) viruses, and harvested up to 96h afterwards. 3) Maximal force of hindlimb dorsiflexors was assessed in adult ULK2 skeletal muscle knockout mice (ULK2fl/fl; ULK2mKO) via stimulation of the fibular nerve, and compared to control littermates (ULK2fl/fl; Cre-). RESULTS: ULK2 is expressed at ~2-fold higher levels than its close homolog ULK1 in skeletal muscle. ULK2 deficiency, but not ULK1, leads to ubiquitin and autophagy receptor protein accumulation (p62, NBR1), suggesting impaired cargo recognition in adult skeletal muscle and primary myotubes, independent of lysosomal function. Preliminary findings indicate that maximal force is reduced in adult ULK2mKO mice. CONCLUSION: Here, we demonstrate a novel and fundamental role for ULK2 in regulating cargo recognition, an essential aspect of selective autophagy, which is commonly impaired in conditions of muscle dysfunction. These results reveal ULK2 as a potential therapeutic target for skeletal muscle contractile and metabolic dysfunction, and serve as basis for future studies dissecting the mechanisms of autophagic cargo recognition in skeletal muscle.

Supported by AHA (16SDG30360001) and Dept. of Health & Human Physiology, University of Iowa.

3 sec per contraction followed by 7 sec of rest [Ato et al. (2016) Physiol Rep], which led to increased ERK1/2 signaling lasting ~3.5 hrs. Parameter sensitivity analysis determined that the model was most sensitive to parameters that described the force-induced rate of conformational change for FAK. We also simulated various force inputs for the contraction protocol described above and observed that ERK1/2 signaling was responsive to forces between 8-15 pN, achieving a plateau for higher forces.

CONCLUSION: Our model provides a working quantitative hypothesis of the dynamics of protein translational control in skeletal muscle induced by mechanical factors. Going forward we will use the model to study the effects that different RE variables (repetitions, sets, load, rest, etc.) have on FAK signaling dynamics by simulating different contraction profiles.

The mammalian target of rapamycin complex 1 (mTORC1) is a regulatory protein for several cell processes and is critical in the control of muscle protein synthesis and hence muscle size. Its activity is primarily regulated by nutrition (i.e., protein) and growth factors (i.e., insulin); however, how the whole-body dynamics of these factors translate into protein translational signaling in skeletal muscle cells is poorly understood.

Purpose: The purpose of this study was to develop and analyze a simple mathematical model of the signaling controlling protein translation in human skeletal muscle following leucine ingestion.

Methods: The model was expressed as a system of ordinary differential equations (ODEs) incorporating the signaling proteins involved in the control of protein translation (e.g., IR/P70S6K/4E-BP1/mTOR axis). Intracellular biochemical reactions were represented by mass-action principles. We calibrated the kinetic parameters of the model to fit to published signaling data from human skeletal muscle following leucine ingestion. The ODEs were solved using the ODE23s solver in MATLAB.

Results: The model outputs qualitatively agreed with published time-course data for plasma leucine, plasma insulin, and phosphorylation of Akt(Thr308), mTORC1(Ser2448) and p70S6K(Ser405) following the ingestion of a single leucine bolus or multiple, pulsatile leucine doses. Parameter sensitivity analysis determined that mTORC1 activity was most sensitive to total mTORC1 concentration and highly sensitive to the rate of leucine transamination to alpha-ketoglutarate.

Conclusion: Our model represents a working quantitative hypothesis of the dynamics of protein translational control in skeletal muscle by nutritional and hormonal factors.

Abstracts were prepared by the authors and printed as submitted.
Two-way repeated measures analysis of variance (ANOVA) with effect size ($\eta^2$) was used to determine effects of injection on HOOS scores of patients at baseline and 6-week follow-up injections. RESULTS: 180 patients analyzed: 85.6% (N154) female, mean age: females 20.5±7.5, males 21.5±7.6 years. Time effects were found for both normal and abnormal hips in all five HOOS score subcategories: symptoms ($p<0.041$, $\eta^2$=0.050), pain ($p<0.001$, $\eta^2$=0.184), activity of daily living (ADL) ($p<0.011$, $\eta^2$=0.076), sports/recreation ($p<0.001$, $\eta^2$=0.151), and quality of life (QOL) ($p<0.001$, $\eta^2$=0.255). Significant differences between preand post-injection were found in sports/recreation ($p=0.032$, $\eta^2$=0.056) and QOL scores ($p=0.001$, $\eta^2$=0.135). Interaction was found for QOL scores only ($p=0.031$, $\eta^2$=0.056). CONCLUSIONS: US-guided iliopsoas injection appears to improve outcomes over the 6 week study period regardless of pre-existing intra-articular hip pathology. Athletes without intra-articular pathology showed greater improvement in sports/recreation and QOL when compared to athletes with abnormal hip pathology. QOL was significantly better in athletes with normal hips than those with hip pathology during 6 weeks. US-guided iliopsoas injections may serve to help patients with iliopsoas tendinosis to advance care and continue with non-surgical treatment regimes.

###板#276 2015

**Medical Utilization Patterns Among Division I Collegiate Athletes**

Christopher Fox¹, Emily Miller¹, Joshua Goldman¹, Peter Awad², Nisha Batta¹, Montana Dunn¹, Glenda Marshall¹, Marissa Ogata¹, Phil Sundin², UCL, Santa Monica, CA. UCL, Westwood, CA. (Sponsor: Aurelia Nattiv, FACSM)

(Purpose: Only relatedness reported)

**METHODS:** Using Presagia Sports, a web-based reporting system, medical visits from September 1, 2016 to August 31, 2017 were reviewed. Demographic information, team affiliation, physician type (primary care versus orthopedic surgery, fellow versus attending), and diagnosis were recorded. Encounter diagnoses were grouped into 12 categories ranging from chronic medical conditions to acute illness and operative orthopedic issues. Encounter diagnoses and categories were reviewed by two primary care sports medicine fellows and cross-referenced with athlete medical records. Poisson regression was used for statistical analysis.

**RESULTS:** A total of 2416 medical visits occurred during the study period, representing 517 of the 793 (65.2%) student athletes. Football (15%) of athletes represented 16.7% of total visits, followed by rowing (14.5%) of athletes with 10.9%, women’s track and field (10.7%) with 9.4%, women’s swim/diving (4.8%) with 9.9% and women’s gymnastics (3.8%) with 7.1%. Female athletes (53.7% of student athletes) composed 62% of all visits, male athletes 38% (p<0.001). 83.3% of all visits were with Primary Care Sports Medicine physicians versus 16.7% with Sports Surgery. When evaluating common diagnoses by sport the following trends were noted: football accounted for 39% of total concussion visits. Rowing had the highest percentage of mental health visits (48%), followed by swim/diving (11%) and women’s water polo (7%). Women’s cross country and track accounted for 58% of female athlete triad visits (amenorrhea, bone stress injuries or disordered eating) followed by gymnastics at 11% and rowing 10%.

**CONCLUSIONS:** A foundational understanding of current training room utilization and trends in the distribution of common sports medicine diagnoses, Sports Medicine physicians have the opportunity to prevent these diagnoses, mitigate their effects, and ensure athletes are receiving care designed to optimize their health and athletic performance.

###板#275 2016

**Youth Multi-sport Participation Is Associated With Higher Bone Mineral Density In Female Collegiate Distance Runners**

Emily Miller¹, Michael Fredericson, FACSM², Andrea Kusman¹, Emily Krauss², Sonal Singh³, Megan Deansig-Roche⁴, Brian Kim⁵, Adam Tenforde⁶, Kristin Sainani⁷, Aurelia Nattiv, FACSM¹, ¹University of California, Los Angeles, Los Angeles, CA. ²Stanford University, Stanford, CA. ³Stanford University, Los Angeles, CA. UCL, Los Angeles, CA. ⁴University of California, Irvine, Irvine, CA. ⁵Harvard University, Boston, MA. (Sponsor: Aurelia Nattiv, FACSM)(No relevant relationships reported)

**PURPOSE:** Youth sport participation is encouraged as a way to promote health and social interactions. But specialization in a single sport at an early age is becoming increasingly common. Distance runners have lower bone mineral density (BMD) compared to athletes in other weight-bearing sports and a higher risk of bone stress

---

**Medicine & Science in Sports & Exercise®**

ACSM May 29 – June 2, 2018

Minneapolis, Minnesota
injuries (BSI). We sought to determine the effect of pre-college participation in sports other than cross country or track on BMD and BSI in collegiate middle and long-distance runners.

**METHODS:**
As part of a prospective study on bone health in collegiate distance runners, baseline data were collected on 81 male and 79 female NCAA Division 1 distance runners at two institutions, including prior sports participation. Baseline BMD was recorded for 55 men and 54 women. We followed athletes for up to 4 years and recorded prospective BSIs. Data were analyzed using t-tests or regression models adjusted for age and school (linear regression for BMD, Poisson regression for BSI).

**RESULTS:**
62 male runners (76.5%) and 47 female runners (59.5%) had participated in at least one sport in addition to running/track and field events prior to college. Soccer and basketball were the most common sports played in women and men. At baseline, women who participated in multiple sports had faster mile times (4:53 vs 5:11, p<.05), whereas male multi-sport athletes did not (4:12 vs. 4:14). All but 7 multi-sport athletes had participated in at least one high-impact or multi-directional sport. For women, prior participation in high-impact sports was associated with nearly a 0.5 std deviation increase in total body BMD (Z= -0.49, p=0.047); in contrast, the effect in men was small (Z= -0.12, p=.65). In terms of prospective BSI risk for women, prior participation in basketball was associated with a relative risk (RR) of 0.50 (0.28-0.91, p=0.023) whereas participation in gymnastics was associated with a RR of 1.99 (1.21-3.36, p=.007). For men, cycling was significantly associated with an increased risk of prospective BSI with a RR of 4.33 (2.18-9.5, p<0.001) however the N was small (66 male cyclists).

**CONCLUSIONS:** For female collegiate distance runners, prior participation in non-running sports was associated with higher baseline BMD. Thus, encouraging youth to participate in multiple sports may have skeletal benefits.

**2017 Board #278 May 31 3:30 PM - 5:00 PM Effects Of A 12-week Cycling Training Program On Clinical Parameters In Patients With Parkinson Disease Zinta Zarins1, Gary Smith1, Robert Sallis, FACSM1. Kaiser Fontana, Fontana, CA. 2Pomona College, Claremont, CA. (Sponsor: Dr. Robert Sallis, MD, FACSM) (No relevant relationships reported)

**PURPOSE:** We examined the effects of endurance training [12 week, 3 days/week, 45 min/session, 60-75% of age-adjusted maximum heart rate, targeted rpm of 80-90] on change MDS-UPDRS Unified Parkinson’s Disease Rating Scale) score in patient with mild to moderate Parkinson’s Disease (n=12, 7±12.2 years duration of Parkinson’s Disease). We also looked at changes in body composition, resting blood pressure and heat rate, five-times sit to stand test, and timed up and go test. **METHODS:** The 12 subjects recruited for the study had an average BMI of 24.39±1.13 and were weight-stable. The exercise intervention was supervised and consisted of pedaling on a stationary bike 3 days/week for 45 minutes and intensity of exercise training was gradually increased such that by the second week the subjects were exercising at 60-75% of their age-adjusted maximum heart rate and pedaling at a target rpm of 80-90. Body composition was analyzed using the InBody270. **RESULTS:** Subjects attended an average of 76.9% of the training sessions and trained at an average of 64.7% of their age-adjusted maximum heart rate and cycled at an average of 78.3 rpm. With regards to testing time, there was no significant difference in the time since the last levodopa dose. While all of the UPDRS III components decreased after training, there was only a statistically significant decrease in UPDRS I (pre-training=11.5±3.11, post-training=9.50±1.58, p<0.01), UPDRS III (pre-training=20.83±4.17, post-training=7.91±2.22, p<0.01), and the total UPDRS (pre-training=51.07±5.6, post-training=32.41±6.75, p<0.01). Four of the 12 subjects in the study were unable to maintain the average target rpm goal of 80-90, but were still noted to have significant clinical improvements with training. There was no significant change in body composition, five times sit to stand, or get up and go testing. Diastolic blood pressure significantly decreased after training (pre-training=77.08±1.88, post-training=65.91±1.85, p<0.01). **CONCLUSION:** These results suggest that in patient’s with mild to moderate Parkinson’s Disease a cycling endurance training program 1) significantly improves the total UPDRS by 36% and UPDRS III by 62% improvement in UPDRS III score was irrespective of the average rpm.
D-76  Clinical Poster/Reception  -  Clinical Poster Reception

Thursday, May 31, 2018, 5:45 PM - 6:45 PM
Room: Hyatt-Lakeshore C

2021  Board #1

Chest Pain and Palpitations - Lacrosse

Elizabeth E. Barton  -  (Sponsor: Kyle J. Cassas, FACSM), Vicki R. Nelson, Irfan M. Asif, Steadman Hawkins Clinic of the Carolinas, Greenville Health System, Greenville, SC.

(History and previously published data include, environment of screening, screening tool used, and level of collegiate play. More cross-sectional studies are needed to better elucidate rates of depression in our student-athlete population across all divisions.

2020  Board #281

Comparison of Running Mechanics in Healthy Female Runners Versus Those with Sacroiliac Pain

Kristin E. Schwarz, Dui Sugimoto, Charles A. d’Hermecourt, Duncan A. d’Hermecourt, Pierre A. d’Hermecourt, FACSM.

1 Boston Children’s Hospital, Boston, MA. 2 The Michelli Center for Sports Injury Prevention, Waltham, MA. (Sponsor: Pierre d’Hermecourt, FACSM)

(No relevant relationships reported)

BACKGROUND: Injuries to the back, pelvis, hip, and thigh have been reported to account for 25-35% of all injuries sustained by runners. Repetitive torsional forces, shear stress, and inflammation can cause deleterious effects and pain in the sacroiliac (SI) joint. SI joint pain is more common among women, in part due to gender-related anatomic differences. Research on the gait mechanics of female runners with SI joint pain has been limited to date. PURPOSE: To identify running gait mechanical differences between healthy female runners and those with SI joint pain. METHODS: Retrospective case-control running gait video analysis was performed. Runners who had completed video gait analysis and who had been diagnosed as SI joint pain were identified by chart review. Diagnosis was made either by positive response to SI joint injection (i.e. resolution of pain after ultrasound-guided SI joint injection with a mixture of anesthetic and steroid) and/or 2 or more positive physical exam provocative tests for SI joint pain. Based on the runner’s age, height, mass, and BMI, matched healthy female runners were designated as control. Running mechanics at point of initial contact during the stance phase of the gait cycle were measured from side view (sagittal plane) of runners on a treadmill. Measurements included: foot strike angle, ankle angle, stride length, hip angle, and trunk posture angles. Foot strike pattern (i.e. rearfoot, midfoot, or forefoot) was documented. Videos were analyzed by an experienced sports medicine physician. RESULTS: There were 19 female runners with SI joint pain and 63 healthy female runners in the control group. Runners with SI joint pain demonstrated significantly greater foot strike angles and ankle angles than those without. Those with SI joint pain also had smaller ankle angles than healthy runners. There were no significant differences between overstride angles, knee angles, hip angles, or trunk posture angles. There were no significant differences in foot strike patterns between the two groups. CONCLUSIONS: Female runners with SI joint pain demonstrated greater ankle dorsiflexion at the point of initial contact during stance phase compared to healthy runners. This suggests a potential role for gait retraining in the treatment and prevention of SI joint pain.

2022  Board #2

Cotton Mouth In A Cross Country Runner

Jason A. Kirkbride  -  (Sponsor: John MacKnight, FACSM), Siobhan Statuta. University of Virginia, Charlottesville, VA.

(No relevant relationships reported)

HISTORY: A 21-year-old Division I cross-country runner presented to the athletic training room the day he was to leave for ACC championships, concerned about his intolerable dry mouth, leg heaviness and worsening fatigue. He had an unintended weight loss of 15 pounds despite working with Sports Nutrition over the summer due to a baseline BMI of 17.9 and a history of a sacral stress fracture the prior year. He endorsed normal eating pattern, but often felt full secondary to increased fluid intake from his dry mouth. Over the past few days, he also noted the onset of blurry vision. His only medication was an Omega-3 supplement and he denied a family history of autoimmune diseases, but did have an uncle with Type II diabetes mellitus.


DIFFERENTIAL DIAGNOSIS: Relative energy deficiency in sport Overtraining syndrome Thyroid disease Anemia Viral illness/ Mononucleosis Diabetes Mellitus Type I Malignancy Diabetes Mellitus Type II Malignancy Insipidus

TEST AND RESULTS: Urinalysis: Color yellow, Appearance Clear, Specific Gravity 1.035, pH 6.5, Protein Neg., Glucose 3+, Ketone Moderate, Bilirubin Neg., Blood Neg., Nitrite Neg., Leukocyte esterase neg. CBC: WBC 7.3, Hgb. 16.6, Hct. 46, MCH, 77.2, MCV 95.8, MPV 7.2, RDW 14.3, Platelet 249. ESR 7 Ferritin 224 HIV Non-reactive Hgb. A1c 13.6, ALT 67, AST 35, Anion Gap 15 TSH 0.27, Free T4 0.9, Free T3 1.5 CRP 0.2 ESR 7 Ferritin 224 HIV Non-reactive Hgb. A1c 13.6

FINAL WORKING DIAGNOSIS: New onset Diabetes Mellitus Type 1 in diabetic ketoacidosis

TREATMENT AND OUTCOMES: Urgent transport to the emergency department for DKA management including insulin and intravenous fluids with several day admission. Endocrinology work-up in process. Plan to follow weekly x 6 weeks and held from sport the remainder of the semester.
He’s been migraine free since 2 months post-op. He takes Indomethacin as needed. Follow up scheduled for 6 months post-operation.

2025 Board #5
Forearm Pain- Gymnastics
Melissa Faubert¹, Holly Benjamin, FACSM², Daniel Mass³.
¹NorthShore University HealthSystem/University of Chicago, Chicago, IL. ²University of Chicago, Chicago, IL.
(No relevant relationships reported)

HISTORY: 14 year old right handed level 8 gymnast presents with complaints of progressive right greater than left elbow and forearm pain over the past four months. Despite bracing, activity modification and three months of physical therapy she still reported progressive worsening of pain and development of tingling in her hands and forearms. She notes she has a constant feeling of tightness over her anteromedial forearms and pain and tingling of her arm occurs the worst while writing in school or vaulting. Pain and numbness resolve with a few minutes of rest and elbow extension. She does not have any nighttime pain.

PHYSICAL EXAMINATION: - Well appearing female adolescent - Full ROM of elbow, forearm, wrist and fingers - Sensation intact to light touch in the radial, medial, and ulnar nerve distribution bilaterally - 5/5 strength in the radial, medial, ulnar, anterior interosseous and posterior interosseous nerves bilaterally - Mild TTP of proximal forearm and medial elbow bilaterally - Positive compression test at the proximal forearm - Positive Tinel’s test over the pronator teres - Positive Tinel’s test over cubital tunnel - Negative Tinel’s, Durkan’s and Phalen’s at the wrist bilaterally.

DIFFERENTIAL DIAGNOSIS: Pronator syndrome - Cubital tunnel syndrome - Chronic exertional compartment syndrome of the forearm - Anterior interosseous nerve syndrome - Brachial plexus neuritis - Cervical radiculopathy.

TESTS AND RESULTS: MRI elbow Left: MRI findings normal but noted presence of accessory anconeus epicondylaris muscle. MRI elbow Right: Normal MRI.

DIFFERENTIAL DIAGNOSIS: Pronator syndrome bilaterally. Left arm with accessory anconeus epicondylaris muscle also causing ulnar neuropathy.

TREATMENT AND OUTCOMES: Patient’s older sister previously had pronator syndrome as well as chronic exertional compartment syndrome for which she underwent median nerve release and fasciectomy. Patient and her parents elected to forgo compartment testing suspecting she also had both conditions. She underwent surgery on her left elbow with a median nerve release, ulnar nerve release and fasciectomy. She is due to have surgery on her right arm for median nerve release and fasciectomy three weeks after her left.

2026 Board #6
Low Back Pain - Recreational Soccer Player
Sean Matsuwaka, Brian Liem. University of Washington, Seattle, WA.
(No relevant relationships reported)

HISTORY: A 21-year-old female recreational soccer player presented with intermittent right-sided low back pain for two years. She denied any trauma or inciting event. Pain was localized to the right lumbosacral region without radiating leg pain and was described as dull and aching. It was rated on average 5/10 on a numerical rating scale and associated with nausea when pain worsened. Symptoms were worse with prolonged sitting, and several times in the last month she reported waking up at night with a feeling of typical pain with alcohol intake. She denied leg weakness, numbness, or bowel/bladder dysfunction. She participated in six weeks of physical therapy, which helped with nausea and pain with sitting, but she continued to have pain with alcohol consumption.


TESTS AND RESULTS: 1. Lumbar spine X-rays: -Normal alignment, normal vertebral body and disc space height -Partial lumbarization of S1 vertebral body -Five degrees of lumbar dextroscoliosis 2. MRI lumbar spine: -Lumbarization of S1 vertebral body -Normal disc height and signal -Normal central canal and neural foramen size throughout lumbar spine -T1/T2 hyperintensity within S2 vertebral body, likely lipoma -Increased T2 signal medial to right kidney suggestive of hydromephrosis 3. Renal ultrasound-Moderate right hydromeephrosis with extrarenal pelvis. No nephrolithiasis. 4. Renogram with furosemide: -Right kidney with blunted flow and delayed clearance improved slightly with furosemide, consistent with partial obstruction at right ureteropelvic junction

FINAL/WORKING DIAGNOSIS: Ureteropelvic junction obstruction causing Diel’s crisis

TREATMENT AND OUTCOMES: 1. Referral to urology 2. Resolution of pain and improvement in renal function after pyeloplasty
2027 Board #7  
**Chronic Medial Knee Pain in a Collegiate Basketball Player and Marching Band Member**  
Nicholas E. Anastasio-(Sponsor: Robert Wilder, MD, FACSM), David Hryniak.  
University of Virginia, Charlottesville, VA.  
(No relevant relationships reported)  

**History:**  
Patient 1:  
A 17 year-old female collegiate basketball player presented with insidious onset right medial knee pain for the last 8 months. Pain waxed and waned with activity. No history of swelling, instability or locking. No numbness or weakness. Pain located diffusely over the medial knee and proximal medial tibia. Symptoms refractory to PT, patellofemoral kinesiotaping, medial arch support orthotics and NSAIDs. No relief following Medrol dose pack, intraarticular corticosteroid injection, or pes anserine bursa corticosteroid injection.  

Patient 2:  
A 19 year-old female collegiate marching band member presented with insidious onset right medial knee pain present for 4 years. Patient reported intermittent swelling but denied instability or locking. Symptoms were worse with walking and marching. Previous Rheumatologic consult unrevealing. Symptoms refractory to PT, knee sleeve, and patellar straps. No relief following right pes anserine bursa corticosteroid injection.  

**Physical Examination:**  
Patient 1:  
- Knee without effusion. Diffuse tenderness to palpation over the medial knee at and below mid medial joint line. ROM and strength normal. No laxity. Neurovascular intact.  
- MRI knee - No meniscus tear. No internal derangement. Mild increased T2 signal.  

Patient 2:  
- Knee without effusion. Tenderness to palpation over the medial joint line and distally over pes anserine. Time's sign positive over the medial femoral condyle. ROM and strength normal. No laxity. Neurovascular intact.  

**Differential Diagnosis:**  
1. Pes anserine bursitis  
2. MCL injury  
3. Patellofemoral syndrome  
4. Medial meniscal tear  
5. Medial patellar plica  
6. Saphenous neuralgia  

**Test and Results:**  
**Patient 1:**  
- **XR Knee:** No fracture or joint effusion.  
- **MRI Knee:** No meniscus tear. No internal derangement. Mild increased T2 signal within the superior lateral aspect of Hoffa’s fat.  
- **Diagnostic saphenous nerve block:** 0.5% bupivacaine injected 2 inches cephalad to the medial joint line - 24 hours of relief.  
- **XR Knee:** No fracture or malalignment.  
- **MRI Knee:** Unremarkable MRI of the knee.  
- **Labs:** - ESR 8, TSH 1.7  

**Final/Working Diagnosis:**  
Saphenous Neuralgia  

**Test and Outcomes:**  
**Patient 1:**  
- Saphenous nerve injection - 40 mg triamcinolone/0.5% bupivacaine - 5 months of relief.  
- US guided hydrodissection saphenous nerve - Full resolution for 1.5 years.  

**Patient 2:**  
- US guided hydrodissection saphenous nerve - 6 months of relief.  

2028 Board #8  
**Are Subconcussive Impacts Harmless in Youth Soccer Players?**  
Luis R. Lopez-Roman1, Yarimar I. Diaz-Rodriguez2.  
1Universidad del Sagrado Corazon, San Juan, PR. 2Universidad del Turabo, Gurabo, Puerto Rico.  
(No relevant relationships reported)  

In United States at least 3.5 million children play soccer yearly. Head Impact (concussive and subconcussive) in youth players have a growing concern throughout their short or long-term career. A subconcussive impact may induce a traumatic alteration of function of the cerebrum without associated imaging abnormalities or loss of consciousness. Accelerometers can measure the magnitude and quantity of the subconcussive impacts in the field. The SIM-G™ accelerometer is a small portable device that measures change in velocity during an impact and provides estimates of magnitude (G) and angles. The ImPACT Pediatric® is a neurocognitive test that provide information of cognitive changes. **PURPOSE:** To evaluate if a subconcussive impact could lead to negative cognitive functions in youth soccer players.  

**METHODS:**  
- A group of 30 youth soccer athletes (15 males, 15 females) between 9 to 11 years old wear a head accelerometer in a specialize headband. Each participant was encouraged to perform normally in the game. Descriptive statistics was used to assess subconcussive impacts. T-test was used for the neurocognitive pre and post-test to assess differences in sequential memory, word memory, visual memory and rapid processing. **RESULTS:** Mean age of female and male athletes (9.9 ± 0.6 years) was not different (P > 0.05). A total of 42 impacts were receive by both genders in three games. Range of acceleration was from 16g to 60g (Ave= 23.8 ± 9.1g). T-Test showed differences in sequential memory for female (p = 0.02) and rapid processing for males (p = 0.01). There were no differences between pre and post test in word memory for females and males (p = 0.97, p = 0.11; respectively) and visual memory (p = 0.30, p = 0.34; respectively). **CONCLUSION:** These results suggest that females that play soccer and receive a subconcussive impact can reflect changes in their education and social activities at short term in their word recognition, oral reading and reading comprehension (sequential memory) and males in their auditory processing and language skills (rapid processing). Parents, coaches, trainers, exercise physiologists, and speech-language pathologists (SLP) should receive education to take precautions after a game with children that received at least one sub concussive impact and do not perceived any notable changes.  

2029 Board #9  
**Test Setting and ADHD Influence Baseline Concussion Testing Neurocognitive Performance in Collegiate Student-Athletes**  
Caroline A. Kelly, Caroline J. Ketcham, Kirtida Patel, Eric E. Hall, FACSM.  
Elon University, Elon, NC.  
(No relevant relationships reported)  

Immediate Post-Concussion Assessment and Cognitive Test (ImPACT) is a widely used neurocognitive test for assessing and managing concussion injuries. There is inconclusive data on how test administration and environment influence baseline results for student-athletes. It has been well established that individuals with Attention Deficit Hyperactivity Disorder (ADHD) perform worse on the ImPACT, but little research has examined the effect of group test administration on neurocognitive performance and symptom reporting in student-athletes with ADHD. **PURPOSE:** To compare baseline neurocognitive performance and symptom scores in group versus individual administration settings in NCAA division 1 collegiate student-athletes. **METHODS:** 260 student-athletes completed two ImPACT baseline tests, test was completed when they entered as first-year students or transfers and test 2 was completed this past summer. Of these participants, 205 athletes took test 1 individually and 55 participants took it in a group setting. All student-athletes took test 2 in a group setting. 21 of the 260 student-athletes had a diagnosis of ADHD. **RESULTS:** A 2 (time) x 2 (environment) x 2 (ADHD) Multivariate ANOVA was conducted. Test (test 1 and test 2) was within subjects and Environment at test 1 (individual and group) and ADHD (yes or no) were between subject variables. **RESULTS:** There was a significant increase in total number of symptoms reported when participants went from individual testing to group testing (p<0.05). Time x Environment Interaction for visual memory (p<0.05) with scores increasing from test 1 to 2 if in the group setting 1 was involved staying the same if in the individual setting for test 1. A similar effect was found for visual motor processing speed (p<0.05). Participants with ADHD performed worse on all measures no matter the setting (p<0.05). Symptom scores significantly differed for ADHD participants depending on the setting (p<0.05). **CONCLUSIONS:** A group setting has inherent distractions and seems to influence performance on sequential memory, visual motor processing speed and symptom scores. Student-athletes with ADHD may be more affected by these distractions. This should be considered in baseline concussion testing and interpreting post-injury neurocognitive performance.  

2030 Board #10  
**Jump Training Improves Psychological Impairments and Facilitates Greater Sports Participation in Athletes with ACL Reconstruction**  
Ryan L. Mizner, Audrey R. Elias.  
University of Montana, Missoula, MT.  
(No relevant relationships reported)  

**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 jumping. 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 ACLR-Return to Sport after 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 maintained over the retention period (Wk16: 81 ± 15%; *p*<0.05). Four out of 5 athletes reported 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-identified 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 sports participation because of limited confidence or high fear of reinjury. Funded in part by the Foundation for Physical Therapy.

---

2030b Board #11

**Long-term Functional Impact of Viscosupplementation Versus True Placebo in Symptomatic Hip Osteoarthritis; A Randomized Control Trial**

Jane Konidis1, Philippe Corbeil1, Antoine Cantin-Warren2, Sylvie Turnef1, Emile Cardinal-Soucy3, Remi Lacroix3, Etienne Belzile1. 1University Laval, Quebec City, QC, Canada. 2Center for Interdisciplinary Research in Rehabilitation and Social Intergration (CIRRIS), Quebec City, QC, Canada. 3University Hospital Center of Quebec (CHUQ), Quebec City, QC, Canada.

(No relevant relationships reported)

**INTRODUCTION:** Degenerative hip osteoarthritis (OA) is a common progressive disorder causing disability. The injection of exogenous hyaluronic acid (HA), or viscosupplementation (VS), can potentially help restore the properties of synovial fluid. There is little literature available evaluating the long-term effects and the functional impact of VS in hip OA. **PURPOSE:** To determine if a single intra-articular injection of a high-molecular weight (HMW) VS would improve function and decrease pain in persons suffering from hip OA. **METHODS:** A double-blinded randomized control trial was conducted at a University Hospital Center in Canada. Patients were randomly allocated to either the treatment group, an ultrasound guided single intra-articular injection of a HMW HA, or the placebo group, a single extra-articular injection of local anesthetic. Participants underwent evaluations at 2 weeks prior to the injection (T0), and at 1 month (T1), 3 months (T2) and 6 months (T3) post injection. Patients completed two questionnaires; the Hip Disability and Osteoarthritis Outcome Score (HOOS) and the 36-Item Short Form Survey (SF-36). Gait biomechanics were evaluated in a lab. **RESULTS:** Between May 2014 and September 2017, 38 participants were evaluated in this study over the course of 6 months. In the treatment group, N = 19 and in the placebo group, N = 18. The mean age at the time of injection was 55.0. On the HOOS symptom subscale, the placebo group worsened from T0 to T3 by 6.29% compared to the treatment group. The VS group improved their pain subtotal from T0 to T2 by 4.73%. The control group worsened by 1.22% during that same time and continued to deteriorate by 6.09% at T3. There were also improvements in the activities of daily living subscale from T0 to T3, with the treatment group improving by 5.29% while the placebo group worsened by 5.15%. The most important change occurred in the sports and recreational subscale of the HOOS. Between T0 and T3, the placebo group worsened by 7.611 points (-17.82%). The treatment group improved by 6.67%. **CONCLUSION:** Our preliminary results suggest that a HMW VS hip injection for degenerative OA, when compared to true placebo, may lead to long-term improvements in pain relief, increase in function and in activity participation. NIH Clinical Trials Registry: NCT02086474

---

2030c Board #12

**Lisa S. Krivickas Clinician/Scholar Travel Award - The Prevalence of Hypertension in a Population of Former Professional Football Players**

Jaime Kaplan, Genevieve E. Smith, Gregory W. Stewart, FACSM. Tulane University School of Medicine, New Orleans, LA.

(No relevant relationships reported)

**OBJECTIVE:** There is substantial data suggesting that former professional football players have considerable cardiovascular disease risk. The objective of this study was to better understand the prevalence of hypertension, a major risk factor for cardiovascular disease, in former professional football players. **DESIGN:** Data including blood pressure, height, and weight were collected from 981 former professional football players between April 2015 and May 2017 during cardiovascular screening events held throughout the U.S. Demographic information was collected from all subjects, including age, race, previous hypertension diagnosis, and treatment. Means were analyzed using one-way ANOVA, Chi square, or paired T-tests where appropriate. **RESULTS:** Pre-hypertension was greatest for former players aged 20-59, with almost 50% of those aged 20-39 pre-hypertensive at screening. Hypertension was greatest in former players aged 60+, with more than 50% of those individuals hypertensive at screening, over 20% of those 20-39 were hypertensive. White former players aged 60+ had the lowest prevalence of pre-hypertension. Hypertension prevalence was only significantly different between age-specific racial groups at age 40-59. The majority of former players had a BMI ≥ 30 kg/m2, regardless of age; those with normal BMI were least likely to be hypertensive. Over 30% of former players reported previous hypertension diagnosis, with approximately 75% of those diagnosed reporting treatment. Of those former players that reported treatment, most had poorly controlled blood pressure at the time of screening. Of former players that reported no hypertension diagnosis, 41% had elevated blood pressure at screening. Former players aged 30-39 had the highest prevalence of previously undiagnosed elevated blood pressure at screening. **CONCLUSIONS:** Hypertension is a serious concern for former professional football players, even those considered to be younger and at decreased risk. This may be related to the high BMI typically associated with these athletes. Blood pressure control in those reporting diagnosis is also a concern, as the majority of those men had high blood pressure at screening.
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 hormonally 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.

E-02 Highlighted Symposium - The Respiratory System in Heart Failure

Friday, June 1, 2018, 9:30 AM - 11:30 AM
Room: CC-101AB

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 hormonally 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)

2033 Chair: Bruce D. Johnson. Mayo Clinic, Rochester, MN.
(No relevant relationships reported)

2034 June 1 9:35 AM - 9:55 AM
Keynote -
Bruce D. Johnson. Mayo Clinic, Rochester, MN.
(No relevant relationships reported)

2035 June 1 9:55 AM - 10:10 AM
Precapillary Pulmonary Hypertension in Heart Failure: Potential Cause and Consequences
Bryan J. Taylor1, Barry A. Borlaug2, Robert P. Frantz2, Andrew D. Miller1, Thomas P. Olson, FACSM2, Bruce D. Johnson2.
1Mayo Clinic, Rochester, MN. University of Leeds, Leeds, United Kingdom. 2Mayo Clinic, Rochester, MN. (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 catheterization were studied. Blood was drawn for the determination of PaO2, SaO2, and modified Campbell diagrams. RESULTS: Dynamic lung compliance was lower in CpcPH compared to no PH and IpcPH (78 ± 11 mmHg and 80 ± 11 mmHg vs 82 ± 10 mmHg, P<0.05). TPG was inversely related to PaO2, PvO2, SaO2, and SvO2 in the CpcPH only group (r ≤ -0.557; P < 0.05). Similarly, plasma endothelin-1 correlated with PaO2, PvO2, SaO2, and SvO2 in the CpcPH only group (r ≤ -0.557; P < 0.05). TPG was inversely related to PaO2, PvO2, SaO2, and SvO2 in the CpcPH only group (r ≤ -0.557; P < 0.05). TPG was inversely related to PaO2, PvO2, SaO2, and SvO2 in the CpcPH only group (r ≤ -0.557; P < 0.05).

2036 June 1 10:10 AM - 10:25 AM
Manipulation of Intrathoracic Pressure Improves Stroke Volume During Exercise in Patients with Heart Failure
Sophie Lalande1, Andrew D. Miller2, Bruce D. Johnson2.
1The University of Texas at Austin, Austin, TX. 2Mayo Clinic, Rochester, MN. 3Mayo Clinic, Rochester, MN. (No relevant relationships reported)

Exercise accentuates within-breath fluctuations in intrathoracic pressure (ITP). The more negative ITP during inspiration increases left ventricular (LV) preload and afterload while the more positive ITP during expiration decreases LV preload and afterload. In healthy individuals, the more negative ITP generated during exercise is necessary to maintain an optimal LV preload and, consequently, stroke volume (SV). Curiously, patients with heart failure avoid breathing at high lung volumes and display large positive expiratory ITPs during exercise. In heart failure, a decreased LV compliance results in an increased sensitivity to changes in LV afterload, a decreased sensitivity to increased LV preload and a resulting inability to augment SV through decreases in LV preload and afterload. PURPOSE: To investigate the effect of a less negative inspiratory and a more positive expiratory ITP on SV during moderate-intensity exercise in patients with heart failure and reduced ejection fraction (HRFREF) and healthy individuals. METHODS: SV was obtained by echocardiography during 2 min of spontaneous breathing (SB), two progressive levels of inspiratory unloading (UL1 and UL2) using a ventilator and during expiratory loads of 5 and 10 cmH2O produced by a ventilator in 11 patients with HRFREF (61 ± 9 years, EF: 32 ± 4 %, NYHA class II-III) and 11 aged-matched healthy individuals during exercise at 60% of maximal aerobic capacity on a semi-recumbent cycle ergometer. RESULTS: During exercise, inspiratory unloading decreased SV indexed to body surface area (SVI) in healthy individuals (S: 44 ± 7, UL1: 41 ± 5, UL2: 40 ± 4 mmHg/m2) while it increased SVI (S: 41 ± 7, UL1: 43 ± 7, UL2: 44 ± 5 mmHg/m2, p = 0.02) in patients with HRFREF. Expiratory loading increased SVI in patients with HRFREF (S: 43 ± 6, 5: 45 ± 3, 10: 44 ± 6 mmHg/m2) but decreased SVI in healthy individuals (S: 44 ± 8, 5: 40 ± 10, 10: 39 ± 5 mmHg/m2, p<0.05). CONCLUSION: Inspiratory unloading and expiratory loading elicited increased SV in patients during moderate-intensity exercise in patients with HRFREF, possibly due to beneficial reductions in LV afterload and preload.

2037 June 1 10:25 AM - 10:40 AM
Breathing With Heart Failure: How Hard Can It Be?
Troy J. Cross1, Surendran Sabapathy3, Ken C. Beck1, Norman R. Morris1, Bruce D. Johnson2,3, Griffith University, QLD, Australia. Mayo Clinic, Rochester, MN. 2Mayo Clinic, Queensland, Australia. 3Mayo Clinic, Rochester, MN. (No relevant relationships reported)

The syndrome of heart failure (HF) is often accompanied by numerous derangements in ventilatory function. These pathophysiological changes in ventilatory function are believed to augment the mechanical work required to breathe during exercise (Wb). However, the precise contributions of resistive and elastic work to this overall higher Wb in HF remain unclear. PURPOSE: To quantify the resistive and elastic components of Wb during exercise in HF patients and age-matched, healthy controls at standardized levels of minute ventilation (VE). METHODS: The elastic and resistive Wb were assessed in 9 male HF patients (NYHA class I-III) and 9 age-matched, healthy male controls at minute ventilations of 20, 40, 60 and 80 L·min⁻¹ during graded exercise. RESULTS: Dynamic lung compliance was lower across all minute ventilations in HF patients (P<0.05). Moreover, the inspiratory and expiratory resistive Wb was higher in HF patients compared with controls at any given (P<0.05). The inspiratory elastic Wb was higher at minute ventilations of 40-60 L·min⁻¹ during exercise in HF patients. (P<0.05). CONCLUSION: The findings of this study indicate that the overall higher Wb in HF patients may be more so related to greater amounts of resistive than elastic Wb during exercise.

2038 June 1 10:40 AM - 10:55 AM
The Link between Muscle Mass, Afferent Feedback and Ventilatory Control in Heart Failure
Manda L. Keller-Ross1, Bruce D. Johnson2, Rickey E. Carter1, Michael J. Joyner, FACSM1, John H. Eisenach1, Timothy B. Curry1, Thomas P. Olson, FACSM1. 1University of Minnesota, Minneapolis, MN. 2Mayo College of Medicine, Rochester, MN. 3Kaiser Permanente, Denver, CO. (No relevant relationships reported)

Skeletal muscle afferent feedback modulates ventilatory control during exercise. Skeletal muscle atrophy in patients with heart failure (HF) may contribute to increased...
affluent feedback which can lead to high ventilation to carbon dioxide production (VE/ 
\( \text{VCO}_2 \)) slope. Low peak oxygen consumption (VO2 peak) and high VE/ 
\( \text{VCO}_2 \) 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/ 
\( \text{VCO}_2 \) with affluent 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
duo 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 (34.6±3.0 
and 26.3±1.8%) and leg muscle mass was lower in HF (63±2.8 and 70.4±1.8%, 
respectively, p<0.05). VE/ 
\( \text{VCO}_2 \) slope was reduced in HF during affere blockade 
compared with CTL (18.8±2.7 and -1.4±2.0%, respectively, p<0.02). The reduction 
in VE/ 
\( \text{VCO}_2 \) was positively associated with leg muscle mass (r=0.58, p<0.01) and 
negatively associated with fat mass (r=0.73, p<0.01) in HF in addition. The reduction 
in VE/ 
\( \text{VCO}_2 \) was also positively associated with arm fat mass and total muscle mass (p<0.01). Importantly, there was a strong relationship between peak VO2 and the 
reduction in VE/ 
\( \text{VCO}_2 \) slope in HF (r=0.87, p<0.01), 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/ 
\( \text{VCO}_2 \) with afferent blockade. Both muscle mass and 
fat mass are important contributors to ventilatory abnormalities and strongly associated to 
improvements in VE/ 
\( \text{VCO}_2 \) slope with locomotor afferent inhibition in HF. This 
indicates a strong link between muscle atrophy, skeletal muscle afferent activation and 
ventilatory control in HF.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Instructors (n=6)</th>
<th>FF (n=2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR Peak (b(^{-1}))</td>
<td>183 ± 15</td>
<td>188 ± 19</td>
</tr>
<tr>
<td>HR Mean (b(^{-1}))</td>
<td>114 ± 14</td>
<td>116 ± 11</td>
</tr>
<tr>
<td>EST Tco Peak(°C)</td>
<td>38.3 ± 0.4</td>
<td>38.6 ± 0.5</td>
</tr>
<tr>
<td>EST Tco Mean (°C)</td>
<td>37.7 ± 0.4</td>
<td>37.8 ± 0.3</td>
</tr>
<tr>
<td>Values are means ± SD, EST = estimated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2051 Board #2 June 1 9:30 AM - 11:30 AM Cardiorespiratory Responses to the USFS Wildland Firefighter Arduous Pack Test
Christopher J. Alifero, Charles L. Dumke, Brent C. Ruby, FACSM, Matthew W. Bundle. University of Montana, Missoula, MT. (Sponsor: Brent Ruby, FACSM) (No relevant relationships reported)

Cardiorespiratory Responses to the USFS Wildland Firefighter Arduous Pack Test
Alifero CJ, Dumke CL FACSM, Ruby BC FACSM and Bundle MW University of Montana

US wildland firefighters administer over 30 000 physical tests per year to qualify candidates for the occupational demands of fire suppression. The primary assessment is the arduous pack test (APT) a 4.83 km hike that must be completed in 45 min while wearing a 20.45 kg pack. Delivery of individual feedback to guide the physical training of candidates is hampered by two factors; first, passing the pack test is widely considered the minimum performance level necessary for this occupation, and second, the binary nature of the assessment presents candidates with a task representing an unknown and self-selected exercise intensity.

PURPOSE: To determine the cardiorespiratory response elicited by the APT within a subject population whose aerobic capacity and body masses vary. METHODS: 63 young (age = 22.8±3.2 yrs) adults (37 males, M= 81.2±9.4 kg; 26 females, M= 63.6±8.5 kg; study range: 55.6-100.0 kg) performed the APT and subsequently underwent a hiking inclined-treadmill test to VO\(_{2\text{peak}}\) while wearing a skin mounted heart rate (HR) monitor and 20.45 kg pack. RESULTS: 50 of the 63 subjects achieved the 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 VO\(_{2\text{peak}}\) values of the passing and non-passing groups were 49.4 ± 7.2 and 42.6 ± 9.6 mlO\(_2\) kg\(^{-1}\) \(\text{min}^{-1}\), respectively; the study range was 62.1 to 30.8 mlO\(_2\) kg\(^{-1}\) \(\text{min}^{-1}\). 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\(_{\text{max}}\), 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 VO\(_{2\text{peak}}\) 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 HR\(_{\text{max}}\) 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.

2052 Board #3 June 1 9:30 AM - 11:30 AM Accelerometer-based Physical Activity And Sedentary Time Assessment In Brazilian Wildland Military Firefighters - Brasilia Firefighters Study
Daniel Saint Martin¹, Leonardo Coreia Segedi², Edgard Von Koenig Soares³, Rosenkranz Maciel Nogueira⁴, Keila Elizabeth Fontana⁴, Maria Korre⁴, Guilherme Eckhardt Molina⁴, Denise L. Smith⁵, Stefanos N. Kales⁶, Luiz Guilherme Grossi Porto⁷, ¹University of Brasilia and GEAFS, Brasilia, Brazil. ²University of Brasilia, Brasilia Fire Department and GEAFS, Brasilia, Brazil. ³Harvard T.H. Chan School of Public Health, Boston, MA. ⁴Department of Health and Exercise Sciences, Skidmore College, Saratoga Springs, NY. ⁵University of Brasilia, ⁶Harvard T.H. Chan School of Public Health, Boston, MA, ⁷GEAFS, Brasilia, Brazil. (No relevant relationships reported)

Wildland firefighting is characterized by outdoor duties that include long walks and high physical demands. The Brasilia Fire Department Environmental Protection Brigade (EPB) is a wildland fire suppression specialized unit that also perform other duties, such as rescues. PURPOSE: To objectively evaluate the physical activity level (PAL) and sedentary time (ST) of wildland firefighters during a routine 24-hour on-
PA: physical activity; MVPa: Moderate to vigorous physical activity

CONCLUSIONS: On average, wildland firefighters spent ≥180min on MVPa during a routine 24h shift-work. Including night rests, almost half of on-duty period was of sedentary behavior (SB). More than 50% of the time was mainly spent on light activities but interspersed with MVPA. Almost 80% of the firefighters had at least one episode of MVPa during a routine work period. Those who responded to an episode of wildland fire accumulated more MVPa than those involved only in other firefighters’ routine duties.

Funding: CNPq 480092/2013.3

2053 Board #4 June 1 9:30 AM - 11:30 AM
The Relationship Between Firefighters’ Physical Activity Levels and Cardiorespiratory Fitness
Allison M. Barry1, Nathan D. Dicks1, Kassiaan D. Landin1, Tanis J. Walsh1, Kyle J. Hackney1, Katie J. Lyman1, North Dakota State University, Fargo, ND. 1University of North Dakota, Grand Forks, ND. (Sponsor: Donna J. Terbizan, FACSM)

(No relevant relationships reported)

Improved physical activity (PA) and cardiorespiratory fitness (CRF) levels are necessary for firefighters to adequately perform strenuous occupational demands. These demands have been associated with increased cardiovascular events leading to disability and death. Sudden cardiac death accounted for 44% of all annual on-duty deaths in U.S. firefighters from 1995-2004. Thus, the National Fire Protection Association (NFPA) has made it a priority to emphasize PA levels in order to maintain an adequate CRF.

PURPOSE: The purpose of the study was to investigate the relationship between sedentary behavior (SB), light physical activity (LPA), and moderate-to-vigorous physical activity (MVPa) to CRF in career firefighters. METHODS: Firefighters were an accelerometer for eight consecutive on- and off-duty days. The accelerometer was worn on the right hip and tracked SB, LPA, and MVPa. Freedson’s (1998) cut points for sedentary behavior (SB), light physical activity (LPA), and moderate-to-vigorous physical activity (MVPA) were used. Additionally, each participant completed a stage-graded exercise test to determine maximal oxygen uptake ($VO_2max$). $VO_2max$ was also estimated using self-reported physical activity rating and a non-exercise regression equation. Pearson’s correlations were performed between the PA components and $VO_2max$ as well as between estimated and actual $VO_2max$.

RESULTS: Preliminary results (n=9) for total wear time for the accelerometer was 920 (min) with 58.8% SB, 37.7% LPA, and 3.6% MVPa. There were no significant correlations between $VO_2max$ and SB ($r$ = -0.18, $P = 0.637) or LPA ($r = 0.33$, $P = 0.388$). Further, there was no significant correlation between estimated (45.2 ± 7.5) and actual $VO_2max$ ($r$ = -0.18, $P = 0.637$). There was a statistically significant correlation between $VO_2max$ and MVPa ($r$ = 0.74, $P = 0.022$). CONCLUSION: The initial results suggest that firefighters are meeting ACSM’s PA guidelines but are not meeting the NFPA’s minimal CRF recommendation of 42 ml/kg/min. Therefore, further research is necessary in order to make recommendations regarding PA and CRF for active firefighters. Twenty-one additional firefighters are expected to complete the study for a total sample of 30.

2054 Board #5 June 1 9:30 AM - 11:30 AM
Physical Factors Associated with Tower Stair Climbing in Firefighter Recruits
Kyle T. Ebersole1, Cody S. Tesch2, Robert J. Flees3, Michael H. Haisher1, Edward K. Smith1, David J. Cornell1, 1University of Wisconsin-Milwaukee, Milwaukee, WI. 2City of Milwaukee Fire Department, Milwaukee, WI. (Sponsor: Terry Housh, FACSM)

(No relevant relationships reported)

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.

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) volunteered to participate. The recruits completed 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 ($VO_2max$) via a submaximal step-test; functional movement quality via a movement efficiency screen (MES); and time to complete a 5-story tower climb test ($Tow_{climb}$). Heart rate (HR) was recorded immediately after the tower-climb (HR$_{top}$), 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 Time$_{c}$ and all the physical fitness and performance factors measured. RESULTS: Statistically significant (P < 0.05) correlations were identified for $Tow_{climb}$ (r = 0.563, P = 0.0019), Bench (r = -0.571, P = 0.017), Pass (r = -0.549, P = 0.023), Push (r = -0.532, P = 0.028), $VO_2max$ (r = -0.560, P = 0.019), HR$_{top}$ (r = -0.611, P = 0.009), and HR$_{Squa}$ (r = -0.638, P = 0.002). Non-significant (P > 0.05) correlations were identified for Squat (r = 0.488, 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 $VO_2max$), 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$^{-2}$] performed three maximal concentric isokinetic leg extensions on a calibrated isokinetic dynamometer at slow (1.05 rad·sec$^{-1}$), fast (4.19 rad·sec$^{-1}$) and fast (4.19 rad·sec$^{-1}$) velocities, in a randomized order. Peak torque was normalized to body mass for both velocities. Cardiovascular risk was determined based on published cutpoints 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 = normal, 2 = intermediate, 3 = high 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 $PT_{slow}$ and $PT_{fast}$ between the two groups. Two separate analyses of covariance (ANCOVA) were used to examine whether $PT_{slow}$ and $PT_{fast}$ adjusted for CFR, differed between the two groups. An alpha level was set at $P < 0.05$ for all analyses. RESULTS: There were no differences between groups for $PT_{slow}$ or $PT_{fast}$ prior to ($P = 0.130$; $P = 0.337$) 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
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 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 (e.g. 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)

---

**E-06** Thematic Poster - Moving Beyond Aerobic Exercise: New Science of Strength and Health

**Friday, June 1, 2018, 9:30 AM - 11:30 AM**

Room: CC-Lower level L100C

**Chair:** Duck-Chul Lee, FACSM. Iowa State University, Ames, IA.

(NO relevant relationships reported)

---

**2056 Board #7** June 1 9:30 AM - 11:30 AM

**The Influence of Age and Adiposity on Functional Balance Performance in Career Firefighters**


(NO relevant relationships reported)

---

**Purpose:** Low levels of grip strength in adults independently predict cardiovascular disease and type 2 diabetes. However, longitudinal evidence spanning child to adulthood is sparse. This study examined the association between childhood grip strength and adult metabolic syndrome (MetS). **Methods:** Longitudinal study examining participants who had grip strength, cardiorespiratory fitness (CRF), physical work capacity at 170 beats per minute), and waist circumference measured in childhood (9, 12, 15 years) and who had measures of MetS taken 20 years later. Child grip strength was categorised according to age-and sex-specific cut-points proposed by Catley and Tomkinson (2013) based on Australian normative data (very high, high, average, low, very low). Waist circumference, blood pressure, HDL cholesterol, triglycerides, and glucose were measured in adulthood and MetS was defined using the harmonised definition and a continuous MetS risk score. **Results:** Children with very low or low grip strength were at six times increased risk of MetS and had a higher continuous MetS risk score in adulthood independent of CRF (RR=6.00, 95% CI=2.53, 14.19; β=0.38, 95% CI=0.23, 0.52), compared with children without very low or low grip strength. Adjustment for childhood waist circumference reduced the effect estimates for both MetS outcomes by 50-62% (RR=2.26, 95% CI=0.90, 5.64; β=0.19, 95% CI=0.07, 0.31) and statistical significance was lost for the dichotomous MetS outcome (p=0.08). **Conclusions:** Lower levels of childhood grip strength were associated with adult MetS, independent of CRF, with part of this effect potentially being mediated through childhood waist circumference. These results suggest strategies aimed at improving grip strength in childhood might reduce future development of MetS. Supported by NHMRC Grant APP1098369

---

**2059 Board #2** June 1 9:30 AM - 11:30 AM

**Muscular Strength And Cardiovascular And All-cause Mortality In Adults With Hypercholesterolemia**

Duck-chul Lee, FACSM, Carl Lavie, Xuemei Sui, FACSM, Steven Blair, FACSM. 1Iowa State University, Ames, IA. 2Ochsner Health System, New Orleans, LA. 3University of South Carolina, Columbia, SC.

(NO relevant relationships reported)

**Purpose:** To determine the associations of muscular strength (MS) with cardiovascular disease (CVD) and all-cause mortality in adults with hypercholesterolemia.

**Methods:** Participants comprised 1,925 adults aged ≥40 years (mean age 50) who had a medical examination during 1980-1990 in the Aerobics Center Longitudinal Study. They were free of CVD, cancer, had ≥85% of their age-predicted maximal heart rate on a treadmill test, and hypercholesterolemia at baseline. MS was measured by 1 repetition maximums of bench and leg presses and a composite MS score was computed by combining the standardized values of both tests. Cardiorespiratory fitness (CRF) was estimated from a maximal treadmill test. We used tertiles of the sex- and age-specific total MS scores. Further, MS and CRF were dichotomized into either weak (lower one-third) or unfit (lower half), or strong (upper two-thirds) or fit (upper half) in a joint analysis of MS and CRF with mortality. Mortality follow-up was through 2003 using the National Death Index. Cox regression models included baseline age, sex, examination year, body mass index, smoking, alcohol intake, physical activity, parent CVD, hypertension, diabetes, abnormal electrocardiogram, total cholesterol, and CRF.

**Results:** During an average follow-up of 18 years, 67 CVD and 172 all-cause deaths occurred. Compared with lower MS group, the hazard ratios (HRs) and 95% confidence intervals (CIs) for CVD and all-cause mortality were 0.45 (0.24-0.85) and 0.58 (0.40-0.85) in middle MS group, respectively, and 0.46 (0.25-0.86) and 0.63 (0.43-0.93) in upper MS group, respectively, after adjusting for confounders including CRF. We found similar trends in both men and women, and normal weight and overweight or obese adults. In the joint analysis, compared with unfit and weak group, HRs (95% CIs) for CVD and all-cause mortality were 0.41 (0.22-0.78) and 0.41 (0.27-0.62) in unfit and strong group, respectively; 0.70 (0.30-1.66) and 0.60 (0.34-1.08) in fit and weak group, respectively; and 0.39 (0.19-0.82) and 0.59 (0.39-0.90) in fit and strong group, respectively.

**Conclusions:** MS, independent of CRF, should be promoted as a predictor of CVD and all-cause mortality in adults with hypercholesterolemia who are at increased mortality risk. Supported by NHLBI Grant AG06945, HL62508, DK088195, and HL13069.

---

**2060 Board #3** June 1 9:30 AM - 11:30 AM

**The Time-Varying Longitudinal Associations Between Muscle Strength, Functional Limitations, and Mortality In Older Adults**

Ryan McGrath1, Brenda Vincent2, I-Min Lee, FACSM, William Kraemer, FACSM, Mark Peterson, FACSM. 1University of Michigan, Ann Arbor, MI. 2VA Ann Arbor Healthcare System, Ann Arbor, MI. 3Harvard University, Boston, MA. 4The Ohio State University, Columbus, OH.

(NO relevant relationships reported)

Understanding how factors, such as muscle strength, slow the disabling process may better inform interventions designed to preserve function and delay mortality. **Purpose:** To determine the time-varying associations between 1) handgrip strength (HGS) and individual activities of daily living (ADL) function, and 2) disaggregated ADL limitations and time to mortality in older adults. **Methods:** A United States nationally-representative sample of 18,467 older adults (age: 66.9±11.1 years) from the Health and Retirement Study were followed for 8 years. Maximal HGS was measured...
Combination with, MVPA.

and mortality. Few have examined strengthening activity (MSA) two or more times per week. While many studies have physical activity (MVPA) per week, and also state that adults should engage in muscle-
in older adults.

CONCLUSIONS: 266 newtons for men and 221 newtons for women, which were the lowest cutoff points (0.97) in women) in predicting all-cause mortality. Ten candidate gender-specific cutoff points for predicting all-cause mortality was internally assessed using bootstrap sampling method.

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 provide 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 266 newtons for men and 221 newtons 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.

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 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<.05; CI 0.07-0.10) and prostate cancer survivors (OR=0.10, p<.05; CI 0.01-0.09) 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<.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.
Some studies report that there is an inverse relationship between muscle strength and the prevalence of diabetes. However, limited data are available on this relationship among Japanese.

**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.

**Abstracts were prepared by the authors and printed as submitted.**
Vitamin D insufficiency is associated with impaired physical performance in physically active adults. Supported by NIH grant P20GM103443.

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 understudied 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.

2069 Board #3 June 1 9:30 AM - 11:30 AM Describing Weight Regain Methodologies of Male Competitive Natural Bodybuilders
Yenny Lalu, Diane Dellava. 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 understudied 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.

Vitamin D insufficiency is associated with impaired physical performance in physically active adults. Supported by NIH grant P20GM103443.

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 understudied 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.

2069 Board #3 June 1 9:30 AM - 11:30 AM Describing Weight Regain Methodologies of Male Competitive Natural Bodybuilders
Yenny Lalu, Diane Dellava. Marywood University, Scranton, PA.

(No relevant relationships reported)
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. Descriptive statistics were calculated to determine if there was a 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.

E-08 Theme Poster - O2 Uptake Kinetics

Friday, June 1, 2018, 9:30 AM - 11:30 AM
Room: CC-Lower level L100F

2075 Chair: John M. Kowalchuk. University of Western Ontario, London, ON, Canada.
(No relevant relationships reported)

2076 Board #1
June 1, 2018 - 9:30 AM - 11:30 AM
A Nonlinear Dynamics Approach To Oxygen, Ventilation, and Heart Rate Dynamics During Exercise In Young Adults

Nathaniel T. Berry1, Jessica Dollar2, Lily Shanahan3, Susan D. Calkins1, Susan P. Keane1, Laurie Wideman, FACSM1.
1University of North Carolina at Greensboro, Greensboro, NC. 2University of Zurich, Zurich, Switzerland. 3University of Western Ontario, London, ON. Speaker: Dr. Susan D. Calkins1.
(Sponsor: Dr. Susan D. Calkins1.
Abstract: The variability surrounding the increasing physiological demands (specifically, VO2max and 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; Females: n=19; height=164±6 cm, weight=70±9 kg). Breathing, ventilation, and HR variability (HRV), 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 on the breath-by-breath dynamics of VO2 and V̇E, as well as HR variability (HRV), during an incremental treadmill test to exhaustion. Results: Male and female VO2max were different (p=0.05; p=0.04). However, there was no significant difference in maximal HR between genders (p=0.05). 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) with incremental 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 on the breath-by-breath dynamics of VO2 and V̇E, as well as HR variability (HRV), during an incremental treadmill test to exhaustion. (No relevant relationships reported)
**2077** Board #2 June 1 9:30 AM - 11:30 AM

**Dynamics of Skeletal Muscle Interstitial PO₂ Recovery from Contractions**

Daniel M. Hirai, Trenton D. Colburn, Jesse C. Craig, Ayaka Tabuchi, Timothy I. Musch, FACSM, David C. Poole, FACSM. Kansas State University, Manhattan, KS. (Sponsor: David C. Poole, FACSM)

*No relevant relationships reported*

The oxygen partial pressure in the interstitial space (PO₂) is driven by the oxygen consumption of the muscle and the diffusion of PO₂ into the tissue. The goal of the study was to determine if skeletal muscle PO₂ is recovered to resting values following exercise and to compare the time course of PO₂ recovery among different populations. The study was designed to investigate the recovery of PO₂ following exercise in three groups: Tetraplegic (TG, n=4), Paraplegic (PG, n=5), and Healthy Control (HC, n=5).

**Results**

1. **TG**
   - PO₂ was measured simultaneously by impedance cardiography and pulmonary gas exchange analysis.
   - At baseline, PO₂ was 49 ± 5 mmHg.
   - During exercise, PO₂ decreased to 17 ± 2 mmHg.
   - Recovery was observed immediately following exercise, reaching 17 ± 2 mmHg within 5 minutes.

2. **PG**
   - PO₂ was measured using an artificial neural network (ANN) and phosphorescence quenching (Oxyphor probes G2 and G4).
   - At baseline, PO₂ was 69 ± 6 mmHg.
   - During exercise, PO₂ decreased to 16 ± 3 mmHg.
   - Recovery was observed immediately following exercise, reaching 67 ± 5 mmHg within 5 minutes.

3. **HC**
   - PO₂ was measured using Oxyphor probes G2 and G4.
   - At baseline, PO₂ was 88 ± 7 mmHg.
   - During exercise, PO₂ decreased to 11 ± 2 mmHg.
   - Recovery was observed immediately following exercise, reaching 88 ± 7 mmHg within 5 minutes.

**Discussion**

The recovery of skeletal muscle PO₂ following exercise is dependent on the rate of oxygen uptake and the rate of oxygen diffusion into the tissue. The results indicate that the rate of PO₂ recovery is faster in healthy controls compared to people with spinal cord injury. The differences in recovery rates may be due to differences in the rate of oxygen uptake and the rate of oxygen diffusion into the tissue.

**References**


**Funding:** NIH HL-2108328

**ACSM May 29 – June 2, 2018**

Minneapolis, Minnesota

---

**2079** Board #4 June 1 9:30 AM - 11:30 AM

**Predicting Oxygen Uptake Responses During Cycling Using an Artificial Neural Network**

Andrew Borrer①, Michael Mazzoleni②, James Coppock③, Brian Mann①, Claudio Battaglini, FACSM.① The University of North Carolina at Chapel Hill, Chapel Hill, NC.② Under Armour Inc., Baltimore, MD.③ The University of North Carolina at Greensboro, Greensboro, NC.④ Duke University, Durham, NC. (Sponsor: Dr. Claudio Battaglini, FACSM)

*No relevant relationships reported*

**Purpose**

To develop a model that accurately predicts the oxygen uptake (VO₂) response to cycling exercise using an artificial neural network (ANN).

**Methods**

- VO₂ data from 50 individuals were collected during cycling exercise at four different intensities.
- The data was split into training (60%) and testing (40%) sets.
- An ANN was trained using the following inputs: heart rate, power output, and cadence.
- The ANN was validated using the remaining data.

**Results**

- The ANN accurately predicted VO₂ with a root mean squared error of 1.7 mL/kg/min.
- The model had a high predictive accuracy (R² = 0.95, SEE = 1.7 mL/kg/min).
- The ANN was able to accurately predict VO₂ across a wide range of exercise intensities.

**Conclusions**

The ANN accurately predicts VO₂ during cycling exercise, providing a useful tool for determining exercise intensity and monitoring training progress.

**References**


**Funding:** NIH HL-2108328

**ACSM May 29 – June 2, 2018**

Minneapolis, Minnesota

---
2081 Board #6
June 1 9:30 AM - 11:30 AM
Estimating the Aerobic Load of Short Non Steady State Cyclic Tasks
Ilse J. Blokland, Thomas van Kan, Jos J. de Koning, FACSM, Han Houdijk. Vrije Universiteit Amsterdam, Amsterdam, Netherlands.
(No relevant relationships reported)

The current analysis of aerobic load requires steady state oxygen uptake (VO\textsubscript{2}), limiting analyses to relatively long lasting, cyclic activities. This is problematic when assessing the aerobic load experienced by patients who are unable to perform cyclic tasks for a longer duration. PURPOSE: To assess validity and reliability of a method estimating the aerobic load of short non steady state cyclic tasks. METHODS: Thirteen healthy adults walked on a treadmill while VO\textsubscript{2} was measured using breath by breath respirometry. Six trials of varying length and intensity (1, 2 and 6 minutes at both 4 and 5 km/h) were performed and repeated on a second day. Aerobic load of the short walking tasks (VO\textsubscript{2short}) was estimated by adding the recovery VO\textsubscript{2} to the VO\textsubscript{2} over the exercise period. The 6 minute trials were used to calculate steady state VO\textsubscript{2}, Concurrent validity of VO\textsubscript{2short} with steady state VO\textsubscript{2} was assessed using a non-integer linear regression analysis. Test-retest reliability of all trials was assessed using intraclass correlation coefficients (ICC). RESULTS: VO\textsubscript{2short} was correlated with steady state VO\textsubscript{2} (r = 0.60-0.84) with highest correlations for the lower intensity trials. Steady state VO\textsubscript{2} was consistently lower than VO\textsubscript{2short}. Regression coefficients between steady state VO\textsubscript{2} and VO\textsubscript{2short} ranged between 0.72-0.81 (p<0.001). Test-retest reliability of VO\textsubscript{2short} (ICC = 0.60-0.87) was comparable to that of steady state VO\textsubscript{2} (ICC = 0.63-0.78). CONCLUSIONS: The estimated aerobic load of short walking bouts is highly correlated with steady state VO\textsubscript{2} at similar intensity but systematically larger, potentially due to overestimation of recovery VO\textsubscript{2}. Test-retest reliability of the presented method is similar to that of steady state VO\textsubscript{2}. Therefore, based on this study, using short bouts of activity seems feasible to assess aerobic load in patients unable to perform cyclic tasks for a longer time, but the overestimation of recovery VO\textsubscript{2} needs to be better understood.

2082 Board #7
June 1 9:30 AM - 11:30 AM
Do Contrasting Recruitment Patterns Underlie The Different Patterns Of Muscle Deoxygenation And Hemoglobin Response In Quadriceps Muscles?
Dai Okushima\textsuperscript{1}, David C. Poole, FACSM\textsuperscript{2}, Thomas J. Barstow, FACSM\textsuperscript{2}, Narihiko Kondo\textsuperscript{2}, Shunsaku Koga\textsuperscript{1}.
\textsuperscript{1}Kobe Design University, Kobe, Japan. \textsuperscript{2}Kansai State University, Manhatten, KS. \textsuperscript{3}Kobe University, Kobe, Japan.
(No relevant relationships reported)

Previous investigations reported greater convective and diffusive O\textsubscript{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 pattern in CE and KE. However, it is unknown whether the different muscle recruitment patterns might account for the disparate O\textsubscript{2} conductances during CE and KE or not. PURPOSE: Using time-resolved near-infrared spectroscopy (NIRS) during ramp incremental CE and KE, we tested the hypotheses that compared to CE, KE would have (1) lower amplitude (from baseline to exhaustion) of deoxy[Hb+Mb] (reflecting a greater O\textsubscript{2} delivery-to-utilization), (2) greater amplitude and value at task failure (i.e. reaching VO\textsubscript{2max}) of total[HHb+Mb] (diffusive O\textsubscript{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 VO\textsubscript{2} was measured breath-by-breath. Deoxy- and total[HHb+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[HHb+Mb] from baseline to task failure were not different between exercise modes. However, in RF muscle, deoxy- (17.0±11.3 vs. 39.5±13.8 μM, P<0.05) and total[HHb+Mb] amplitude (5.3±4.0 vs. 23.8±8.5 μM, P<0.05) were lower for KE compared with CE despite greater activation for KE than CE. In addition, total[HHb+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[HHb+Mb] responses suggest that perfusive and diffusive O\textsubscript{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.

E-09 Thematic Poster - Training in Youth
Friday, June 1, 2018, 9:30 AM - 11:30 AM
Room: CC-Lower level L100H

2084 Board #1
June 1 9:30 AM - 11:30 AM
Validation of A Pacer Prediction Equation For Assessing Aerobic Capacity Of Visually Impairedchildren
(No relevant relationships reported)

The Hungarian National Student Fitness Test (NETFIT\textsuperscript{TM}) is a health-related, criterion-referenced test system developed by the Hungarian School Sport Federation (HSSF) and The Cooper Institute (TCI) that was implemented in 2014/15 in schools throughout the country. The test battery was developed for typically developing children (TDC), so the interpretation of the test results was difficult for students with special educational needs (SEN). PURPOSE: to evaluate the validity of the Progressive Aerobic Cardiovascular and Endurance Run (PACER) test for children with visual impairment. METHODS: 20 partially sighted and 20 legally blind children (aged 10–19 years old) were selected randomly from 3 special schools to complete both laboratory (maximal treadmill protocol) and field assessments (PACER) of aerobic capacity. Agreement between lab- and PACER-derived peak oxygen consumption (VO\textsubscript{2peak}) was examined using linear regression analysis and two-sided equivalence testing techniques, respectively. RESULTS: The final sample resulted in a total of 22 visually impaired children. The regression model used in NETFIT\textsuperscript{TM} fit well for the partially sighted children (R\textsuperscript{2}=0.827), but not for blind children. There was a significant difference between the predicted and the measured peak VO\textsubscript{2} values by blind children (34.88 vs. 39.14 mL/kg/min, t=-2.287, p=0.038). Multiple regression analyses of PACER performance variables and peak VO\textsubscript{2} measures indicated the best model for estimating relative peak VO\textsubscript{2} for blind children: peak VO\textsubscript{2} =43.608 + (0.636*shuttles) – (0.829 * BMI). The lab and PACER VO\textsubscript{2} using the new regression model shared 84% of the variance by blind children (R\textsuperscript{2}=0.835) and that limits of agreement ranged from -9.86 mL/kg/min to +18.9 mL/kg/min. The absolute error values were 1% for girl and 11% for boys, and the average peak VO\textsubscript{2} estimates from PACER were within the 10% equivalence range for both sexes (girls: 35.22 to 28.18 mL/kg/min, boys: 37.82 to 46.22 mL/kg/min). CONCLUSION: The PACER test using the new regression model for blind children is a reliable field test to assess aerobic capacity for children with visual impairment. From the schoolyear 2017/2018 the adapted NETFIT\textsuperscript{TM} will be used in this method in the mandatory assessments. Financed by priority project EFOP 3.2.8.-16. granted by European Union.
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 EFA (KMO=0.877, p<0.000). EFA resulted in a 12-item, 3-subscale that each included 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=0.00, 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 competitiveness, 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.

Table1. Factor structures by Exploratory Factor Analysis and Reliability (N=150)

<table>
<thead>
<tr>
<th></th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>Total Variance explained</th>
<th>ρ_subscale</th>
<th>ρ_full scale</th>
<th>ρ_scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>S28</td>
<td>803</td>
<td>...</td>
<td>...</td>
<td>858.6%</td>
<td>733.26</td>
<td>0.8613</td>
<td></td>
</tr>
<tr>
<td>S29</td>
<td>801</td>
<td>...</td>
<td>...</td>
<td>871.7%</td>
<td>744.26</td>
<td>0.8623</td>
<td></td>
</tr>
<tr>
<td>S23</td>
<td>748</td>
<td>...</td>
<td>...</td>
<td>827.7%</td>
<td>708.26</td>
<td>0.8603</td>
<td></td>
</tr>
<tr>
<td>S24</td>
<td>730</td>
<td>...</td>
<td>...</td>
<td>837.7%</td>
<td>745.26</td>
<td>0.8613</td>
<td></td>
</tr>
<tr>
<td>S9</td>
<td>804</td>
<td>...</td>
<td>...</td>
<td>818.7%</td>
<td>593.26</td>
<td>0.8333</td>
<td></td>
</tr>
<tr>
<td>S7</td>
<td>798</td>
<td>...</td>
<td>...</td>
<td>839.7%</td>
<td>658.26</td>
<td>0.8603</td>
<td></td>
</tr>
<tr>
<td>S3</td>
<td>757</td>
<td>...</td>
<td>...</td>
<td>812.7%</td>
<td>630.26</td>
<td>0.8623</td>
<td></td>
</tr>
<tr>
<td>S8</td>
<td>725</td>
<td>...</td>
<td>...</td>
<td>800.7%</td>
<td>654.26</td>
<td>0.8603</td>
<td></td>
</tr>
<tr>
<td>S10</td>
<td>849</td>
<td>...</td>
<td>...</td>
<td>788.7%</td>
<td>466.26</td>
<td>0.8083</td>
<td></td>
</tr>
<tr>
<td>S14</td>
<td>791</td>
<td>...</td>
<td>...</td>
<td>819.7%</td>
<td>612.26</td>
<td>0.8613</td>
<td></td>
</tr>
<tr>
<td>S18</td>
<td>768</td>
<td>...</td>
<td>...</td>
<td>806.7%</td>
<td>599.26</td>
<td>0.8603</td>
<td></td>
</tr>
<tr>
<td>S26</td>
<td>677</td>
<td>68.93%</td>
<td>776.7%</td>
<td>639.26</td>
<td>0.8603</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

Ericha Mabel Mancera-Soto1, Diana Marcela Ramos-Caballero1, Edgar Cristancho1, Walter Schmidt2. 1Universidad Nacional de Colombia, Bogotá, Colombia. 2Bayreuth University, Bayreuth, Germany. (Sponsor: William Byrnes, FACSM)

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 ± 8.8week. 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 (score 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<0.001); and regression analysis (r=0.91) showed highest effects of sex (β=121.5g, β=0.01 in males) and body mass (9.5g/kg, β=0.57). Because Hbmass of girls reached a plateau at approx. 14 years and boys increased Hbmass until the age of 17 years, two regression analyses were performed separately for females and males and the following effects were found: Males: r=0.93; Hbmass = 11.8g/kg + 15.4*g*years + 60.9 (for trained status) + 35.1 (for altitude) + 13.7*g*tanner Stage - 254.2; females: r=0.84; Hbmass = 6.84g/kg + 9.84*years + 54.6 (trained) + 36.9 (altitude) - 24.8. Absolute and relative VO2max was closely related to Hbmass (absolute values: r=0.85, r=3.57g*kg + 39g; relative values: r=0.70; y=-3.56*x+6.1). CONCLUSION: Besides 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 1гармен 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

Bhupinder Singh, Melanie F. Niño, Jennifer D. Goulart, Amber Hammons. California State University, Fresno, CA.

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 9.8±0.9 years, and mean BMI percentile 96.1±4.1, 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).

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). Right leg isometric strength was assessed on a leg press device. Three-dimensional gait analysis software (Optronik, 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.

CONCLUSIONS: Increase in hip and knee moments after fatigue suggests biomechanical deficiencies, which may lead to increased joint stress or to injury.
The results suggest that level of adiposity and strength might be important factors in predicting gait biomechanics and could make a significant impact for healthcare professionals as they encourage wellness and fitness among their obese clientele.

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 Weiland2, Kelly Boscarino2, Amber Newell1, Heakyoung 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 peers. The purpose of the present study was to examine the influence of a five 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·kg⁻¹·min⁻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-tests evaluated between-group differences between high and low baseline PA with changes in AEE and VO₂. RESULTS: Although non-significant (low N), medium effect size was seen in the reduction of AEE during walking on day 5 (2.50±0.5 J·kg⁻¹·s⁻¹) compared to baseline (2.95±0.5 J·kg⁻¹·s⁻¹; p=0.28, Cohen’s d=0.66). Similarly, submaximal VO₂ was lower on day 5 (8.4±2.0 mL·kg⁻¹·min⁻¹) compared to baseline (9.5±3.1 mL·kg⁻¹·min⁻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·kg⁻¹·min⁻¹) than children with high PA (n=3) (Δ0.10±0.9 mL·kg⁻¹·min⁻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 five 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, John S. Fitzgerald1, Bradley J. Nelson1, Tyler A. Bosch1. 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 lower 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 yrs 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 dynamometers. 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=0.07-0.90). However, ACLR INV legs had significantly lower total LM (7.1±1.8 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=0.010-0.019) for extension at 60° and 120°/sec (p=0.004-0.010) and flexion at 60°/sec (p=0.005). No significant differences between ACLR NINV vs CON legs (p=0.23-0.90). 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. The slope between total LM and peak force was smaller for ACLR participants (INV: n=0.04-0.36, p=0.25; NINV: m=0.03, r=0.50, p=0.10) compared to CON (INV: n=0.06, p=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 Alverno-Cruz2, Jesús Barrera-Expósito3, Elvis A. Carmenero1. 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). Photographical cells were used to measure sprint times (S30m, 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 (CMJA); the difference between SJ and CMJ 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 best 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=0.25m/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=0.36m/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.
applied to identify potentially influential factors in the accelerative and decelerative preferential strategies between male and female athletes. Preliminary findings suggest that torso length (r=0.22) and torso to femur length ratio (r=.70, p<.005) 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=.675, p=.004), hip flexion (r=.604, p=.013), and combined lower extremity flexion (r=.552, p=.027) strategies in females. CONCLUSIONS: Preliminary findings of the present study suggest that male- vs. female-specific movement strategies, 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.

2094 June 1 9:45 AM - 10:00 AM
Pre-Season Measures of Neurologic Function and Subsequent Head Impact Exposure in Youth Football
Thayne A. Munce, FACSIM, Jason C. Dorman, Paul A. Thompson, Verle D. Valentine, FACSIM. 1 Sanford Sports Science Institute, Sioux Falls, SD. 2 Sanford Research, Sioux Falls, SD. (No relevant 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 reaction time (King-Devick 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 = .002). Among the discrete variables, faster KD and RT times were both found to be significantly related to increased individual head impact frequency in practices (P = .001, P = .032, respectively). Faster KD times were also significantly associated with higher linear acceleration (R=.570, P<.005) and combined lower extremity flexion (R=.014). There were no significant relations (P = .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.

2095 June 1 10:00 AM - 10:15 AM
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. (No relevant 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 mimic game-like testing may be more appropriate to determine readiness to RTS. PURPOSE: To determine how a currently used RTS test, the cross over triple jump (COJ), compares to a game-like agility test, the modified T-test (MTT) with respect to lower extremity biomechanics. METHODS: Nineteen Division I female athletes who were free of injury at the time of enrollment completed the testing protocol. The protocol consisted of having the athlete’s complete a 5 minute warm-up followed the completion of COJ and MTT tests. The order of which was randomized. The COJ was performed 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 an A 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 COJ were significantly more flexed at (Δ ~9.0 degrees ± 2.6, p<.001) and tended to be more internally rotated (Δ ~2.2 degrees ± 3.5, p=.042; 95%CI: 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 COJ 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.

2096 June 1 10:15 AM - 10:30 AM
Correlation of Hop Distance and Loading Symmetry during Return to Sport Testing in Healthy Subjects
Kristen Renner, Alex Peebles, Thomas K. Miller1, Robin Queen, FACSIM. 1Virginia Tech, Blacksburg, VA. 2Virginia Tech Carilion School of Medicine, Roanoke, VA. (Sponsor: Robin Queen, FACSIM) (No relevant relationships reported)

The hop distance symmetry is used frequently to determine readiness to return to sport (RTS) following anterior cruciate ligament reconstruction (ACLR). 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 ± 0.79, weight: 68.6 ± 7.7 kg). Participants were fit for a pair of In-Versa 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 (5xNSxSx100) 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=0.04) 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 loading 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.

2097 June 1 10:30 AM - 10:45 AM
Wobble Board Dynamic Assessment in Subjects with Chronic Ankle Instability
Andrea Fusco, Philip X. Fuchs, Giuseppe F. Giancotti, Marriana De Maio, Carlo Varalda, Herbert Wagner, Laura Capranica, Cristina Cortis. 1University of Cà Foscari, Venezia, Italy. 2University of Salzburg, Salzburg, Austria. 3Italian Weightlifting Federation FIFE, Roma, Italy. 4University of Rome Foro Italico, Roma, Italy. (Sponsor: Carl Foster, FACSIM) (No relevant 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±1.7years; weight=66.6±14.5kg; height=167.7±11.3cm) 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<0.05) was used to evaluate limb differences (injured; uninjured) in relation to gender. RESULTS: For WB, females showed better (p<0.05) performances than males, regardless of limb. Significantly (p<0.001) better performances were found in the uninjured (WB=20±3.4; A=89±4.9°; PM=101±13.1°; PL=107±13.4°; COMP=104±10.9°) compared to the injured (WB=16±6.4°; A=96±11.8°; PM=96±11.0°; PL=101±14.9°; COMP=100±11.9°) one, 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.

2098  June 1 10:45 AM - 11:00 AM

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

Caroline Westwood, Carolyn Killelea, Mallory Faherty, Timothy Sell, FACSM. Duke University, Durham, NC. (Sponsor: Timothy Sell, FACSM)

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: To determine if a novel visuomotor dynamic balance task can objectively identify youth athletes with previous history of SRC regardless of training levels. Incorporating cognitive-motor tasks may help to improve balance control deficits in youth post-SRC and ensure true readiness for return-to-sport.

PURPOSE: To determine if a novel visuomotor dynamic balance task can objectively identify youth athletes with previous history of SRC regardless of training levels. Incorporating cognitive-motor tasks may help to improve balance control deficits in youth post-SRC and ensure true readiness for return-to-sport.


2099  June 1 11:00 AM - 11:15 AM

Effect of Training Level on a Visuomotor Balance Task in Youth with Previous Sport-Related Concussion

Katelyn Mitchell, Michael E. Cinelli. Wilfrid Laurier University, Waterloo, ON, Canada.

INTRODUCTION: The demands of sport require the integration of cognition and sensory inputs to produce more complex, goal-directed movement. Howell and colleagues (1) revealed that the differences in balance control between athletes with or without previous concussion were greater in youth compared to young adults during dual-task gait. PURPOSE: 1) to determine if a novel visuomotor dynamic balance task can objectively identify differences between youth hockey players with/without sport-related concussion (SRC); and 2) if there are balance control differences between players participating in minor hockey and private hockey academy training. METHODS: Youth hockey players (N=47; age=12-17 years), who reported previous SRC (n=17) and CONTROL (n=30). Group 1 was from a minor hockey team (SRC1=4; CONTROL1=12) and group 2 a private hockey academy (SRC2=13, CONTROL2=18). Participants stood in single support on a Nintendo Wii Balance board sampled at 100Hz and performed a lower limb reaching task with their non-stance foot. Five FitLights were arranged on the floor anteriorly at +60°, +30°, and 0° and were used as Go(GREEN)/No-Go(RED) stimuli. Balance control was assessed using RMS velocity of COP (vCOP) in anterior-posterior (A/P) and medial-lateral (M/L) planes. RESULTS: There were significant differences for both A/P vCOP (SRC= 8.04cm/s; CONTROL= 11.04cm/s, p <0.05) and M/L vCOP (SRC= 6.72cm/s; CONTROL= 7.22cm/s, p <0.05), as the SRC group performed the task slower than the CONTROL. There were no significant differences between SRC1 and SRC2 in vCOP A/P (p=0.50) or M/L (p=0.26) likewise for CONTROL1 and CONTROL2 vCOP A/P (p=0.68) and M/L (p=0.97).

CONCLUSION: The assessment of a visuomotor dynamic balance task can objectively identify youth athletes with previous history of SRC regardless of training levels. Incorporating cognitive-motor tasks may help to improve balance control deficits in youth post-SRC and ensure true readiness for return-to-sport.

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 ICCC'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.
E-11 Free Communication/Slide - Exercise Psychology - Pain
Friday, June 1, 2018, 9:30 AM - 11:30 AM
Room: CC-Mezzanine M100F

Chair: Erica M. Taylor, FACSM. Delaware State University, Dover, DE.
(No relevant relationships reported)

2101 June 1 9:30 AM - 9:45 AM
Physical Activity is Indirectly Associated with Pain in College-Aged Women: Somatization and Panic Symptom Pathways
Patrick J. O’Connor, FACSM, Matthew P. Herring, Cillian P. McDowell, Rodney K. Dishman, FACSM. 1University of Georgia, Athens, GA. 2University of Limerick, Limerick, Ireland.
(No relevant relationships reported)

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 somatiform 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) in pain (5.3%, 1.9%). 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.

2102 June 1 9:45 AM - 10:00 AM
Resistance Training Does Not Alter Pain Sensitivity In Gulf War Veterans With Chronic Musculoskeletal Pain
Jacob B. Lindheimer1, Aaron J. Stegner2, Stephanie M. VanRiper3, Ryan J. Dougherty2, Neda E. Almassi4, Jacob V. Nimmiman1, Laura D. Ellingson2, Patrick J. O’Connor, FACSM3, Danette E. Ninneman1, Ryan J. Dougherty2, Neda E. Almassi4, Jacob V. Nimmiman1, Laura D. Ellingson2, Patrick J. O’Connor, FACSM3, Dane B. Cook, FACSM. 1US Department of Veterans Affairs, East Orange, NJ. 2US Department of Veterans Affairs, Madison, WI. 3University of Wisconsin-Madison, Madison, WI. 4Iowa State University, Ames, IA. 5University of Georgia, Athens, GA.
(No relevant relationships reported)

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 sensitivity among those with high sensitivity to noxious stimuli. PURPOSE: To examine the effect of whole-body resistance exercise training (RET) on pain sensitivity among GV with CMP. The Stand Back group was assigned to a 16-week, whole-body resistance exercise training program (n=21; 49±7 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 (45°C, 47°C, 48.9°C) at baseline, 6, 11, and 17 weeks. Separable three-way repeated measures MANOVA models with time (baseline, 6, 11, and 17 weeks) and temperature (45°C, 47°C, 48.9°C) 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 = 28.9%). Mean pain ratings across measurement time-points for 45°C, 47°C, and 48.9°C stimuli corresponded to 3, 7, and 13, and for unpleasantness 5, 10, and 14 across baseline, 6, and 17 weeks, 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.

2103 June 1 10:00 AM - 10:15 AM
Energy, Health, and Productivity Following a Sedentary Behavior Intervention in Workers with Low Back Pain
Tyler D. Quinn1, Andrea L. Hergenroeder2, Sophy J. Perdomo2, John M. Jakicic, FACSM1, Anthony Delitto3, Bethany Barone Gibbs1,4, University of Pittsburgh, Pittsburgh, Pa. 1University of Kansas, Kansas City, KS.
(No relevant relationships reported)

Decreased sedentary behavior is related to several positive health outcomes, however, further investigation of potential effects on presenteeism, health, and productivity in desk workers with chronic low back pain is warranted. PURPOSE: The Stand Back randomized trial evaluated subjective measures of health and psychosocial well-being before and after a six month intervention to reduce sedentary behavior. METHODS: 24 individuals with chronic low back pain and desk jobs (sitting ≥ 20 hours/week) completed either the control or intervention group. The intervention included monthly behavior counseling, a sit-stand desk attachment, a wrist-worn activity prompter, and cognitive behavioral therapy for pain self-management. The Stanford Presenteeism Scale (SPS), Health Work Questionnaire (HWQ), the SF-36 Health Survey (SF-36), and self-reported work sitting questionnaire were administered at baseline and six months. All questionnaires and subscales were analyzed across intervention groups using ANCOVA regression, adjusting for baseline values. Cohen’s d was used to estimate effect size. RESULTS: At six month follow-up, the intervention group reported 1.5 hours/day less sitting time (p<0.001) and decreased low back pain Oswestry Disability Index (-7.8%, p=0.027) compared to control. Compared to controls, the subscales of energy/fatigue, social functioning, and pain (SF-36) were significantly improved across groups at six months. Productivity (HWQ), concentration (HWQ), and SPS score remained unchanged (Table 1). CONCLUSION: Interventions to reduce sedentary time may be effective in improving energy, social functioning, and pain with no negative impact on productivity and concentration in desk workers with chronic low back pain.

<table>
<thead>
<tr>
<th>Table 1: Changes across groups at six months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Stanford Presenteeism Scale</td>
</tr>
<tr>
<td>SPS score</td>
</tr>
<tr>
<td>Health Work Questionnaire</td>
</tr>
<tr>
<td>Total Score</td>
</tr>
<tr>
<td>Productivity</td>
</tr>
<tr>
<td>Concentration/Focus</td>
</tr>
<tr>
<td>Supervisor relations</td>
</tr>
<tr>
<td>Non-work Satisfaction</td>
</tr>
<tr>
<td>Work Satisfaction</td>
</tr>
<tr>
<td>Impatience/Irritability</td>
</tr>
<tr>
<td>SF-36</td>
</tr>
<tr>
<td>General health</td>
</tr>
<tr>
<td>Physical functioning</td>
</tr>
<tr>
<td>Limitations (physical health)</td>
</tr>
<tr>
<td>Limitations (emotional problems)</td>
</tr>
<tr>
<td>Energy/Fatigue</td>
</tr>
<tr>
<td>Emotional well-being</td>
</tr>
<tr>
<td>Social functioning</td>
</tr>
<tr>
<td>Pain</td>
</tr>
</tbody>
</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 resources (TCR). Data were grouped by distance (<50 miles, 50-99 miles, 100+ miles), experience in years (novice-3, 3-9, 10+), age (20-39 years, 40+ years), number of ultra competitions completed (1-2, 3-5), 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’ λ criterion) indicated no significant effects across distance (F(1,75) = 1.256, P = 0.252), ethnicity (F(2,75) = 0.840, P = 0.609), age (F(2,75) = 0.511, P = 0.600), pressure pain threshold (PPT) was unchanged at all sites following training (all PS > 0.52). The magnitude of the change in PPT after training for MICT compared to HIIT was 16.2 ± 13.9 % (p < 0.001). CONCLUSIONS: While the limited sample size may have affected the results, observed power was deemed adequate (1-β = 0.52). The study examined the effects of aerobic training status of sensitivity in overweight or obese, sedentary males. 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 and as to determine the efficacy of coping skills interventions on ultra performance. Further research is warranted to assess coping skills with larger ultra populations, as well as to determine the efficacy of coping skills interventions on ultra performance.

REFERENCE

1. Håkansson, Stefan. "Regional-specific pain adaptations to exercise training. Inter-individual differences in PPT were unchanged at all sites following training (all P > 0.52). The magnitude of the change in PPT after training for MICT compared to HIIT was 16.2 ± 13.9 % (p < 0.001)." Pain Research and Treatment 2018: 5849238.


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 mindfulness helped patients with chronic pain 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 mindfulness 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 ±N 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.

**E-12 Free Communication/Slide - Physical Activity in Clinical Populations**

**Friday, June 1, 2018, 9:30 AM - 11:15 AM**

**Room:** CC-101G

**2110 Chair:** Matthew Harber, FACSM. Ball State University, Muncie, IN.

**2111 June 1 9:30 AM - 9:45 AM**

**Physical Activity Levels and Smoking Status in Relation to Weight Control after Bariatric Surgery**

Ryan E.R. Reid, Nathan A. Chiarlitti, Alexandra Sirois, Patrick Delisle-Houde, Nicolas V. Christou, Ross E. Andersen, FACSM, McGill University, Montreal, QC, Canada. (Sponsor: Ross E. Andersen, FACSM)

**Background:** The prevalence of obesity is increasing at an alarming rate, as is the number of morbidly obese individuals (i.e. BMI>40) in our society. Bariatric surgery is considered an effective treatment for morbid obesity with promising results on weight control, quality of life and health. However, the success of bariatric surgery in terms of health outcomes varies largely, which might be related to changes in physical activity from pre- to post-surgery. **PURPOSE:** This study aims to determine whether pre- to post-surgery changes in physical activity were associated with health outcomes such as, excessive weight loss, VO2 max, fat-free mass and quality of life up to two years after surgery. **METHODS:** 3879 post-bariatric patients were divided into three groups based on pre- to post-surgery change in physical activity: decrease, stable and increase. Measurements regarding physical activity (Baecke questionnaire), body composition (bioelectrical impedance analysis), cardiopulmonary 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 changes in health outcomes were conducted. **RESULTS:** Increasing physical activity was associated with larger excess weight loss (p=3.17; 95%CI=1.40-4.93; P=0.001) and greater increases in VO2 max (β=2.01; 95%CI=0.11-3.50; P=0.009) and %fat-free mass (β=1.05; 95%CI=0.50-1.65; P=0.001) compared to stable- and declining physical activity. Decreasing physical activity was associated with a decrease in VO2 max (β=-3.91; 95%CI=-6.40- -1.43; P=0.002). The increase-group showed greater increase 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 excess weight loss and greater improvements in body composition, cardiopulmonary fitness and quality of life. Therefore, increasing physical activity after bariatric surgery seems essential for bariatric success in terms of health outcomes.

**2112 June 1 9:45 AM - 10:00 AM**

**The Effect Of Changes In Physical Activity After Bariatric Surgery On Health Outcomes.**

Malou AH Nuijten1, Rens Wolf2, Onno Tett2, Esmé A. Bakker1, Ignace MC Janssen2, Maria TE Hopman, FACSM1.

1 Radboud University Medical Center (RUMC), Nijmegen, Netherlands. 2 Dutch Obesity Clinic, Arnhem, Netherlands.

**Background:** The prevalence of obesity is increasing at an alarming rate, as is the number of morbidly obese individuals (i.e. BMI>40) in our society. Bariatric surgery is considered an effective treatment for morbid obesity with promising results on weight control, quality of life and health. However, the success of bariatric surgery in terms of health outcomes varies largely, which might be related to changes in physical activity from pre- to post-surgery. **Purpose:** This study aims to determine whether pre- to post-surgery changes in physical activity were associated with health outcomes such as, excessive weight loss, VO2 max, fat-free mass and quality of life up to two years after surgery.

**Methods:** 3879 post-bariatric patients were divided into three groups based on pre- to post-surgery change in physical activity: decrease, stable and increase. Measurements regarding physical activity (Baecke questionnaire), body composition (bioelectrical impedance analysis), cardiopulmonary 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 changes in health outcomes were conducted. **Results:** Increasing physical activity was associated with larger excess weight loss (p=3.17; 95%CI=1.40-4.93; P=0.001) and greater increases in VO2 max (β=2.01; 95%CI=0.11-3.50; P=0.009) and %fat-free mass (β=1.05; 95%CI=0.50-1.65; P=0.001) compared to stable- and declining physical activity. Decreasing physical activity was associated with a decrease in VO2 max (β=-3.91; 95%CI=-6.40- -1.43; P=0.002). The increase-group showed greater increase 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 excess weight loss and greater improvements in body composition, cardiopulmonary fitness and quality of life. Therefore, increasing physical activity after bariatric surgery seems essential for bariatric success in terms of health outcomes.

**2113 June 1 10:00 AM - 10:15 AM**

**Effect of Obesity Coupled with Resting Alveolar-capillary Function on Exercise Capacity and Ventilatory Efficiency in Adult Heart Failure**

Erik H. Van Iterson1, Joshua R. Smith1, Bruce D. Johnson1, Katelyn Uithoven2, Eric J. Bruhn1, Thomas P. Olson, FACSM1.

1 Mayo Clinic, Rochester, MN. 2 University of Minnesota, Minneapolis, MN. (Sponsor: Thomas P. Olson, FACSM)

**Purpose:** Impaired oxidative capacity and exercise ventilatory inefficiency are primary features of human heart failure (HF). Although commonly assessed at rest, pulmonary limitations at the alveolar-capillary level also impact exercise. While it remains unclear how these interdependent features of HF contribute to exercise intolerance; obesity may further confound this issue. This study aimed to assess the impact of resting alveolar-capillary function on exercise capacity and ventilatory efficiency in obese (O) and non-obese (NO) HF patients. **Methods:** Male HF undergoing cardiology pulmonary exercise testing (CPET) were stratified as NO or O (N=55 vs N=31; age 57±13 vs 55±13 yrs; LVEF 28±11 vs 30±11 %; BMI 26.2±2 vs 34.2±2 kg/m²; NYHA class I-IV: 23 vs 5, 20 vs 16, 11 vs 9, 1 vs 1, respectively). Breath-by-breath ventilation and gas exchange were continuously measured via open circuit spirometry during CPET. Lung diffusion capacity for carbon monoxide (DLCO) and alveolar volume (VA) measured at rest. The mixed expired CO2 and end-tidal CO2 ratio was used to estimate global ventilation-perfusion matching (PECO2/PECO2<0.60 airway limited; ~0.60 airway/perfusion limited). The ventilatory equivalent for CO2; (VE/VA) slope was calculated rest to peak exercise. **Results:** NO and O resting DLCO (25±5 vs 24±5 ml/min/mm Hg), VA (6±1 vs 6±1 ml/kg), and DLmax (4±1 vs 4±1 ml/min/mm Hg/L) were similar (all P>0.05). Peak exercise RER (1.14±0.12 vs 1.12±0.15), VO2 (8.67±0.7 vs 8.67±0.7 L/min), PECO2; (0.74±0.04 vs 0.76±0.04), and VE/VA (35±12 vs 32.5) did not differ in NO and O (all P>0.05). Peak VO2 correlated with DLmax; and VA in NO and O (r=0.66 vs 0.48; r=0.62 vs 0.49; all P>0.05), but not for DLmax;/VA (r=0.11 vs 0.08). VE/VA, VCO2 slope correlated with DLmax; and VA in NO (r=0.45 and 0.49; both P<0.05), but not O (r=0.26 and 0.06); whereas DLmax;/VA was similar (r=0.25). Peak PECO2/PEC02<0.60 correlated with DLmax; and VE/VA, in NO (r=0.33 and 0.37), but only VE/VA in O (r=0.33) (all P<0.05); whereas DLmax;/VA was similar (r=0.06 vs 0.05).
CONCLUSION: These data suggest that exercise capacity, ventilation-perfusion matching, and ventilatory efficiency are similar in NO and O HF. However, the translation of resting alveolar-capillary function to these interdependent measures of exercise capacity may be confounded by obesity.

Obstructive sleep apnea (OSA) is a disorder that results in 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 accelerometer.

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. 98.6 ± 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. 44.2 ± 25.4, 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.

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: Characterize patterns of sedentary 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 Actical wrist accelerometry. 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 ≥ 30 min) over the 28-days.

RESULTS: Participants spent a mean (SD) of 9.5 ± 2.0 hrs/day in sedentary 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. 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.

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.
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, meteorin-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% interpolated by 50-60% VO2peak. 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=0.096) 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).

2120 June 1 9:30 AM - 9:45 AM Pelvic Injury - Weightlifting

E-13 Clinical Case Slide - Hip and Pelvis II

Friday, June 1, 2018, 9:30 AM - 11:30 AM
Room: CC-200E

Chair: John Hatzenbuehler, FACSM, St. Luke’s Family Medicine, South Portland, ME.

(No relevant relationships reported)

Discussant: William W. Briner, FACSM. Hospital for Special Surgery, Uniondale, NY.

(No relevant relationships reported)

2124 June 1 10:10 AM - 10:30 AM Testicular Pain- Football

Mary Iaculli, DO. Evergreen Sports Medicine Fellowship, Augusta, ME. (Sponsor: Peter Sedgwick, MD, FACSM)

(No relevant relationships reported)

HISTORY: A 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 gonitourinary surgery. He admits to third episode that occurred one year prior and self-resolved with ice.


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.
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/analysis:** negative; Urine culture: negative; Scrotal US 9/22/17: 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

---

2125  June 1 10:30 AM - 10:50 AM
**Hip Pain - Hiking**
Cory Mitchell, Caitlin Waters, Herb Stevenson. UMass Memorial Medical Center, Worcester, MA. (Sponsor: Pierre Rouzier, FACSM)

**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&Ox3, in NAD. Central obesity. HEENT: NCAT. 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. Internal/external 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

**TEST AND RESULTS:** Left hip x-ray: Mild degenerative changes Rheumatologic consult: Negative screening labs Left hip MRI: Partial tear of the gluteus minimus tendon Neurosurgery consult: Lumbar spine MRI: negative Physiatry consult: EMG left leg - normal, cannot rule out lateral femoral cutaneous neuropathy

**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. Pulpation-guided greater trochanteric bursa cortisone injection: minimal relief. Ultrasound-guided needle tenotomy of gluteus minimus tendon: resolution of antalgic gait with 50% improvement in pain without an effect on burning sensation. Ultrasound-guided nerve block and cortisone injection: resolved burning symptom without effect on lateral hip pain. Returned to regular daily activities and household chores. Yet to resume hiking due to lack of muscular endurance.

---

2126  June 1 10:50 AM - 11:10 AM
**Left Hip Pain and Swelling Following a Bicycle Accident**
George A. Ceremuga1, Edward R. Laskowski, FACSM, Kristina M. Colbenson2. (1)Mayo School of Graduate Medical Education, Rochester, MN. (2)Mayo Clinic, Rochester, MN. (Sponsor: Edward Laskowski, FACSM)

**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 definite 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 lentiform 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 Stinchfield’s and FABER tests on left. Straight leg raise is negative bilaterally.

**DIFFERENTIAL DIAGNOSIS:** 1. Morel-Lavallee lesion 2. Gluteus maximus contusion 3. Fracture of the greater trochanter

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

**FINAL WORKING DIAGNOSIS:** Morel-Lavallee lesion

**TREATMENT AND OUTCOMES**
1. Touch weightbearing crutch ambulation for left lower extremity and use of crutches as needed
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.

DIFFERENTIAL DIAGNOSIS: Parsonage Turner Syndrome
Brachial Plexopathy
Radiculopathy, mononeuropathy
Inflammatory Myopathy
Facioscapulohumeral muscular dystrophy

TEST AND RESULTS: EMG: Isolated right pectoral nerve mononeuropathy. MRI: Denueration 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 pectoralis 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:
A 20-year-old male kayaker presented for a second opinion for increasing pain and dysfunction in his right, dominant shoulder joint for five months. The pain had begun insidiously with no history of trauma. The patient described the pain as aching, sharp, and burning which progressed to become constant in nature. The patient’s pain was exacerbated specifically by kayaking and had become so severe that he had to cease participation.

PHYSICAL EXAMINATION:
The active range of motion of his shoulders was normal and symmetric. He had normal range of motion of his cervical spine. To inspection he had notable atrophy of his supraspinatus and infraspinatus of his right but not left shoulder. He had no winging but did have scapular dyskinesis. He had weakness to external rotation in the right shoulder with the arm at the side, but he had a negative external rotation lag sign. He had weakness to resisted abduction with the shoulder abducted 90 degrees and the elbow extended. He otherwise was neurologically intact for sensory, motor and reflex testing in both upper extremities.

He had a negative Spurling’s test. He had pain with elevation of the arm, but was not tender anywhere around the shoulder.

DIFFERENTIAL DIAGNOSIS: 1. Suprascapular nerve entrapment or compression
2. Cervical radiculopathy
3. Facioscapulohumeral Muscular Dystrophy 4. Rotator cuff tear

TEST AND RESULTS:
Cervical spine and shoulder radiographs: normal
EMG-NCS: severe right suprascapular neuropathy MRI shoulder: muscle atrophy c/w nerve injury; multi-loculated synovial cyst base of coracoid MRI cervical spine: normal

FINAL WORKING DIAGNOSIS:
Suprascapular nerve entrapment and compression

TREATMENT AND OUTCOMES:
1. Arthroscopic subacromial decompression, suprascapular nerve release at the suprascapular ligament and spinoglenoid notch, and ganglion cyst excision
2. sling for 1-2 weeks, early passive range of motion ok, no pendulums
3. No limited bedside MSK US of left shoulder: no obvious entrapment at the spinoglenoid notch.

Tests and Results:
#EMG of left upper extremity.
#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.
An 18-year-old right-hand dominant male, nationally-ranked Tae Kwon Do 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 immediate exacerbation of symptoms. Additionally, he started feeling radiating/burning symptoms down anteromedial forearm. Upon initial evaluation, he presented with extremely reduced grip strength (reproduction of radiating pain), loss of full elbow extension, and shooting pain.

PHYSICAL EXAMINATION: Examination revealed full and pain-free cervical ROM, with no reproduction of symptoms. Resting postural assessment revealed increased thoracic kyphosis with segmental hypomobility from T1-6. Elbow assessment revealed bilateral elbow hyperextension of 20deg. Upper-limb tension testing was + for radial and median n. on right, with reproduction of radiating symptoms into forearm. 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. 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 15# (55#/ 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
4. Closed-chain tendon 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

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

TEST AND RESULTS:
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

E-15
Clinical Case Slide - Wrist and Hand
Friday, June 1, 2018, 9:30 AM - 11:10 AM
Room: CC-101CD

Chair: Melody Hrubes, UIC Sports Medicine, Chicago, IL.

No relevant relationships reported

Discussant: Oluwaseun A. Olufade, Emory University, Johns Creek, GA.

No relevant relationships reported

History: 17 yo defensive lineman presents with new onset right hand numbness, tingling, and mild discomfort during a high school football game. He denies any known injuries to the affected extremity during the game but endorses that he uses his hands a lot during play. He had not noticed swelling, redness, or weakness. Denies elbow, forearm, shoulder or neck pain. He described the paresthesias as limited to the back of his hand and thumb. The discomfort is described as generalized pain over the back of his wrist. He denies any prior injury to the hand, wrist, elbow, shoulder, or neck; however, he does tape both his wrists to “prevent injury” during gameplay and recently bought new football gloves.

PHYSICAL EXAMINATION: Right hand:
- No deformity, swelling, erythema, or ecchymosis. Bony prominences non-tender to palpation. Notable paresthesias and decreased sensation over the dorsal aspect of the hand with intact sensation of the ulnar side of the hand, palm, and digits. 5/5 strength in intrinsic muscles of hands, grips strength, and thumb strength. No thumb instability.
Wrist:
- Bilateral wrists are wrapped with athletic tape. No obvious deformity or skin changes. 5/5 strength with flexion, extension, evasion, inversion, pronation and supination.

Ammunition sniff box was non-tender. Mild discomfort with Finkelstein test and resisted extension of thumb. Neck non tender to palpation with full ROM.


TEST:
Gloves and wrist tape removed with partial improvement of hand/wrist discomfort.

FINAL WORKING DIAGNOSIS:
Cervical radiculopathy, DeQuervain’s tenosynovitis, Intersection syndrome, Radial tunnel syndrome, Brachial plexus injury, Cervical injury.

TREATMENT AND OUTCOMES:
1. Right wrist tape and football gloves were removed. 2. After evaluation and improvement in symptoms he was released to return to play in the same game without restrictions. 3. One hour later he had complete resolution of paresthesias when re-evaluated at half time 4. Symptoms at halftime could be reproduced with pronation, flexion, and ulnar deviation 5. Discontinued future wrist taping 6. The patient was symptom-free and had a normal exam at 1 week follow-up appointment.

He was advised to avoid overtightening of football gloves.
articulation, and full wrist range of motion. Wrist X-Rays were read by radiology as negative for fracture, but interpreted by the sports medicine team as a possible ulnar styloid fracture. There was no evidence of a distal radioulnar joint (DRUJ) injury. He had to stop sport for three weeks of relative rest and use of a wrist brace. He presented to clinic four years later due to worsening symptoms that inhibited his level of competition in Taekwondo.

He had not sustained any further wrist injuries in the interim. There was increased pain with active range of motion and he felt an occasional click in his wrist and intermittent tingling in his fifth digit.

Physical Examination: Left wrist exam demonstrated no gross deformity, swelling, erythema, or ecchymosis. The limb was neurovascularly intact. There was tenderness to palpation of the hook of the hamate and the triangular fibrocartilage complex. Full wrist and hand range of motion. Mild weakness noted in fifth digit flexion and wrist flexion; strength otherwise intact. Wrist extension with ulnar deviation reproduced the patient’s pain. There was increased dorsal instability of the ulnar styloid at the distal radioulnar joint (DRUJ) (positive piano key sign).


Tests and Results: There was no evidence of flexor pollicis longus (FPL) tendon elongation into the distal radioulnar joint indicating disruption of the triangular fibrocartilage complex (TFCC). The TFCC appears irregular and demonstrates intermediate signal. These findings were interpreted by the Sports Medicine team to represent concomitant central and peripheral TFCC tears.

Final Diagnosis: Central and peripheral TFCC tears

TREATMENT AND OUTCOMES: After consultation with orthopedic surgery, the patient is currently scheduled for arthroscopic debridement of the central tear and repair of the peripheral tear of his TFCC.

HISTORY: 14 year old right handed level 6 gymnast presents with complaints of progressive right greater than left elbow and forearm pain over the past four months. Despite bracing, activity modification and three months of physical therapy she still reported progressive worsening of pain and development of tingling in her hands and forearms. She notes she has a constant feeling of tightness over her anterior median forearms and pain and tingling of her arms occurs the worst while writing in school or using a computer mouse.

PHYSICAL EXAMINATION: - Well appearing female adolescent - Full ROM of elbow, forearm, wrist and fingers - Sensation intact to light touch in the radial, median and ulnar nerve distribution bilaterally - 5/5 strength in the radial, median, ulnar, anterior interosseous and posterior interosseous nerves bilaterally - Mild TTP of proximal forearm and medial elbow bilaterally - Positive compression test at the proximal forearm - Positive Tinel’s test over the pronator teres - Positive Tinel’s test over cubital tunnel - Negative Tinel’s, Durkan’s and Phalen’s at the wrist bilaterally DIFFERENTIAL DIAGNOSIS: Pronator syndrome - Cubital tunnel syndrome - Chronic exertional compartment syndrome of the forearm - Anterior interosseous nerve syndrome - Brachial plexus neuritis - Cervical radiculopathy

TEST AND RESULTS: MRI elbow Left: MRI findings normal but noted presence of accessory anconeus epicondylaris muscle. MRI elbow Right: Normal MRI. FINAL WORKING DIAGNOSIS: Pronator syndrome bilaterally. Left arm with accessory anconeus epicondylaris muscle also causing ulnar neuropathy. TREATMENT AND OUTCOMES: Patient’s older sister previously had pronator syndrome as well as chronic exertional compartment syndrome for which she underwent median nerve release and fasciectomy. Patient and her parents elected to forgo compartment testing suspecting she also had both conditions. She underwent surgery on her left elbow with a median nerve release, ulnar nerve release and fasciectomy. She is due to have surgery on her right arm for median nerve release and fasciectomy three weeks after her left.

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 optimal 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
Friday, June 1, 2018, 7:30 AM - 11:00 AM
Associations Between Land-Based Performance Assessments and Maximal Effort Combat Swim Force Production

Meaghan Beckner, Elizabeth Nagle, FACSM, Anne Beethe, Takashi Nagai, Megan Schmidt, Chris Connaboy, John Abt, FACSM, Scott Lephart, FACSM, Bradley Nindl, FACSM. University of Pittsburgh, Pittsburgh, PA. University of Kentucky, Lexington, KY.

(no relevant relationships reported)

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 maximal 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 anerobic 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<sub>mean</sub>) (0.883, p<0.001). Correlations were identified between LL and TST peak force (TST<sub>peak</sub> (right: 0.653, p=0.021; left: 0.639, p=0.020). There was no significant correlation between isometric peak HS and TST. CONCLUSION: LL and absolute WAnT mean power were 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.

(no relevant relationships reported)

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 noticeable during backhands. The pain was sharp and severe for about three seconds after each hit and then quickly resolved to a pain-free baseline.

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. Finger and wrist ranges of motion were full and pain-free, and there was no swelling.


TEST AND RESULTS: PA, oblique, and splaged 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/reactivation.

TREATMENT AND OUTCOMES: 2141 June 1 10:30 AM - 10:50 AM
Forearm Pain-Gymnastics
Melissa Faubert, Holly Benjamin, FACSM, Daniel Mass. NorthShore University HealthSystem/University of Chicago, Chicago, IL. University of Chicago, Chicago, IL.

(No relevant relationships reported)
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±1.0 years old, weighed 79.1±12.8 kg, were 187.3±12.6 cm tall, had a VO2max 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 = -0.99, p<0.001), Maximal Oxygen Uptake (r = -0.84, p<0.001) and Oxygen Uptake at the ventilatory breakpoint (r = -0.82, p<0.001) were found to be 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.
A modality specific swimming protocol to assess maximal aerobic power (MAP) is essential to accurately quantify swimming training and performance. A graded intensity MAP swimming protocol executed in a swimming flume controls swimming speed (i.e., velocity), and may facilitate kinematic and metabolic assessments. PURPOSE: To assess: 1) reliability of a swimming flume maximal oxygen consumption (VO\textsubscript{2max}) (i.e., MAP) protocol; and 2) validity of a VO\textsubscript{2max} protocol using a swimming pool performance swim (PS) test as the criterion.

METHODS: Nineteen healthy males (n=9) and females (n=10) (age, 28.5 ± 8.5 years; BMI = 23.5 ± 3.4 kg m\textsuperscript{-2} body fat = 21.4 ± 8.6%; height, 174.7 ± 8.2 cm; weight, 72.9 ± 12.5 kg; % body fat, 21.4 ± 8.6) performed two swimming flume VO\textsubscript{2max} tests (VO\textsubscript{2max}A and VO\textsubscript{2max}B), and one PS test [500 meters (444.7 ± 139.4 seconds)]. Test-retest reliability of VO\textsubscript{2max} (ml·kg\textsuperscript{-1}·min\textsuperscript{-1}), cardiorespiratory efficiency (O2 pulse; VO\textsubscript{2max}), maximal respiratory exchange ratio (RERmax), ventilation (Vemax) (L·min\textsuperscript{-1}), heart rate (HR, b·min\textsuperscript{-1}), and respiratory exchange ratio (RER) were measured continuously, and ratings of perceived exertion (RPE), blood lactate (BLa; mmol·L\textsuperscript{-1})), and post-hoc analysis revealed higher speeds during V\textsubscript{2A} and V\textsubscript{2B} separated by 8 weeks between V\textsubscript{2A} and V\textsubscript{2B}. In addition, an interaction for speed at higher weights was observed. In summary, VO\textsubscript{2max} elicited higher maximal physiological responses compared to a VO\textsubscript{2max} protocol, indicating that VO\textsubscript{2max} 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 perform power.

RESULTS: The VO\textsubscript{2max} protocol employed presently is a reliable and functionally valid assessment of MAP. It is proposed that a swimming flume-based protocol to measure MAP will facilitate mode specific comparisons of test responses with performance outcomes for military, clinical, or athletic populations.

Table 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>VO\textsubscript{2max}A</th>
<th>VO\textsubscript{2max}B</th>
<th>ICC</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VO\textsubscript{2max}(ml·kg\textsuperscript{-1}·min\textsuperscript{-1})</td>
<td>18</td>
<td>46.7 ± 8.6</td>
<td>47.9 ± 8.5</td>
<td>0.628**</td>
<td>0.002</td>
</tr>
<tr>
<td>HRmax, (b·min\textsuperscript{-1})</td>
<td>19</td>
<td>172 ± 18</td>
<td>174 ± 11.8</td>
<td>0.403</td>
<td>0.041</td>
</tr>
<tr>
<td>O2Pulse (ml·b\textsuperscript{-1})</td>
<td>19</td>
<td>0.3 ± 0.1</td>
<td>0.3 ± 0.1</td>
<td>0.502*</td>
<td>0.014</td>
</tr>
<tr>
<td>REPmax</td>
<td>12</td>
<td>0.3 ± 0.3</td>
<td>1.1 ± 0.2</td>
<td>0.555**</td>
<td>0.002</td>
</tr>
<tr>
<td>Vemax (l·min\textsuperscript{-1})</td>
<td>19</td>
<td>103.5 ± 20.2</td>
<td>111.6 ± 25.0</td>
<td>0.671**</td>
<td>0.000</td>
</tr>
<tr>
<td>PS time (sec)</td>
<td>16</td>
<td>444.7 ± 139.4</td>
<td>452.6 ± 53.0</td>
<td>0.608**</td>
<td>0.005</td>
</tr>
</tbody>
</table>

**p<0.01; ***p<0.005

PURPOSE: To examine the cyclical nature of collegiate swim training on anaerobic performance.

METHODS: Ten NCAA Division 1 swimmers (n=4 women, age 20.3±0.5 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 (V\textsubscript{1}), mid-offseason (V\textsubscript{2}), and early season (V\textsubscript{3}) separated by 8 weeks between V\textsubscript{1} and V\textsubscript{2}, and 14 weeks between V\textsubscript{2} and V\textsubscript{3}. Each testing session was comprised of an in-pool power test consisting of incrementally-loaded 25-m sprints 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 (La), and ratings of perceived exertion (RPE) were assessed within the first minute of each rest period. Two-way RM-ANOVA (visits-bucket weight) was used to compare the effect of training across the primary outcomes.

RESULTS: A main effect of visit was observed for average speed whereby V\textsubscript{3} was faster in women (V\textsubscript{3}: 1.08±0.26 m·s\textsuperscript{-1}; V\textsubscript{1}: 1.10±0.18 m·s\textsuperscript{-1}; P<0.001) and men (V\textsubscript{3}: 1.20±0.26 m·s\textsuperscript{-1}; V\textsubscript{1}: 1.41±0.29 m·s\textsuperscript{-1}; P<0.001) compared to V\textsubscript{2}. In addition, an interaction for speed at higher weights was observed and post-hoc analysis revealed higher speeds during V\textsubscript{3} in women at 65 lbs (V\textsubscript{3}: 0.75±0.22 m·s\textsuperscript{-1}; V\textsubscript{1}: 0.73±0.25 m·s\textsuperscript{-1}; P=0.02) and men at 120 lbs (V\textsubscript{3}: 0.83±0.09 m·s\textsuperscript{-1}; V\textsubscript{1}: 1.45±0.57 m·s\textsuperscript{-1}; P=0.77; 0.14 m·s\textsuperscript{-1}; P<0.001). A main effect of visit was seen for HR demonstrating a higher average HR during V\textsubscript{3} in women (165.3±14.4 bpm) compared to V\textsubscript{1} (156.7±17.1 bpm) and V\textsubscript{2} (156.2±14.8 bpm).
Medicine ball (MB) exercises are effective for strength and conditioning in adults, but the cardiometabolic demand of this training modality for children is unknown. PURPOSE: To examine the acute cardiometabolic responses to MB exercise in children. METHODS: 14 children (10.1 ± 1.3 yr) were tested for peak oxygen uptake (VO₂) on a treadmill and subsequently (~48 hours later) performed a progressive 10 min MB protocol of 5 exercises (EX): standing marches (EX1), alternating lunges (EX2), squat swings (EX3), chest passes (EX4) and double arm slams (EX5). A 2.3 kg MB was used for all trials and each MB exercise was performed twice for 30 sec with a 30 sec rest interval between sets and exercises. Participants exercised while wearing a heart rate (HR) monitor and connected to a metabolic system. Comparisons between exercises were made using one-way analysis of variance with repeated measures. 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 61.1% to 89.6% and 28.2% 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.

**E-27 Free Communication/Poster - Youth**

**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.

Purposes compared to control.

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

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

Takahiro Nakanó1, Koshio Kasuga2, Tomoaki Sakai1, Kazuo Oguri1, 1Nagoya Gakuin University, Aichi, Japan. 2Gifu University, Gifu, Japan. 3Gifu Chukyo Gakuin University, Gifu, Japan. (Sponsor: Kiyoyo 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 situation 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 disliked 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.

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

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

Yan Peng1, Meng Yang2, Liangjung Yang1, Chuandong Wei1, Tindong Chang1, 1Sichuan Aerospace Vocational College, Chengdu, China. 2Northeast Normal University, Changchun, China.

No relevant relationships reported.

Purposes of Chinese adolescent physical literacy assessment (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 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 two rounds, and the indexes are effective. As 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 NPOPSS Grant 15CYT011, and Fundamental Research Funds for the Central Universities Grant 1709Z240.

Abstracts were prepared by the authors and printed as submitted.
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 (NYFVS) 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 VO₂max (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 VO₂max (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 were 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.

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 similarly to habitual physical activity in youth. Fair to moderate (r = 0.24-0.49, kappa for structured play ranged from non-significant to poor (-0.09-0.19), but was from 24.0-36.6% for structured play and 30.1-44.3% for unstructured. Weighted tracking of MVPA minutes was evaluated using tracking coefficients (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 (k<0.20), fair (k=0.21-0.40), moderate (k=0.41-0.60), good (k=0.61-0.80), or very good (k=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 (k=0.42) for structured play and excellent (0.80) for unstructured play (r=0.05). Percent agreement ranged from 24.0-36.6% for structured play and 30.1-44.3% for unstructured. Weighted kappa for structured play ranged from non-significant to poor (-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. Funded by NICHD R01 55400.

FITNESSGRAM has established criterion standards for body composition and body mass index (BMI) according to gender and age in children. Standards for aerobic capacity (AC) have also been established to assess cardiorespiratory function. Tri-Ponderal Mass Index (TMI) has been shown to better classify overweight and obesity than BMI in youth. PURPOSE: The purpose of this study was to determine the association between TMI and FITNESSGRAM AC classification in sixth-grade children. METHODS: Subjects were 528 sixth-grade boys and girls, ages 11-13, who had completed each of the FITNESSGRAM components as a part of their yearly assessment. In addition to weight and height, subjects’ AC was determined from one-mile run/walk times, age, gender and BMI. 52.0% percent of these students were classified within the Healthy Fitness Zone (HFZ) for AC. 31.0% percent of these students were classified as High Risk for AC. RESULTS: The correlation between TMI and BMI was 0.8, and the correlation between BMI and AC was -0.75. The correlation between TMI and AC was -0.73. Receiver Operating Characteristic (ROC) analysis indicated that a TMI of 13.94 represents the best cut-off for girls and 16.53 for boys. The best cut-off for boys was 17.75. A TMI of 15.05 represents the best cut-off for classifying boys within the HFZ for AC, with 90.0% correctly classified, and AC = 0.96. Also, a TMI of 15.05 represents the best cut-off for classifying within the HFZ for AC, with 90.0% correctly classified, and AC = 0.96. Also, a TMI of 15.05 represents the best cut-off for classifying girls as High Risk for AC, with 90.0% correctly classified, and AC = 0.96. Also, a TMI of 17.75 represents the best cut-off for classifying boys as High Risk for AC, with 93.0% correctly classified, and AC = 0.97. CONCLUSIONS: TMI is strongly associated with classification according to FITNESSGRAM AC standards in sixth-grade children. These data suggest that a TMI of 13.94 for girls and 15.05 for boys are the best criteria for HFZ classification for FITNESSGRAM AC. Also, a TMI of 16.53 for girls and 17.75 for boys are the best criteria for High Risk classification for FITNESSGRAM AC. Appropriate evaluation of body size is important since body size has been shown to be highly related to aerobic capacity and performance, especially in weight-bearing exercises.

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 on physical fitness characteristics at age 10. 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 homeroom 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. Supported by Grant-in-Aid for Scientific Research (K), Japan.

from Ministry of Education, Culture, Sports, Science and Technology in Japan.

2182 Board #18 June 1 9:30 AM - 11:00 AM
A Comparison of Health Related Fitness Variables between Youths in Singapore and Hong Kong
Yew Cheo Ng1, Govindasamy Balasekaran, FACSMS1, Stanley Sai-Chuen Hui, FACSMS2, Visvasuresh Victor Govindaswamy3, Jolene Lim1, Peggy Boey1, Nanyang Technological University, Singapore. 2 Singapore. 3 The Chinese University of Hong Kong, Shatin, Hong Kong. 4 Concordia University Chicago, Illinois, IL. (No relevant relationships reported)

Physiological fitness encompasses health-related fitness (HRF) variables which may reduce cardiovascular risk factors if identified early in youths. PURPOSE: To compare HRF variables between youths in Singapore (SGP) and Hong Kong (HK). 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 (PACE-R), 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%). Conclusion: 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.

2183 Board #19 June 1 9:30 AM - 11:00 AM
Effects of Jump Rope Exercise on Shortening Stretching Cycle Ability in Elementary School Students
Kazufumi Terada1, Tatsuki Nakagawa2, Nobuyuki Miyai1, Mikio Arita1, Nanyang Technological University, Singapore. 2 The Chinese University of Hong Kong, Shatin, Hong Kong. 3 Concordia University Chicago, Chicago, IL. (No relevant relationships reported)

PURPOSE: The purpose of this study was to investigate the effect of jump rope exercise on shortening-stretching cycle ability in elementary school students. METHODS: A total of 83 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 it and RJ (r=0.57, p<0.01), RJ (r=0.57, 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 ST (r=0.43, p<0.001), RJ (r=-0.70, p<0.01), and GS (left-hand: r=0.58, p<0.01). However, jump rope exercise frequency did not result in any apparent differences in training effects.

2184 Board #20 June 1 9:30 AM - 11:00 AM
A Comparison of Health Related Fitness Variables Between the Youths of Singapore and Bangkok
Govindasamy Balasekaran, FACSMS1, Stanley Sai-Chuen Hui, FACSMS2, Kallaya Kijboonchoo3, Visvasuresh Victor Govindaswamy4, Jolene Lim5, Ng Yew Cheo5, Peggy Boey1, Nanyang Technological University, Singapore. 2 Singapore. 3 The Chinese University of Hong Kong, Shatin, Hong Kong. 4 Institute of Nutrition, Mahidol University, Salaya, Thailand. 5 Concordia University Chicago, Chicago, IL. (No relevant relationships reported)

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 yrs; 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 ± 14.3 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), and 1 minute sit-up test (SUT) and 15m youth Progressive Aerobic Cardiovascular Endurance Run (PACER) 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 ± 23.72 cm, p < 0.0005), HST for both hands (SGP: 30.32 ± 15.53 kg, BKK: 52.20 ± 12.72 kg, p = 0.001), SUT (SGP: 38.94 ± 11.92, BKK: 27.31 ± 9.97, p < 0.0005), and PACER (SGP-40.93 ± 23.90 laps, BKK: 30.37 ± 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.
MEDICINE & SCIENCE IN SPORTS & EXERCISE®

2186 Board #22 June 1 9:30 AM - 11:00 AM Impact of Flag 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. VO2max was estimated from 20-m SRT using Pacer equation. Mixed model Repeated Measures ANOVAs were used for data analysis.

RESULTS: A significant group-by-time interaction was observed for jump rope test (turns/min), 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 (in sec), 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 intervention 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 McCrory, 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 weren’t associated with the 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 cm, 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 supported.

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±1.21 y, 1.82±0.8 m, 83.1±7.6 kg) consented to procedures approved by the EMU-HSRC. Zephyr bioharness-3 (Zephyr, MD) PWS measured triaxial accelerations and heart rate for all on-ice practices and games. Exponentially weighted session Dynamic Averaging 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 season 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 DA (311.0±101 v. 303±101) 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±21 y, 1.82±0.8 m, 83.1±7.6 kg) consented to procedures approved by the EMU-HSRC. Zephyr BH3 (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...
E-28 Free Communication/Poster - Cerebral Blood Flow

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

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, Trynn F. Gable. Williamette 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-intensity, body weight activities with little variability in the exercises performed. This method of training lacks progressive resistance training (PRT), a cornerstone to adaptation for specific 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 jump, medicine ball-put, and an arm-ergometer modified Wingate anaerobic test (Arm-WAnT). Analysis: Gymnastics:必须 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 subsequently 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. Gymnasts Levels 4 to 10 similarly improved vertical power (224±75W to 247±68W, p<0.001), Arm-WAnT peak power (80.9±30.1W to 93.2±40.6W, 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 Ogho, FACSM. Toya University, Kawagoe, Japan. 
(No relevant relationships reported)

Previous studies reported that an increase in the contralateral middle cerebral artery mean blood 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. PURPOSE: The purpose of this study was to examine the effect of HG exercise on CBF in ipsilateral and contralateral posterior cerebral arteries. METHODS: 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 (PCAVs) were measured by finger plethysmography and transcranial Doppler (TCD). When PCAVs were examined separately, CBF was not different across M1-M4, but declined during M5-M7 (108.5±2.5, 116.3±2.9, and 58.4±2.5, respectively; p<0.05) with M7 being lower than M1-M6. IF was highest during M1 (86.6±0.1) and significantly declined over the season and was lowest at M7 (74.9±1.0). In contrast, for G, IF 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 (183.0±1.1) and was lowest (p<0.05) at M7 (74.9±1.0). For performance modeling metrics, CTI peaked at M3 (p<0.05), but despite the reduced DTI for P in M7, CTI, ATL and PR 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 substantially, while game loads remained constant but intensities were reduced. The training loads imparted by games were sufficient to maintain CTI, but AT 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 Hale, Sarah Ross, Gregrey Kline, Robert T. Mallet. UNT Health Science Center, Fort Worth, TX. 
(No relevant relationships reported)

Purpose: Cerebral perfusion and oxygen delivery are enhanced in young adults during 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, NIBP100D), O2 saturation (SaO2, Radiometer), middle cerebral artery blood flow velocity (Vmax, E- Dop) and cerebral tissue oxygenation (ScO2, Somatex 5100C INVOS) were continuously monitored. RESULTS: Baseline SaO2, HR, and mean ABP were not significantly different in elderly vs. young adults (SaO2, 96.9±0.3 vs 97.0±0.3%; HR 71±4 vs 63±2 bpm; ABP 93±3 vs 89±2 mmHg). However, baseline Vmax(EA) (43.5±2.2 vs 53.7±1.8 cm/s, p<0.005) and ScO2 (68.6±0.7 vs 75.4±0.9%, p<0.001) were lower in elderly than young adults. During hypoxia exposure, HR was significantly increased with decreases in SaO2; the rate of change or ymrdadad eraardityanid eunai hypoxia was smaller (P=0.001) in elderly (-0.48±0.05 bpm/%) than young (-0.84±0.2 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 units hypoxemia, the rate of change in SaO2 was smaller (P=0.002) in elderly (0.69±0.01 %%/min) than young (0.85±0.03 %%/min) adults, while the rates of increase in Vmax(EA) were similar between elderly and young groups (-0.28±0.05 vs -0.37±0.01 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.
The previous prospective study identified that prolonged sleep could be associated with the increased future stroke risk in an apparently healthy aging population. However, the underlying mechanism is unknown. Chronic excessive pulsatile flow is thought to be a risk for cerebrovascular disease. In the supine posture, stroke volume (SV) is greater than that in upright posture since decrease in hydrostatic pressure increases venous return and consequently cardiac preload.

**PURPOSE:** We determined whether greater SV in the supine posture is associated with the augmented mechanical stress (characterized by cerebral pulsatile hemodynamics) in the cerebral vasculature.

**METHODS:** To test this hypothesis, we applied -30 mmHg of lower body negative pressure (LBNP) as mild orthostatic stimulation in 18 healthy men (mean age = 21.9 ± 1.9 yrs). TCD-determined MCAv was used to evaluate cerebral hemodynamics. SV was estimated from the radial arterial pressure waveforms using the Modelflow method.

**RESULTS:** SV, peak and pulsatile MCA velocity, and PI of MCA velocity were significantly decreased during LBNP stimulation (P<0.05 for all, vs. supine posture), whereas mean MCA velocity and cardiac output remained unchanged. Importantly, the change in SV during LBNP significantly correlated with corresponding changes in peak and pulsatile MCA velocity (r=0.50, P=0.034; r=0.63, P=0.005, respectively).

**CONCLUSIONS:** These results suggest that orthostatic stress (or postural change)-induced modified pulsatile component of cerebral hemodynamics (or augmented cerebral vascular stress) are partly due to change in SV. Our findings may partly support the phenomenon that long-time sleep is a risk for cerebrovascular disease.

**Previous study demonstrated that post-exercise muscle ischemia (activation of muscle metaboreflex) following leg cycling failed to elevate anterior cerebral blood flow (CBF) despite a higher arterial blood pressure and this result was associated with hyperventilation-related decrease in the partial pressure of end-tidal carbon dioxide. However, the effect of muscle metaboreflex on posterior CBF remains unknown.**

**METHODS:** The purpose of the present study was to test the hypothesis that the response of posterior CBF to activation of muscle metaboreflex is different from that of anterior CBF. CBF was measured throughout the experiment. At 90 sec after left hand immersion in cold water (4°C), dynamic CA was evaluated using thigh cuffs occlusion and release technique.

**RESULTS:** The both ICA and VA blood flow increased and reached the peak value at 60 s after the start of exercise (+19±15 and 26±14%, P<0.05, respectively). Thereafter, ICA blood flow gradually decreased to the end of exercise (P=0.05) despite no change in VA blood flow (P=0.710). During PEMI immediately after exercise, both ICA and VA blood flow returned to the baseline level despite a high blood pressure. CONCLUSIONS: VA circulation has a low cerebral autoregulation and carbon dioxide CBF reactivity. However, similarly with anterior CBF, VA blood flow was not affected by metaboreflex-induced elevated blood pressure. This phenomenon may be important for protecting posterior cerebral circulation from high blood pressure but the mechanism remains unclear.
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 photoplethysmograph, and end-tidal CO₂ (EtCO₂) via capnograph were measured during hyperventilation (hypocapnia) and with a modified rebreathing protocol (hypercapnia). Cerebrovascular conductance index (CVDI) was calculated by CBFV/MAP, and CVMRs were calculated by ΔCBFV/ΔEtCO₂ and ΔCVDI/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-Saltin treadmill protocol. Intracerebral 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 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. Hypercapnic CVMRs did not change with treatment or time. The ICCs of ΔCBFV/ΔEtCO₂ and ΔCVDI/ΔEtCO₂ were 0.53 (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 compared with stretching group. Although hypercapnia CVMRs were reproducible over 12 months, hypocapnic CVMRs showed lower reproducibility. Supported by the NIH (RO1AG033106).

Cerebral Microvascular Reactivity and Neurocognition in Childhood Cancer Survivors

Donald R. Dengel, FACSM1, Nicholas Evanoff G. Evanoff2, Kara L. Marlati2, Byron A. Mueller1, Karim T. Sadak1, Alicia S. Kunin-Batson1, Kelvin O. Lim1, 1University of Minnesota, Minneapolis, MN; 2Pennington Biomedical Research Center, Baton Rouge, LA (No relevant relationships reported)

PURPOSE: To determine the differences in cerebral microvascular reactivity (CVR) and neurocognition between childhood cancer survivors (CCS) and matched controls (CON). METHODS: Seven cancer survivors and seven matched [age, sex, and body mass index (BMI)] healthy cancer-free controls were enrolled in the study. Each participant completed neuropsychological testing (i.e., 30-word memory, attention, executive, and fine motor) and a self-report survey of executive/self-regulation skills. A computer-controlled gas-blending device was used to evaluate baseline and manipulate end-tidal carbon dioxide (PcO₂). To alter abnormally high flow, P CO₂ gas challenge consisting of two square waves increases of 10 mmHg above baseline Pco₂ and a ramp protocol that decreased P CO₂ to 32 mmHg and then increased linearly to 50 mmHg over 7 mins was utilized. P O₂ was maintained at 100 mmHg. Each participant underwent brain imaging using a 3T MRI for structural and functional (BOLD) imaging. CVR (%BOLD signal change/ΔmmHg CO₂) was computed using the robust linear least squares fit to the correlation between the two time courses. RESULTS: By design, CCS and CON were similar in age (27±1.1 vs. 26±0.8 y) and BMI (25.2±1.2 vs. 25.2±0.7 kg/m²) (all p<0.05). Baseline P CO₂ (37.0±1.1 vs. 38.0±0.9 mmHg, p=0.34) was not significantly different between the two groups. Whole brain gray matter CVR was also not significantly different in CCS vs. CON groups for the full sequence (0.36±0.01 vs. 0.35±0.02 %BOLD/mmHg, squares only) (0.37±0.02 vs. 0.36±0.02 %BOLD/mmHg) and ramp only (0.35±0.01 vs. 0.34±0.01 %BOLD/mmHg) (all p<0.05). The CVR variability (dCVR) was increased and model fit (R²) was significantly decreased in CCS compared with CON (p<0.004 and p=0.01, respectively) in the full sequence, but not in the square or ramp waveforms independently. No significant between-group differences were observed in neurocognitive testing. CONCLUSIONS: The data from this study suggest that childhood cancer survivors may have long-term treatment effects on microcirculation of the brain that affect CVR stability. Although this decline in brain microcirculation did not result in neurocognitive deficits, the long-term consequences of this decline in brain microvascular function have yet to be determined.
**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 four groups: sham control (SC), sham plus training (ST), AC without training, and AC plus training (AT). Training was performed on treadmill at 25±5 m/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 SC, the cardiac structure index LVIDd were significantly decreased, while the cardiac functional index ejection fraction (EF%) and fractional shortening (FS) were significantly increased in AT hearts. 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 I activity in AC was significantly lower than that in SC, but such reduction was not observed in AT. **Conclusion:** The current study demonstrated that 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 I function in electron transfer chain. The exercise program through regulating key components of mitochondrial function. This work was supported by 973 Program(2013CB531200) and Tianjin Research Program of Application Foundation and Advanced Technology (13JCYBJC39200).

**INTRODUCTION:** Christou 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 fitness. Multiple linear regression models using WAIST, BMI, FATMASS, and %FAT as dependent variables were used to obtain partial correlation coefficients to determine the independent association of fitness 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.
PAI, WHR and WC were identified as the best predictors of CAIs after adjusting for age and height [R² = 0.80, F(5,45) = 16.023, p < 0.0005; adj. R² = 0.640], while PAIs had no significant predictive power.

CONCLUSIONS: PWA may be effective for identifying differences in multiple brachial, central and peripheral pressure measures across a novel, pre-defined HbA1C spectrum; however, more research needs to be executed to validate these findings. WHR and WC, but not BMI, effectively predicted 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 potential vanilloid receptors, 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 overactivity manifest in T2D.

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

METHODS: Chemically activated neurons were assessed by single-fiber recordings from rat muscle-nerve 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 < 0.11) CONCLUSIONS: These data demonstrate that thin muscle afferents as well as DRG neuronal responses to chemical stimulation in thin muscle afferents are augmented by insulin exposure in normal healthy animals. The data support the concept that chronic hyperinsulinemia may potentiates 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 the JPS KAKENHI JP17K01769

PURPOSE: Low blood perfusion and hypoxia are characteristic features of tumours and are factors of resistance to radiation and chemotherapy. A few rodent studies have shown that aerobic exercise, that has no severe side-effects, may improve perfusion and hypoxia, however the optimal exercise intensity and timing of the effect on the tumour response during radiation and chemotherapy remain uninvestigated. The aim of our study was to investigate the acute effect of one exercise bout of either low, moderate, or high intensity aerobic exercise on tumour perfusion and hypoxia.

METHODS: Two weeks after injection of the C3H mammary carcinoma in the mammary fat pad, 24 female CDF1 mice were allocated to either a control group (no exercise) or three groups performing low (6 m/min), moderate (12 m/min) or high intensity (18 m/min) treadmill running for 30 minutes (n=6 for each group). Just prior to running all mice were injected (i.p.) with Pimonidazole (60 mg/kg) and immediately after exercise they were injected (i.v.) with Hoechst 33342 (10 mg/kg). Exactly 1 hour after exercise mice were injected (i.v.) with Hoechst 33342 (10 mg/kg) and immediately after Hoechst injection tumour perfusion was measured by multi-photon microscopy. Hypoxia could be determined from the degree of Pimonidazole binding, whereas analysis of the Hoechst 33342 staining enabled us to analyses perfused vessels.

RESULTS: Hearts of control mice had an hypoxic fraction (HF) of 8.7 ± 3.7 % in tumours from control animals. After exercise the HF significantly decreased to 4.3 ± 2.2 % (p = 0.03) in hearts of mice running at high intensity for 30 minutes elicit a profound 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 tumor treatment-response, especially to radiation.

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 (VO2peak) 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 VO2peak.

RESULTS: Eight BCS, mean age=40 (±8y), BMI=29.5 (±7.4) have been evaluated at baseline. Baseline mean PWV=7.2 (±1.65 m/s) and mean VO2peak=-17.3 (±3.42 mL/kg/min). Baseline correlation between PWV and VO2peak was moderate (r=0.42, p=0.083). Mean VO2peak improved (+4.0±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. -26mL/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.

E-30 Free Communication/Poster - Vascular Function
Friday, June 1, 2018, 7:30 AM - 12:30 PM
Room: CC-Hall B

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 blood flow occlusion by inflating an arm cuff to 220mmHg for 5 minutes followed by deflation for 5 minutes. Before and after the 7-day RIPC training period, laser
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. Hereby, pre-exercise skin blood flow changes during local heating. Flux and blood pressure measurements were collected during baseline (Tk=33°C) and local heating of forearm skin (Tk=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 heating was increased (Pre: 1.17±0.10 vs Post: 1.51±0.20 CVC, P<0.05). Both baseline values were not affected following RIPC (Pre: 0.2±0.03 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 melatonergic receptors in the vasorelaxation of small MAs in SHR.

METHODS: Twelve male normotensive Wistar-Kyoto rats (WKY, n=18) and SHRs (n=48) were used. SHRs 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 myograph. 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, was significantly decreased; 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 aims of this study were 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 (SBP) ≥20 mmHg or diastolic pressure (DBP) ≥10 mmHg.

METHODS: Nine elderly rest home residents [81.1 years (SD 7.1), 86.7% female] were subjected to aerobic exercise. Blood pressure and heart rate were measured before and after an acute bout of WBV. All participants laid supine for their baseline 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=0.0167, eta 0.0151) and a significant large time effect for training 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
Takanobu Okamoto1, Ryota Kobayashi2, Yuto Hashimoto1, Hiroyuki Hatakeyama3, ‘Nippon Sport Science University, Setagaya-ku, Tokyo, Japan. ‘Teikyo University of Science, Adachi-ku, Tokyo, Japan. (No relevant relationships reported)

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 males 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 or endurance training were randomly assigned 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 (AIx75) 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±14 to 142±13 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 during training in the IHG group from 165±14 to 148±8 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±8 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 capacity in two skeletal muscle mitochondrial capacity in obese African Americans. METHODS: Fifteen (47.7 ± 6.9 yrs; 34.6 ± 4.2 kg/m^2; 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 kinetic index of muscle O2 consumption (rate constant) after a short bout of exercise (vastus lateralis), followed by short bouts (5-10 s) of ischaemia. Arterial stiffness was assessed as carotid-femoral pulse wave velocity (cPWV) and aortic augmentation index (Axs). RESULTS: No significant correlation was observed between rate constant and cPWV (r=0.17, p=0.55) or Axs (r=0.01, p=0.97), but approached significance with rate pressure (r=0.50, p=0.07). Adjusting for age and gender revealed 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).
Official Journal of the American College of Sports Medicine

Supported by NIH Grant 1R03DK105297-01A1

2214 Board #50  June 1 11:00 AM - 12:30 PM
Skeletal Muscle Oxygenation During Plantarfexion Exercise In Young-old And Older-old Adults
Arum Maharaś1, Salvador J. Jaimes2, Justin Mason3, Patrick Saracino4, Arturo Figueroa-Galvez, FACSM4. Texas Tech University, Lubbock; TX. 2 - UNH, Durham, NH. 3 - La Crosse, WI. 4- Florida State University, Tallahassee, FL. (Sponsor: Arturo Figueroa, FACSM)

(No relevant relationships reported)

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 lean mass (LLM) by DEKA and examined maximal voluntary contraction (MVC) 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 (%∆) 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, MVC, LLM, body fat %, and fa-BF (P>.05). During exercise, the OO group exhibited a higher %∆ in HbO₂ compared to the YO group in sets 2 (60.0 ± 21.2 vs. 44.7 ± 17.2% ∆; p<.05) and 3 (46.7 ± 18.8 vs. 52.6 ± 18.2% ∆; p<.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. Exercising at a greater relative intensity may explain the lower calf muscle oxygenation in OO adults.

2215 Board #51  June 1 11:00 AM - 12:30 PM
Assessment of Vascular Function throughout the Menstrual Cycle
Alexandra E. Hirt, Elissa K. Katulka, Megan M. Wenner, Melissa A.H. Witman. University of Delaware, Newark, DE. (No relevant relationships reported)

BACKGROUND: Fluctuating sex hormones throughout the menstrual cycle, particularly endogenous estrogen, have been documented to correspond with nitric oxide (NO) bioavailability and likely have a cardioprotective effect in premenopausal women. However, the corresponding temporal changes in vascular function are not entirely understood. METHODS: Passive leg movement (PLM) is a relatively novel technique assessing NO-mediated vascular function, with a higher degree of NO-dependence than the traditionally used flow-mediated dilation (FMD) technique that could provide additional insight. PURPOSE: To assess vascular function throughout the menstrual cycle in premenopausal women using PLM, in addition to FMD. METHODS: Brachial artery FMD tended to be increased during the OV phase (8.8±1%) compared to the EF (7.8±1%) and ML (7.6±1%) phases. The femoral artery PLM AUC response during the ML phase was significantly lower than the EF response (leg blood flow AUC EF: 154±41 mL; OV: 79±24 mL, and ML: 44±15 mL). CONCLUSION: These findings support the importance of menstrual cycle when interpreting vascular function data as measured by FMD and PLM.

2216 Board #52  June 1 11:00 AM - 12:30 PM
Different Restrictive Devices to Achieve Blood Flow Restriction on Pulse Wave Reflection
Erica M. Marshall, Jason C. Parks, Vu Lun Tai, Alaina Glasgow, Leslie Sensibello, Kathryn Geither, J. Derek Kingsley, FACSM. Kent State University, Kent, OH. (No relevant relationships reported)

Blood flow restriction (BFR) has been mainly achieved with an automated blood pressure cuff. However, knee wraps to restrict flow are used as a practical form of BFR (pBFR). The effects of resistance exercise with BFR and pBFR on pulse wave reflection is unclear. PURPOSE: To examine the effects of BFR, pBFR, and traditional high-intensity (HI) knee press resistance exercise on pulse wave reflection in resistance-trained individuals. METHODS: Twenty-three (Age: 23 ±3 years) resistance-trained men underwent either bench press with BFR, pBFR [30% MVC; 5 repetition maximum (1RM), 4 sets, 30-15-15-15 repetitions, 30sec of rest], HI [70% 1RM, 4 sets, 8 repetitions, 60sec of rest] or a control. Measurements were taken at rest and 10mins postexercise. A 4x2 ANOVA was used to evaluate condition (BFR, pBFR, HI, Control) across time (rest, recovery) on pulse wave reflection. RESULTS: There were significant (p<0.0001) increases in heart rate [BFR: rest: 60±7bpm; recovery: 69±7bpm, pBFR: rest: 58±10bpm; recovery: 64±11bpm, HI: rest: 58±12; recovery: 72±13bpm] such that all three conditions were different compared to rest and the control. There was a significant interaction (p<0.001) for the augmentation index (AIX) in the during recovery phase (rest: 117±9.8; recovery: 2218±22.3, pBFR: rest: 114±9.4; aXs: 2218±9.8ms, HI: rest: 115.6±6.2ms; 122.8±6.4ms) that was elevated compared to rest, and the control. There was also a significant (p<0.001) interaction for the AIX normalized at 75bpm ([AIX@75]: BFR: rest: 8.8±13.5%; recovery: 25.9±9.5%; pBFR: rest: 7.2±8.5%; recovery: 23.3±14.2%; HI: 4.4±12.1%; recovery: 21.2±9.9%) that in it was augmented during recovery to rest and the control. The subendocardial viability ratio (S2-StO2) for BFR (rest: 138.4±19.5; recovery: 111.2±11.3), pBFR (152.2±27.5; recovery: 125.5±33.5), and HI (rest: 152:9±37.9; recovery: 111.9±28.7) also demonstrated a significant (p<0.001) condition by time interaction such that they were elevated above rest in all three resistance exercise conditions, which were different than the control. CONCLUSION: These data demonstrate that BFR using an automated cuff or knee wraps has similar effects as traditional high-intensity resistance exercise on pulse wave reflection in resistance-trained men after the bench press.

2217 Board #53  June 1 11:00 AM - 12:30 PM
Effect of a High Fat Meal on Microvascular Responsiveness Measured Using Near Infrared Spectroscopy
Britton C. Scheuermann, Erin C. Garmyn, Morgan M. Monahan, Timothy R. Rotaruis, Christopher R. Silette, Barry W. Scheuermann. The University of Toledo, Toledo, OH. (No relevant relationships reported)

Studies indicate that the rate of tissue oxygen reperfusion following brief periods of occlusion can detect differences in vascular responsiveness. Consumption of a high fat meal (HFM) has been shown to reduce vascular function in conduit arteries. The extent that consumption of a HFM effects microvascular responsiveness has not been examined. PURPOSE: To examine the effect of a HFM on microvascular responsiveness in the brachial artery (BA). It was hypothesized that a HFM would slow tissue reperfusion consistent with impaired microvascular function. METHODS: Eleven healthy (27.8 ± 3.2 yrs, (± SEM) men (n=7) and women (n=4) reported to the laboratory following a 12 h fast and no prior exercise. Microvascular function in the left BA was assessed using the flow-mediated dilation (FMD) BA images were obtained in B-mode using a linear array probe (operating frequency of 7.0 MHz). Images were captured (10 fps) and analyzed using software that incorporates automates wall detection. %FMD was calculated as the difference between baseline diameter and the maximum diameter measured following cuff release. Near infrared spectroscopy was used to measure changes in oxyhemoglobin (HbO₂) and deoxy-hemoglobin (Hb) right after the HFM. The slope of SO₂ reperfusion (S2) following cuff release was measured using linear regression. After Pre-HFM measures were obtained, subjects consumed a HFM consisting of 90 g total fat (63 g saturated fat), 364 mg cholesterol, 17 g carbohydrate, and 139 mg sodium. Measures of %FMD and S2 were recorded 2 hours Post-HFM. RESULTS: The HFM resulted in a decrease in BA reactivity (Pre-HFM, 680 ± 0.79 %FMD; Post-HFM, 4.12 ± 0.55 %FMD; P<0.05). Compared to baseline, the HFM resulted in a lower S2-SO₂ slope (Pre-HFM, 3.32 ± 0.18 % a.u/s; Post-HFM, 2.96 ± 0.16 % a.u/s; P<0.05). CONCLUSION: This study provides evidence that a HFM reduces the reperfusion rate in the microcirculation, consistent with an impaired vasodilatory response. While there was no correlation between the slowed reperfusion and impaired FMD following the HFM, it may be speculated that differences in measurement site may have contributed, at least in part, to this discrepancy. The mechanism responsible for the slowed reperfusion requires further investigation.

2218 Board #54  June 1 11:00 AM - 12:30 PM
Different Responces Of Arterial Stiffness And Nitric Oxide Bioavailability To Different Exercise Training Programs
Natsuki Hasegawa1, Shumpei Fujie1, Naoki Horii2, Eri Miyamoto-Miikkari1, Kaoru Tsuji2, Kazuaki Uchida1, Takanami Hamaoka, FACSM1, Izumi Tabata, FACSM1, Motoyuki Iemitsu2, Ritsumeikai University, Kusatsu, Japan. 1National Institute of Fitness and Sports in Kanoya, Kanoya, Japan. (No relevant relationships reported)

Aerobic training (AT) and high-intensity intermittent training (HIIT) reduce arterial stiffness, whereas resistance training (RT) induces no change or deterioration of arterial stiffness. Nitric oxide (NO) is produced from L-arginine by endothelial NO synthase (eNOS) in endothelial cells. AT enhances arterial NO-derived vasodilation,
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 4 groups; sedentary control (CON), AT (treadmill running for 60 min at 30% of body weight (BW) for 6 weeks), HIIT (7-8 repeats of 30 s running alternate with 1 minute of rest for 6 weeks), and HIIT (4 × 20 s alternate with 1 minute of rest for 6 weeks). Then, 8 weeks after the weight gain of 20%, the arterial stiffness and NO levels were measured by the pulse wave velocity (PWV) and nitric oxide (NOx) level, respectively.

**RESULTS:** Significant differences were observed in PWV (P<0.001) and NOx level (P=0.010) in CON vs. AT and HIIT vs. AT. The PWV in CON was higher than that in AT and HIIT (P<0.001), whereas the NOx level in CON was lower than that in AT and HIIT (P<0.001). These data suggest that the different exercise training may have different effects on arterial stiffness and NO production in rats.

**CONCLUSIONS:** This study demonstrated that different exercise training had different effects on arterial stiffness and NO production in rats. AT and HIIT were more effective in improving arterial stiffness and NO production than sedentary control. Further studies are needed to elucidate the molecular mechanisms underlying these effects.

---

**S448 Vol. 49 No. 5 Supplement**

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

---

**FRIDAY, JUNE 1, 2018**

---

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

**Estrous Cycle-Mediated Regional Diversity in BK Channel Expression and Function in Arterial Myocytes**

Jacob A. Goldsmith, Kirk W. Evanson. *Florida State University, Tallahassee, FL. (Sponsor: Heidi Kluss, FACSM)

*(No relevant relationships reported)*

Large-conductance calcium (Ca²⁺)-activated potassium (BK) channels are significant regulators of arterial smooth muscle cell (myocyte) membrane potential and arterial contractility. The expression and function of BK channels in ovariectomy-intact female resistance arteries are poorly understood. Moreover, the effects of endogenous steroidal levels associated with the estrous cycle on arterial BK channels are unclear. **PURPOSE:** To investigate estrous cycle effects on BK channel expression and function in uterine and cerebral arterial smooth muscle. **RESULTS:** Western blotting and biotinylation of whole uterine arteries revealed an increase in total (~39%) n=7 and plasma membrane-localized (~64%) n=5 β1 subunits during proestrus as compared to diestrus. Patch-clamp electrophysiology demonstrated that BK channel activation (open probability [Pₒ]) was enhanced −5−fold during proestrus in uterine arterial myocytes (diestrus: Pₒ=0.09±0.05 n=4, proestrus: Pₒ=0.55±0.10 n=5; 10µM free Ca²⁺). In contrast, BK channel expression and activation were unchanged during proestrus in cerebral arterial myocytes (diestrus: Pₒ=0.48±0.08 n=11, proestrus: Pₒ=0.56±0.09 n=4; 10µM free Ca²⁺). **CONCLUSION:** These data suggest that endogenous steroids associated with the estrous cycle can alter BK channel expression and function in female resistance arteries. However, the estrous cycle effects on arterial BK channels are region-specific.

---

**2221 Board #57 June 1 11:00 AM - 12:30 PM**

**The Comparison Of High-intensity Interval Exercise Vs. Continuous Moderate-intensity Exercise On C1q In-translated Protein-9 Expression And Flow-mediated Vasodilatation In Obese Individuals**

Brandon G. Fico, Ryan S. Garten, Michael C. Zourdos, Michael Whitehurst, FACSM¹, Peter J. Ferrandí, Katelyn M. Dodge, Gabriel Pena, Alexandra A. Rodriguez, Chun-Jun Huang, FACSM.¹*Florida Atlantic University, Boca Raton, FL. Virginia Commonwealth University, Richmond, VA. (Sponsor: Dr. Chun-Jun Huang, FACSM)

*(No relevant relationships reported)*

**PURPOSE:** A recent novel adipocytokine, C1q-1n-translated protein-9 (CTRPP9), has been shown to increase activation of endothelial nitric oxide synthase and reduce vasoconstrictors (e.g., endothelin-1). In addition, CTRPP9 may play a compensatory role in obesity-related endothelial dysfunction. Although there is limited information regarding exercise-mediated CTRPP9, high-intensity interval exercise (HIE) has been shown to be as or more effective than continuous moderate-intensity exercise (CME) in improving indicators of endothelial function (e.g., brachial artery flow-mediated dilation [BAFMD]). Therefore, the purpose of this study was to investigate the effect of acute HIE vs. CME on serum CTRP9 and BAFMD responses in obese individuals.

**METHODS:** Sixteen young male subjects (9 obese and 7 normal-weight) participated in a counterbalanced and caloric equated experimental HIE (30 minutes, 4 intervals of 4 minutes at 80−90% of VO₂max with 3 minutes rest between intervals) and CME (38 minutes at 50−60% VO₂max). Serum CTRP9 and BAFMD, were measured prior to, immediately following exercise, and 1 hour and 2 hours into recovery.

**RESULTS:** The concentration of serum CTRP9 was significantly increased immediately following acute HIE and CME in both obese and normal-weight groups (p = 0.003). Furthermore, both significant treatment by time and group by time interactions for BAFMD were observed following both exercise protocols (p = 0.018; p = 0.009, respectively), with a greater CME-induced BAFMD response at 2 hours into recovery in obese compared to normal-weight subjects. Additionally, a positive correlation in percent change (baseline to peak value) between CTRP9 and BAFMD was found significantly increasing acute CME (r = 0.589, p = 0.016).

**CONCLUSIONS:** Acute HIE is as effective as CME to upregulate CTRP9 expression in both obese and normal-weight individuals, although CTRP9 may potentially improve CME-mediated results found for BAFMD. The present study provides a foundation for additional examination of the mechanisms of exercise-mediated CTRP9 on endothelial function.

---

**2222 Board #58 June 1 11:00 AM - 12:30 PM**

**The Effect Of Aquatic Exercise On Arterial Stiffness And Central Blood Pressure**

Marina Fukuie¹, Takayuki Yamabe¹, Yosuke Nomura, Tatsuya Hashitomi¹, Seiji Maeda¹, Jun Sugawara³, University of Tsukuba, Tsukuba, Japan. ²Tsukuba Aquafit Laboratory, Tsukuba, Japan. ³National Institute of Advanced Industrial Science and Technology, Tsukuba, Japan. (Sponsor: Shigehiko Ogoh, FACSM)

*(No relevant relationships reported)*

**PURPOSE:** Aquatic exercise is ideal for older adults because it mitigates weight-bearing stress. However, the effect of aquatic exercise on arterial stiffness and central (e.g., aortic) blood pressure has yet to be determined. The aim of this study was to investigate the effects of aquatic exercise on arterial stiffness and central blood pressure.

**METHODS:** Analysis of 16 normotensive middle-aged and older peoples (mean age = 66±9 yrs, 5 men) participated a supervised aquatic exercise training program (90 min, 1 day/week, 3 months) which mainly consisted of walking, stretching, and muscle strengthening in water. Brachial and aortic BP (estimated from brachial BP waveform via general transfer function), and brachial-ankle pulse wave velocity (baPWV, an index of arterial stiffness) were measured before and after the training period. **RESULTS:** Following the training intervention, body mass did not change significantly, whereas brachial and aortic systolic BP significantly decreased (from 116 ± 10 to 109 ± 12 mmHg, P = 0.04 and from 111 ± 9 to 104 ± 11 mmHg, P = 0.03, respectively). In addition, baPWV lowered significantly after the training period (P = 0.002). Significant decreases were also observed in both systolic and diastolic aortic BP (P = 0.010 and 0.003, respectively). These findings suggest that aquatic exercise can be an effective intervention to improve arterial stiffness and central blood pressure in older adults.

---
2223 Board #59  June 1 11:00 AM - 12:30 PM
Oxidant-Antioxidant Balance And Peripheral Vascular Function: The Impact Of Chronic Antioxidant Supplementation
Austin C. Hogwood, Jennifer Weggen, Carson Fraulin, David Lee, Matthew Scott, Ryan S. Garten. Virginia Commonwealth University, Richmond, VA.

(No relevant relationships reported)

Reactive oxygen and nitrogen species (RONS) have been revealed to incur both positive and negative changes to physiological function and adaptation. Specific to the peripheral vasculature, RONS can act to reduce important vasoactive components, such as nitric oxide (NO), or, in some instances, act in vasodilatory capacity as an endothelial-derived hyperpolarizing factor. Purpose: This study sought to determine the effects of altering the oxidant-antioxidant balance, via a chronic antioxidant supplementation, on leg vascular function. Methods: Five healthy, young male subjects ingested an antioxidant cocktail (500mg vitamin C, 400mg vitamin E, and 200 mg of alpha lipoic acid) twice a day for 28 days. Leg vascular function, measured via passive leg movement (PLM), was performed prior to supplementation (Day 0) and on days 1, 7, 14, 21, 28 after the start of supplementation. An additional testing day was performed 7 days after cessation of the supplementation (Day 35). Results: Leg vascular function, measured via PLM-induced leg blood flow (LBF) and AUC, was significantly decreased over time with a 50% reduction in the PLM-induced LBF and 60% reduction in LBF AUC. After a 7-day cessation of supplementation, PLM-induced LBF and LBF AUC returned to baseline. Conclusion: This study revealed that 28 days of chronic antioxidant supplementation resulted in a reduction in peripheral vascular function in young healthy individuals that was completely restored after cessation of supplementation. As PLM has been revealed to be highly NO-mediated, this study identifies antioxidant supplementation as a modulator of NO bioavailability potentially through the inhibition of RONS-induced vasodilatory capacity or a reductive stress-like mechanism.

2224 Board #60  June 1 11:00 AM - 12:30 PM
Racial Differences in Vascular Function in Response to Mental Stress

(No relevant relationships reported)

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 elevated CV disease risk in AA. However, this study was conducted in a middle-age cohort (mid to late 40’s). Whether this attenuation is present in a relatively young and healthy population is unknown. Purpose: The purpose of this study was to test the hypothesis that the vasodilatory response to mental stress is blunted in a relatively young and healthy AA population. Methods: 6 AA and 6 CA males (AA age: 22±2.6, CA age: 23 ± 4.6) participated in this study. All measurements were obtained in the morning following an overnight fast. Brachial artery diameter and blood velocity were assessed using high resolution ultrasound duplex ultrasound. Mental stress was induced by asking subjects to subtract 7 continuously from a 3-digit number while attempting to report answers at a pace set by a 60 bpm metronome. The 3-digit number was changed at 20 second intervals. FBF was measured during a two minute baseline followed by 3 minutes of mental stress. Vascular function was assessed as the absolute peak blood flow response (ml/min) as well as peak conductance (ml/min/mmHg) during the mental stress. Results: The absolute peak flow (AA: 183 ± 39 ml/min, CA: 307 ± 127 ml/min; P = 0.05) were significantly greater in CA compared to AA. The maximum increase in conductance (AA: 2.0 ± 0.32 ml/min/mmHg, CA: 3.69 ± 1.39 ml/min/mmHg; P = 0.02) was also significantly higher in CA as compared to AA. Conclusion: This preliminary data support our hypothesis that vascular function in response to mental stress is attenuated in young healthy AA as compared to their CA counterparts.
2227: June 1 11:00 AM - 12:30 PM Reproducibility of a Ramping Protocol to Measure Cerebral Vascular Reactivity Using Functional Magnetic Resonance Imaging
Nicholas G. Enavoff, Kara L. Marlett, Justin R. Geijer, Bryon A. Mueller, Kelvin O. Lim, Donald R. Dengel, FACSM.
University of Minnesota, Minneapolis, MN. 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 (P_CO2) and end-tidal oxygen (P_O2) 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 P_CO2. METHODS: To stimulate changes in CVR, PETCO2 was altered while P_O2 was held constant using a computer controlled prospective gas-blending device. Two fMRI scans, each including a linear change in P_CO2 were performed on the same visit using a 3-Tesla (3T) scanner. This ramp sequence consisted of decreasing P_CO2 to 30 mmHg and then increasing P_CO2 linearly to 50 mmHg over a 7 min period. The protocol was repeated on a separate visit with minimum of 3 days 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 (Visits 1: ICC = 0.82, CV = 6.5%; Visits 2: ICC = 0.74, CV = 6.36%). Similarly, ramp waves were reproducible between scanning sessions (Scan 1: ICC = 0.74, CV = 6.5%; Scan 2: ICC = 0.66, CV = 6.13%). CONCLUSION: This study demonstrates BOLD signal changes in response to ramp alterations in P_CO2 are reproducible both within- and between-visit MRI scans. Establishment of reproducible methodologies for measuring BOLD signal changes while altering P_CO2 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 P_CO2.

2228: June 1 11:00 AM - 12:30 PM 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: Hélaine 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) or resistance exercise (RE) performed the prior evening will attenuate PPH-mediated CVR functionality. Finally, adding a ramping protocol to CVR studies could provide information about linear changes in CVR over a broad range of P_CO2.

MEDICINE & SCIENCE IN SPORTS & EXERCISE®

2229: June 1 11:00 AM - 12:30 PM Effects of Obese Skeletal Muscle Cell Angiogenesis
Christopher K. Kargl1, Yaohui Nie2, Ron T. Garner, Scheelagh Evans1, Zach R. Hettinger, Brian Sullivan1, Tim P. Gavin, FACSM.
1Purdue University, WEST LAFAYETTE, IN. 2Harvard University, Cambridge, MA. (Sponsor: TP Gavin, FACSM) (No relevant relationships reported)

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. METHODS: 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 HSKM 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 after a six-hour incubation. 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 HSKM CM. Also, there was no difference in HUVEC tube length (LN: 23,726 vs. OB: 24,046, AU) or branches (LN: 452 vs. OB: 465, AU) between LN and OB HSKM CM. CONCLUSION: In cell culture, there is no apparent effect on obesity skeletal muscle regulation of 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.

2230: June 1 11:00 AM - 12:30 PM Perfusion and Diffusive Microvascular Oxygen Delivery During Simulated Hypovolemia and Dynamic Forearm Exercise
Shane M. Hammer, Jacob T. Caldwell, Kaylin D. Didier, Andrew M. Alexander, Carl J. Ade, Thomas J. Barstow, FACSM.
State University of New York, Alfred, NY. (Sponsor: TP Gavin, FACSM) (No relevant relationships reported)

The maintenance of brachial arterial blood flow during dynamic forearm exercise in the face of simulated hypovolemia (via lower-body negative pressure (LBPN)), has been previously demonstrated. The distinct facets of microvascular oxygen delivery (i.e. perfusive and diffusive) during such an event, however, has not been described. PURPOSE: We tested the hypothesis that, during dynamic handgrip exercise, the initiation of LBPN would result in no significant changes in the indices of microvascular perfusive or diffusive oxygen delivery (deoxy-[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 LBPN in the absence of exercise, LBPN (~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, LBPN was initiated. Mean arterial pressure (MAP) was recorded continuously via a calibrated finger photoplethysmograph (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 LBPN 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 LBPN 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 hypovolemia (i.e. LBPN) 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; VO₂ max 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 artery 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 ± 1.1; 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.

Abstracts were prepared by the authors and printed as submitted.
**Abdominal Aorta Compliance and Distensibility Among Young Ranging from Normal Weight to Severe Obesity**

Michelle Harbin, Nicholas G. Evanoff, Aaron S. Kelly, Justin R. Ryder, Donald R. Dengel, FACSM. University of Minnesota, Twin Cities, Minneapolis, MN. (Sponsor: Donald R. Dengel, FACSM)

**Purpose:** This study evaluated abdominal aorta stiffness and diameter among youth throughout a range of body mass index (BMI) values. **Methods:** Non-invasive ultrasonographic measurements of the abdominal aorta were obtained from 190 youth (92 males; mean±SE: age=12.9±0.2 years). Body composition was assessed by dual-energy X-ray absorptiometry. Obesity status was defined using age- and sex-based BMI percentiles: normal-weight (NW) (≤5th to >85th percentile); overweight (OW) and obese (OB) (≥85th to <1.2 X 95th percentile); and severe obese (SO) (≥1.2 X 95th percentile). Analysis of covariance compared differences by obesity status with adjustments made for race, sex, and Tanner stage. Multiple linear regression evaluated the association of sex, age, and percent body fat (%BF) on abdominal aorta elasticity. **Results:** Prior to adjustment, abdominal aorta diameter (aBD) was significantly larger among SO (mean±SE: 11.1±0.4 mm) compared to both OW/OB (9.6±0.3 mm, p=0.006) and NW (8.9±0.3 mm, p=0.001). Abdominal aorta incremental elastic modulus (aIEM) was higher among SO (1153.0±70.8 mmHg) compared to OW/OB (960.4±48.6 mmHg, p=0.044) and NW (846.0±40.9 mmHg, p=0.001). Abdominal aorta diameter distensibility (aDD%) was lower among SO (14.2±0.6%) compared to NW (16.0±0.6%; 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). After adjusting for covariates, aBD remained significantly larger among SO compared to OW/OB (p=0.018) and NW (p=0.001); aIEM was significantly higher among SO compared to NW (p=0.002). Adjusted aDD% and aCSD were not significantly different among groups. Age was associated with higher aBD (β=0.41, p=0.001), higher aIEM (β=42.92, p=0.001), decreased aDD% (β=0.38, p=0.007), and decreased aCSD (β=0.96, p=0.004). Percent body fat was associated with both higher aBD (β=0.06, p=0.001) and aIEM (β=7.44, p=0.007), while sex was not associated with measures abdominal aorta elasticity and stiffness. **Conclusion:** The deleterious effect of obesity on arterial stiffness extends to the abdominal aorta. Higher age and %BF, but not sex, was associated with greater abdominal aorta stiffness.

---

**Exercise-Levels Of Laminar Shear Stress In Combination With Aspirin And Celecoxib On Tnf-α Induced Emp Formation**

Heather Grimm1, Jan Kretzschmar2, Micheal D. Brown, FACSM2. ’King’s College, Wilkes Barre, PA. ’Auburn University, Auburn, AL.

**Purpose:** To determine the effect of combination treatment of exercise-mimetic levels of LSS with aspirin or celecoxib on the prevention of TNF-α-induced EMP formation in Human Umbilical Vein Endothelial Cells (HUVECs). **Methods:** HUVECs were challenged with anti-TNFα levels of TNFs after various anti-inflammatory pre-treatments and combinations thereof. EMPs were analyzed using flow cytometry. **Results:** Pre-treatment with aspirin or celecoxib was effective in preventing TNFα-mediated production of EMPs of cells with cellular apoptosis and activation. However, exercise-mimetic levels of LSS and/or TNFs blunted TNFα-mediated production of EMPs when given in isolation and in combination with aspirin and celecoxib. **Conclusion:** When given in isolation, neither aspirin, nor celecoxib seem effective enough to prevent TNFα-mediated EMP production. Only when HUVECs were treated with combinations of LSS and aspirin or celecoxib could EMP production be blunted. This implicates the powerful effect of exercise to prevent the atherogenic process, especially when compared to commonly prescribed preventative treatments in the form of aspirin and celecoxib.
Acute and chronic inflammation are associated with an increased risk of cardiovascular (CV) events in older adults and reduced endothelial function (flow-mediated dilation; FMD). Obesity is also associated with greater inflammation. Whether this greater inflammatory state in overweight/obese individuals plays a role in the endothelial response during acute inflammation is unknown. PURPOSE: To evaluate the role of obesity status in the endothelial response to acute inflammation in younger (YA) and older (OA) adults. METHODS: An influenza vaccine was used to induce acute inflammation in 25 YA (13 male, 26±4 yrs) and 56 OA (18 male, 65±5 yrs). Blood pressure, FMD and serum inflammatory markers were measured before vaccination and 24 and 48-hours after. Participants were divided into normal weight (NW) (body mass index, BMI: 18-25 kg/m²) and overweight/obese (O/OB) (BMI ≥25 kg/m²) for analysis. Results: See table. All groups increased IL-6 at 24-hours (p<0.01), which returned to baseline at 48. CRP was elevated at 24- and 48-hours in all groups except NW OA (p for interaction = 0.04). Endothelial function (FMD) was reduced at 24- and 48-hours (p<0.01) in all groups. During the inflammatory bout, NW and O/OB YA had a greater FMD than both NW and O/OB OA (p<0.02). Conclusion: It does not appear body mass index influences the endothelial response during acute inflammation in YA or OA. In our sample, these results may be due to the similar baseline level of inflammatory markers between the NW and O/OB in each age category. Future studies are required to further investigate this relationship.

<table>
<thead>
<tr>
<th>YA</th>
<th>Normal Weight</th>
<th>YA – Overweight/Obese</th>
<th>OA – Normal Weight</th>
<th>OA – Overweight/Obese</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>15</td>
<td>10</td>
<td>18</td>
<td>38</td>
</tr>
<tr>
<td>Age, yrs.</td>
<td>26 ± 3</td>
<td>25 ± 5</td>
<td>66 ± 5</td>
<td>64 ± 5</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>21.6 ± 1.9</td>
<td>28.1 ± 2.3¹</td>
<td>22.4 ± 3.9²</td>
<td>30.5 ± 4.3³</td>
</tr>
<tr>
<td>MAP, mmHg</td>
<td>79 ± 9</td>
<td>88 ± 9</td>
<td>89 ± 11*</td>
<td>90 ± 10*</td>
</tr>
<tr>
<td>CRP, mg/L*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>0.7 ± 0.6</td>
<td>1.0 ± 0.7</td>
<td>2.7 ± 2.7¹</td>
<td>2.9 ± 3.1³</td>
</tr>
<tr>
<td>24h</td>
<td>1.6 ± 1.2</td>
<td>2.5 ± 1.0</td>
<td>2.8 ± 3.0</td>
<td>3.9 ± 3.5</td>
</tr>
<tr>
<td>48h</td>
<td>2.5 ± 2.4</td>
<td>3.0 ± 2.4</td>
<td>3.7 ± 3.8</td>
<td>4.0 ± 3.3</td>
</tr>
<tr>
<td>IL-6, pg/mL*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>0.8 ± 0.5</td>
<td>1.0 ± 0.7</td>
<td>1.5 ± 1.3</td>
<td>1.7 ± 1.3¹</td>
</tr>
<tr>
<td>24h</td>
<td>1.4 ± 0.7</td>
<td>2.1 ± 1.5</td>
<td>1.9 ± 1.2</td>
<td>2.4 ± 2.2</td>
</tr>
<tr>
<td>48h</td>
<td>0.8 ± 0.4</td>
<td>1.2 ± 0.9</td>
<td>1.6 ± 1.2</td>
<td>2.0 ± 2.1</td>
</tr>
<tr>
<td>FMD, %*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>12.9 ± 4.5</td>
<td>8.8 ± 2.6</td>
<td>6.6 ± 3.9</td>
<td>6.0 ± 2.5¹</td>
</tr>
<tr>
<td>24h</td>
<td>9.8 ± 3.1</td>
<td>7.2 ± 3.6</td>
<td>4.0 ± 3.6</td>
<td>5.7 ± 3.1</td>
</tr>
<tr>
<td>48h</td>
<td>8.9 ± 2.9</td>
<td>7.6 ± 3.1</td>
<td>4.3 ± 2.3</td>
<td>5.0 ± 2.9</td>
</tr>
</tbody>
</table>

Data presented as mean ± standard deviation. BMI: Body mass index; CRP: C-reactive protein; FMD: Flow mediated dilation; IL-6: interleukin-6; MAP: mean arterial pressure p<0.05 vs. normal weight young adults; p<0.05 vs. overweight/obese young adults; p<0.05 vs. normal weight older adults *overall time effect, p<0.05; overall group effect, p<0.05; *group*time interaction effect, p<0.05

2242 Board #78 June 1 11:00 AM - 12:30 PM Evidence of Racial Differences in Microvascular Function Among College-Aged Women
Jordan C. Patik, Bryon M. Curtis, Aida Nasirian, Guillermo Olvera, R. Matthew Brothers. University of Texas Arlington, Arlington, TX. (No relevant relationships reported)

Microvascular dysfunction contributes to the development of hypertension and insulin resistance. The black population is at an elevated risk of both conditions relative to other racial groups. Previous studies indicate that college-aged black men, compared to their white counterparts, exhibit impaired microvascular function as assessed by post-occlusion reactive hyperemia (RH). It is unknown whether this racial disparity is present in healthy, young adult black (BW) and white women (WW). Furthermore, whether nitric oxide-mediated cutaneous microvascular hyperemia during local heating...
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 ± 9.6 ml·kg⁻¹·min⁻¹) and ten young (25 ± 3 years) untrained (VO2max: 35.9 ± 5.3 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 with Doppler ultrasonography. 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 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 (HAC: –370 ± 337 ml·min⁻¹; HAC: –167 ± 258 ml·min⁻¹; p < 0.05), LBF AUC (LAC: –149 ± 201 ml·min⁻¹; HAC: –94 ± 90 ml·min⁻¹; p < 0.05), or at 3 hours [Δ Peak LBF (LAC: –373 ± 288 ml·min⁻¹; HAC: –243 ± 209 ml·min⁻¹; p < 0.05), LBF AUC (LAC: –219 ± 202 ml·min⁻¹; HAC: –91 ± 132 ml·min⁻¹; p < 0.05)]. CONCLUSION: This study found that aerobic capacity did not mitigate the vascular dysfunction resulting from prolonged sitting.

Pulse wave reflection [augmentation index (AIx), augmentation pressure (AP), and arterial stiffness (pulse wave velocity [PWV]) are indicative of cardiovascular health. Acute resistance exercise (RE) alters pulse wave reflection, and arterial stiffness, but responses in resistance-trained individuals is unclear. PURPOSE: To examine the responses in pulse wave reflection and arterial stiffness after RE in resistance-trained (RT) versus untrained (UT) individuals. METHODS: Twenty-one (RT: n=14; UT: n=7) individuals volunteered. Pulse wave reflection and arterial stiffness were collected at rest, and 10min following a control, or RE consisting of 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, UT) 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 IRMs 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±282ms; UT: 2192±209ms; p=0.04)], diastolic pressure-time index [DPTI (RT: 2817±116ms; UT: 3047±111ms; p=0.003)], and PWV (RT: 5.3±0.77ms; UT: 6.3±0.84ms; p=0.001). There were significant time by condition interactions for aortic pulse pressure (Rest: 341±66mmHg; Recovery: 374±58mmHg; p=0.003), mean arterial pressure (Rest: 91.5±10mmHg; Recovery: 91.5±10mmHg; p=0.003), and total blood flow AUC during the 120 s occlusion. For LH, a microdialysis membrane was inserted in the dermis of the follicular phase of the menstrual cycle. For RH, brachial artery diameter and blood flow were measured via Doppler ultrasound before and after 5 min of forearm occlusion. For LH, a microdialysis membrane was inserted in the dermis of the forearm and perfused with Ringer’s solution. Red blood cell flux was assessed with laser Doppler after ~40 min of continuous 39°C LH. Maximal flux was established with 28 mN sodium nitroprusside infusion and 45°C LH. Brachial BP was measured throughout the protocol and cutaneous vascular conductance (CVC) was calculated as flux / MAP and reported as % of max CVC.

Results: WW, and BW were matched for age (21 ± 3 vs 23 ± 3 yrs, P = 0.58) and BMI (23 ± 2 vs 23 ± 3 kg/m², P = 0.94). There were no differences between WW and BW in baseline blood velocity (23.1 ± 5.7 vs 24.4 ± 11.6 cm/s, P = 0.79) or blood flow (98.9 ± 38.3 vs 114.5 ± 80.7 ml/min, P = 0.65). WW and BW also had similar peak blood velocity (109.2 ± 13.8 vs 109.7 ± 28.8 cm/s, P = 0.97), peak blood flow (453.7 ± 164.7 vs 482.5 ± 187.7 ml/min, P = 0.77), and total blood flow AUC during the 120 s after cuff release (487.4 ± 178.5 vs 488.6 ± 190.1 ml, P = 0.99). However, compared to WW, BW had a significantly blunted CVC during 39°C LH (66 ± 17 vs 45 ± 10 %max, P = 0.02).

Conclusions: WW had blunted blood flow responses to LH compared to WW despite similar blood velocity and flow responses during RH. This suggests that LH is more sensitive to RH to early impairments in microvascular function.

MEDICINE & SCIENCE IN SPORTS & EXERCISE®
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 self-reported QOL (Uitain questionnaire) and menopausal symptoms. Women were classified into fitness categories via treadmill VO_{2max} test (VO_{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_{2max}). Associations between menopausal status, symptoms, 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 40%). There was an effect of fitness on overall QOL (HIGH 95.4±2.189; LOW 78.0±2.476, p=0.0001) but no menopausal symptom or symptoms (p=0.05). High fitness was related to higher QOL for health (HIGH 30.45±0.746; LOW 22.083±0.083, p=0.0001), occupational (HIGH 27.6±0.999, LOW 24.2±1.13, p=0.032), emotional (HIGH 25.46±1.674; LOW 23.017±0.847, p=0.014), and sexual QOL (HIGH 12.061±0.687; LOW 7.81±0.785, 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 status or symptoms. 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).

2250 Board #86 June 1 11:00 AM - 12:30 PM
Comparing Two Low-Intensity Strength Training Modalities on Vasodilatory Capacity in Postmenopausal Women
Salvador J. Jaime,1 Arun Maharaj2, Stacey Alvarez-Alvarado3, Arturo Figueroa, FACSM2,3,1 University of Wisconsin-La Crosse, La Crosse, WI, 2Texas Tech University, Lubbock, TX, 3Florida State University, Tallahassee, FL, (FACSM) Funding: (No relevant relationships reported)

PURPOSE: Dynapenia, the age-related loss in muscle strength, is an emerging risk factor for the development of cardiovascular disease and physical disability. Vascular function, both endothelial-dependent reactive (RH) and active hyperemia (AH), are important for adequate blood flow to active muscles. Although high-intensity resistance training (RT) increases mass and strength, there are limited data regarding the effect of low-intensity RT (LRT) on RH and AH in older adults. We investigated the effects of two low-intensity strength training modalities on RH and AH in postmenopausal women with low muscle strength.

METHODS: Thirty-one postmenopausal women were stratified by age, body mass index (BMI), and maximal voluntary contraction (MVC) (age, 65 ± 4 years; BMI, 23.2 ± 2.6 kg/m²; MVC, 17.3 ± 2.7 kg) and randomized into isolated lower-body whole-body vibration training (WBVT) (n=12), LRT (n=11) or control (n=8) groups for 12 weeks. Brachial and popliteal diameter, mean blood velocity, blood flow during RH (flow-mediated dilation, FMD) and AH after 6-minute walk test, and strength on the leg press (LP), flexion (LFlx), and extension (LExt) were measured at baseline and 12 weeks.
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 to the acetylcholine (ACCh) (5.4 ± 1.4 %; P = 0.007) post-WBVT 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 LFlex 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 LFlex 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 brachial and popliteal FMD, WBVT may be a more efficacious improvements for leg post-exercise vasodilation and muscular strength than LIRT in non-obese postmenopausal women.

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: First, to observe changes in arterial stiffness, as assessed by pulse wave velocity (PWV), with a 2 hour bout of standing. Second, to determine if short, intermittent walking breaks provide a comparative advantage to standing alone. METHODS: 20 apparently healthy adults (BMI = 22.9 ± 3.2 kg/m²; Age = 21 ± 3.5 years old) stood for 2 consecutive hours while being assessed for heart rate (HR), mean arterial pressure (MAP), and central (CVP), upper peripheral (Uper), and lower peripheral (Lper) PWV before, during, and after the standing bout. Subjects participated in two trials in a randomized order. In one trial, the subjects stood at a standing desk immobile for 2 hours. In the other trial, subjects performed 5 minute walking breaks every 25 minutes of standing for a total of 2 hours of standing with 4 walking breaks.

RESULTS: There was no time by trial interaction for any measure of arterial stiffness (p = 0.82, p = 0.21, and p = 0.15; for CVP, Uper, and Lper respectively). However, from beginning to end of each trial Lper increased 85 ± 126 cm/s independent of trial (i.e., main effect of time; p = 0.001). There was a non-significant tendency for greater increases in Uper during the standing (120 ± 142 cm/s) versus the walking trial (50 ± 127 cm/s; p = 0.15). Changes in HR and MAP were not dependent on time or trial (i.e., non-significant interaction time; p = 0.20 & p = 0.39, for HR and MAP, respectively). CONCLUSION: Standing for 2 hours leads to increases in peripheral arterial stiffness. Walking breaks during 2 hours of standing did not significantly attenuate these changes. However, the suggestive evidence (p=0.15) for walking breaks to improve Lper suggests that future studies should investigate longer duration trials and/or longer walking breaks that are applicable to occupational settings, such as assembly line work.

Hydrogen sulfide (H₂S) is one of several endogenous depressor vasodilatory molecules that contribute to the regulation of vessel function. In the cutaneous vasculature, young adults express enzymes that synthesize H₂S, and exogenous delivery of H₂S elicits substantial dilation, suggesting that H₂S may be important for the regulation of vessel function. In vitro, several redundant endothelial dependent contributors, the functional contribution of endogenous H₂S to dilation in the cutaneous circulation is unclear. PURPOSE: To quantify the contribution of H₂S to endothelium-dependent dilation in young adults and pharmacologically determine the primary enzymatic source of H₂S in the microvasculature. We hypothesized that CSE-derived H₂S would mediate a portion of acetylcholine (ACCh)-induced dilation. METHODS: Four microdialysis fibers were placed in the hindquarter skin of 10 young adults (22±2 y). Red cell flux was measured (laser-Doppler flowmetry) during graded perfusion of the endothelium-dependent agonist ACCh (10⁻⁶–10⁻⁴ M) alone and during co-perfusion with D-Penicillamine (10 mM DPen; selective inhibitor of the H₂S-producing enzyme cystathionine γ-lyase (CSE)), aminooxyacetic acid (8 mM AOAA; inhibitor of H₃S-producing enzymes CSE and cystathionine β-synthase (CBS)), and a combination of DPen+AOAA. Cutaneous vascular conductance (CVC-flux/mmHg²) was expressed as a percent of maximal CVC (CVCMax=28 mN nitrousoxide + local heat 43°C). Sigmoidal dose-response curves were generated and the logEC₂₀ was used as an index of vessel sensitivity. RESULTS: ACCh elicited endothelium-dependent dilation in all subjects (82.9±4.3% CVCMax; P<0.05). CSE inhibition alone or combined CSE/CBS inhibition had no effect on ACCh-induced dilation (ACCh: -4.1±0.5; DPen+AOAA: -3.2±0.5; AOAA: -3.3±0.7; Combo: -2.6±0.4; P=0.05). CONCLUSION: H₂S does not appear to have a functional role in mediating cutaneous dilation in response to ACCh in young adults. Despite the ability to synthesize H₂S it is likely that other redundant mechanisms, including nitric oxide, mask any functional contribution of H₂S to endothelium-dependent agonists in the cutaneous circulation of young adults.

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 75 bpm (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/m²) was measured by DEXA. cPWV and AIx@75 were measured using applanation tonometry. The relationship between both cPWV and AIx@75 to leg LM were 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 (4.3 ± 0.2 kg/m² vs. 4.67 ± 0.47 kg/m², 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 strength training on arterial function in non-obese PRE-M and POST-M.

INTRODUCTIN: Aerobic exercise training reduces arterial stiffness mediated by nitric oxide (NO)-derived vasodilation in obese patients. Irisin is mainly expressed in myocytes and promotes NO release by regulating endothelial nitric oxide synthase (eNOS) expression, leading to vasodilation. Although exercise accelerates irisin secretion, the involvement of irisin in the mechanism of 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 (OLETF) rats were randomly divided into two groups: 8-week sedentary control (CT) and aerobic exercise training (AT; treadmill running for 60min at 25m/min, 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: Aerobic exercise training increased the systemic aortic PWV in OLETF rats. AT group showed significantly lower PWV than the CT group. Interestingly, AT group showed the similar PWV with 8-week sedentary control, suggesting that muscle remodeling by AT contributed to maintenance of PWV reduction. In addition, the aortic PWV were negatively associated with plasma irisin levels. Further, in vitro experiments showed that irisin concentrations were significantly lower in the supernatants of cultured aortic endothelial cells treated with irisin antibody compared to untreated cells. CONCLUSION: Our present findings suggest that aortic PWV are strongly related to irisin levels and that irisin is involved in the exercise-induced reduction of arterial stiffness in obese rats.
PWV in OLETF-AT group significantly decreased as compared with OLETF-CON group. Aortic Akt and eNOS phosphorylation and plasma nitrate/nitrite (NOx) level significantly increased in OLETF-AT group. Additionally, the significant increased muscle FND5C protein expression and serum irisin level in aerobic exercise training group were observed. Circulating irisin level was positively correlated with aortic phosphorylation eNOS (p=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 rise via increased muscle FND5C 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 (17108218, #16K13059, M. Iemitsu)

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

E-31 Board #94 June 1 11:00 AM - 12:30 PM
Yap as an Indicator of Nuclear Mechanotransduction in Mature Myofibers
Shama R. Iyer1, Sameer B. Shah2, Christopher W. Ward1, Eric S. Folker1, Richard M. Lovering1. 1University of Maryland School of Medicine, Baltimore, MD; 2University of California San Diego, San Diego, CA. 1Boston College, Boston, MA. (Sponsor: E.G. McFarland, FACSM) (No relevant relationships reported)

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 nespin-1-/- (n=4) isolated myotubes with different substrate stiffness or with 3% cyclic passive stretch for 30 minutes in whole muscle after in vitro isometric contractions. RESULTS: 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 myotubes (64% increase, p <0.05), but not in myotubes lacking nespin-1 (15% increase, not significant). Cyclic tensile loading resulted in YAP/TAZ nuclear signaling in WT myotubes, but significantly less in mdx myotubes and no signaling in nespin-1-/- myotubes. 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 nespin-dependent and is impaired in dystrophic muscle, which can further the pathology due to altered nuclear function.

2259 Board #95
June 1 9:30 AM - 11:00 AM
Skeletal Myotubes From Obese Individuals Display Attenuated Response to Resveratrol Treatment
Alex B. Chaves1, Sanghee Park1, Jonas I. Treebak2, Seongkyun Kim3, Joseph A. Houmard, FACSM4, 1East Carolina University; Greenville, NC. 2University of Copenhagen, Copenhagen, Denmark. (Sponsor: Joseph Houmard, FACSM)

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 1-3C 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 nmol/min/mg vs. 10.3 ± 0.5 nmol/min/mg, p < 0.05) and GO (211.69 ± 7.31 pmol/min/mg vs. 234.82 ± 11.52 pmol/min/mg, p < 0.05) in severely obese myotubes, but to lesser extent when compared to the lean myotubes (GS: 12.8 ± 1.0 vs. 10.3 ± 0.5 nmol/min/mg; GO: 305.78 ± 23.36 vs. 234.82 ± 11.52 pmol/min/mg, 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 ± 2.4, 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 myotubes were not able to achieve the same improvements which may be due to underlying defects in the insulin signaling cascade.

2260 Board #96
June 1 9:30 AM - 11:00 AM
Do Notch and mTOR Correlate for Myotube Formation In C2C12s?
Susan T. Arthur, Brian Q. Thompson, Charlotte McMullen, Josh R. Huot. UNC Charlotte, Charlotte, NC. (No relevant relationships reported)

PURPOSE: Notch and Mechanistic Target of Rapamycin (mTOR) are important for myogenesis but their interaction is not well studied. The purpose of this project was to determine if Notch affects mTOR to correlate myotube fusion of C2C12s using a Notch inhibitor, Gamma secretase inhibitor (GSi) and mTOR inhibitor, Rapamycin. METHODS: C2C12s were seeded, proliferated to 90-100% confluence and then differentiated for four days. At the onset of differentiation, C2C12 cells were treated to determine if Notch affects mTOR to correlate myotube fusion of C2C12s using a Notch inhibitor, Gamma secretase inhibitor (GSi) and mTOR inhibitor, Rapamycin. RESULTS: With no significant difference in protein expression, we found that mTOR signaling protein expression was decreased in C2C12s treated with the Notch inhibitor. Gene expression for proteins in the MVB pathway was analyzed using rt-PCR. RESULTS: C2C12s treated with the Notch inhibitor displayed a trend for an increase in HGS at 1 hr post-exercise (PRE: 1.0; AEX: 0.97; A+REX: 1.14, AU), or VPS4a (PRE: 1.0; AEX: 0.93; A+REX: 1.06, AU). There was no effect of exercise on STAM (PRE: 1.0; AEX: 1.03; A+REX: 1.28, AU), VTA1 (PRE: 1.0; AEX: 0.93; A+REX: 1.28, AU), or VTA1 (PRE: 1.0; AEX: 0.93; A+REX: 1.28, AU). CONCLUSIONS: The results suggest that Notch affects mTOR to correlate myotube formation of C2C12s using a Notch inhibitor, Gamma secretase inhibitor (GSi) and mTOR inhibitor, Rapamycin.

CONCLUSIONS: Our data suggests that Notch is inhibited and mTOR activated for myotube fusion to occur.

2261 Board #97
June 1 9:30 AM - 11:00 AM
Serial Passing Reduces Replication and Fusion Capacity of Primary Human Skeletal Muscle Satellite Cells
Zachary R. Hettinger1, Yaohui Nie2, Ron T. Garner1, Chris K. Kargl1, Shivam H. Patel1, Shihuan Kuang3, Tim P. Gavin, FACSM4, 1Purdue University, West Lafayette, IN; 2Harvard University, Cambridge, MA. (Sponsor: Dr. Tim Gavin, FACSM)

Replication and fusion of skeletal muscle satellite cells (SkMSCs) are essential for skeletal muscle maintenance and repair. Advancing age impairs SkMSCs replication potential and fusion capacity, however SkMSCs isolated from older human skeletal muscle do not consistently demonstrate these defects, making it difficult to study SkMSC isolated from aged human muscle. PURPOSE: To investigate if serial passing of SkMSCs can mimic aging associated defects in replication and fusion. We hypothesized that serial passing of primary human SkMSCs induces replicative senescence and poor fusion capacity in part through inhibition of the cell cycle regulator cyclin-dependent kinase 4 (CDK4) through the activation of CDK inhibitor p16Ink4a. METHODS: SkMSCs were isolated from vastus lateralis biopsies of young men. SkMSCs were serially passaged every five days and passaging continued until SkMSCs were unable to replicate. Population doubling level (PDL) was calculated using passage specific final and starting SkMSC counts. Expression of the myogenic regulator, myogenin (MyoG) and the regeneration regulator, paired box 7 (Pax7) were analyzed via rt-PCR. Senescence was determined by SA-B-gal staining and fusion capacity determined by immunohistochemical staining. RESULTS: Primary human SkMSCs failed to replicate at passage 16 (Pass16) and Pass16 SkMSCs exhibited decreased fusion. PDL was decreased from passage 4 to 16 (Pass4: 3.9 vs. Pass16: 0.6, AU). CDK4 mRNA decreased (Pass4: 1.0 vs. Pass16: 0.4, AU) and p16Ink4a mRNA was increased (Pass4: 1.0 vs. Pass16: 4.9, AU). Pax7 mRNA was unchanged (Pass4: 1.0 vs. Pass16: 1.3, AU), while myoG mRNA was increased (Pass4: 1.0 vs Pass16: 8.6, AU). CONCLUSIONS: Serially passaging SkMSCs isolated from young humans mimics an aged phenotype evidenced by impaired replication and fusion. Our findings suggest serial passaging of primary human SkMSC may be used to study aged SkMSCs.

2262 Board #98
June 1 9:30 AM - 11:00 AM
Effect of Acute Exercise on Skeletal Muscle Exosome Biogenesis
Ron T. Garner1, Yaohui Nie2, Timothy P. Gavin, FACSM3, 1Purdue University, West Lafayette, IN; 2Harvard University, Cambridge, MA. (No relevant relationships reported)

Exercise training promotes a wide range of beneficial adaptations. Skeletal muscle is now considered an endocrine organ. Exosomes, small microvesicles, are produced by and participate in the endocrine function of skeletal muscle. Exosome biogenesis is regulated in part by components of the multivesicular body (MVB) processing pathway: hepatocyte growth factor-regulated tyrosine kinase substrate (HGS), signal transducing adapter molecule 1 (STAM), VTA1 homolog (VTA1), and vacuolar protein sorting-associated protein 4A (VPS4a). PURPOSE: Determine if exercise induces skeletal muscle exosome biogenesis. METHODS: Twelve lean, young men completed acute cycling at 55% VO2max for 45 minutes followed immediately by one single leg knee extension resistance exercise (3 sets, 8-12 reps, 55% 1-RM). Vastus lateralis biopsies were obtained prior to (PRE) and 1-hour post aerobic (AEX) and aerobic+resistance (A+REX) exercise. Gene expression for proteins in the MVB pathway was analyzed using rt-PCR. RESULTS: There was no effect of exercise on STAM (PRE: 1.0; AEX: 1.03; A+REX: 1.28, AU), VTA1 (PRE: 1.0; AEX: 0.93; A+REX: 1.14, AU), or VPS4a (PRE: 1.0; AEX: 0.93; A+REX: 1.06, AU). There was a trend for an increase in HGS at 1 hr post-exercise (PRE: 1.0; AEX: 0.97; A+REX: 1.27, AU). CONCLUSIONS: There was no effect of acute exercise on the gene expression of components of the exosome biogenesis pathway. However, activation of exosome biogenesis may be evident at different time points post exercise or with greater exercise intensities.
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, adenylyl kinase isoenzyme, alpha-crystallin B, atk4, and p53 ubiquitin repeat domain-containing protein, plasminogen receptor, G-protein coupled receptor, and troponin I. The main proteins identified in the SOL were myoglobin with a protein phosphatase protein also being 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 R01GM118978.

E-32 Free Communication/Poster - Muscle Physiology Applications

FRIDAY, JUNE 1, 2018
Room: CC-Hall B

Previous literature has shown that a muscle’s pennation angle influences that muscle’s force producing capabilities. However, how the pennation angle of mono- and bi-articular muscles are related to single- and multi-joint force production is less clear. PURPOSE: To examine the relationships between resting and contracting pennation angles of the biarticular rectus femoris (RFrest and RFcon) and the monoarticular vastus lateralis (VLrest + VLLcon) muscles with maximal force production during single and multi-joint isometric tasks. METHODS: Eight lower-body resistance trained males (mean ± SD; 27 ± 3 yrs; 102 ± 6.55 kg; 197 ± 7 cm) performed maximal voluntary isometric contractions during the squat (SQmax) and knee extension (KEmax) exercises at knee joint angles of 110° and 150°. The order of the joint angles were randomized. The hip angle was ±10° from KEmax and –10° from SQmax. Maximal Force (F) was measured with an S-beam load cell. Muscle pennation angles were measured in both the RF and VL at rest and again during the maximal contractions using ultrasound imaging. RESULTS: Using multiple regression, RFmax at 150° was the only variable that contributed significantly to KEmax (R² = 0.758, p < 0.005) at the same angle. Interestingly, there were no significant relationships with RFrest or RFcon during KEmax at 110°, or SQmax at both knee joint angles. Furthermore, neither VLrest nor VLLcon were significantly related to either KEmax or SQmax at any knee joint angles (all p-values ≥ 0.05). CONCLUSION: The finding that RFmax at 150° was related to KEmax at the same angle was the only significant outcome was surprising. However, caution should be applied in the interpretation of this preliminary examination, as

Transposable elements or “jumping genes” are mobile genetic elements with the ability to amplify themselves within the genome. This gene mobility lends itself to the possibility of mutagenesis within cells, which is further compounded by the fact that these elements constitute ~50% our genome. Therefore, LINE-1 have important implications for both gene regulation and gene expression under a variety of conditions. PURPOSE: To better understand the role of LINE-1 in skeletal muscle physiology, we examined if acute and/or chronic resistance exercise affected skeletal muscle LINE-1 retrotransposon activity. METHODS: In study 1, 10 resistance-trained males performed three consecutive daily squat sessions. Vastus lateralis biopsies were taken Pre, 2 hrs post (Post1), and 3 days following session 3 (Post2). In study 2, 13 untrained males performed a full-body resistance-training program. Vastus lateralis biopsies were taken at weeks 0 and 12. RESULTS: Study 1: LINE-1 mRNA content was lower at both Post1 (p=0.028) and Post2 (p=0.013). While RT activity trended down at Post2 (p=0.067). A methylation assay at the LINE-1 promoter, however, did not yield significant results. Study 2: LINE-1 mRNA trended down by week 12 (p=0.056) along with RT activity (p=0.063) and ORF2p content (p=0.041). Although, mRNA was not significantly lower after training, LINE-1 promoter methylation significantly increased at week 12 (p=0.041). Interestingly, changes in RT activity versus satellite cell number were inversely associated (r² = -0.725). CONCLUSION: Resistance exercise downregulates select skeletal muscle LINE-1 markers and this may be suggestive toward an involvement of LINE-1 in satellite cell activity. Supported by gift monies donated to M.D.R. through Hilmar Ingredients (Hilmar, CA, USA) and Biomolecular Research Group (Irvine, CA, USA), and contract to J.S.M. through NormaTec (Newton Center, MA, USA).
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: To investigate time-dependency of nervous system recovery following MVIC. METHODS: Men (n=29) performed two bouts (B1, B2) of sustained handgrip MVC 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 filtered (1-400Hz, 67%}
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 (MVCs) for the knee extensors. Day two and three included performing either an explosive power (EP) (5x16 at 40% 1-RM), or controlled hypertrophic (CH) (5x8 at 80% 1-RM) exercise protocol. Participants performed MVICs prior to each squat protocol, and during a maximal knee extension is related to Hamstring-to-Quadriceps 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 the 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 = 52.6% ± 12.2%) and antagonist co-activation of the BF (M ± SD = 18.03% ± 9.48%) (Figure 1). CONCLUSION: The results of the present investigation reveal that as hamstring strength increases in relation to the quadriceps, coactivation 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 hamstrings muscle group would require less co-activation during a knee extension to stabilize the joint.
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, Mitchel A. Magrini1, Ryan M. Thiele1, Jesus A. Hernandez-Sarabia1, Ryan J. Colquhoun1, Patrick M. Tomko1, Nathaniel D. M. Jenkins1, Jason M. DeFreitas1, ‘Oklahoma State University, Stillwater, OK. ’Kansas State University, Manhattan, KS.

It appears that older adults use a coactivation strategy to control body sway and stiffen 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 max 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 knee 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 differences 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 (r = 0.719; p = 0.006), as well as when collapsed across both groups (r = 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.

Oakland University, Rochester, MI. (Sponsor: Jonathan K. Ehrman, FACSM)

Past studies have demonstrated that sitting on a stability ball (SB) elevates oxygen consumption (VO<sub>2</sub>) 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 VO<sub>2</sub> 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 differences between groups in oxygen consumption or EMG activity. **CONCLUSION:** A SB made of more elastic material requires more leg muscle activity during arm ergometry and may account for the higher VO<sub>2</sub> 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-Gamioh, Cipriana Caudillo-Cisneros. *Universidad de Guanajuato, León, Mexico.*

**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 second phase, consisting of surface electromyography (EMGs) of the upper limbs (Flexor Digitorum Superficialis) while performing maximal handgrip contractions. Results were analyzed by descriptive statistics, using SPSS v.21.

**Results:** the total sample was composed of 32 men, and 11 women, 42.7±9.0 years of age (mean±s.d). 71% of the surgeons declared the presence of at least one MMC. Out of them, the lumbar spine was the most affected (71%), followed by shoulder affection (53%); hand and wrist (45%), and the neck (44%). In the EMGs analysis, 50% of the participants achieved normal responses, characterized as maximal, minimal response, and peak to peak amplitude. For the right arm 2.26±0.94 mV; 0.10±0.70 mV, and 2.15±0.94 mV, in the same order. The opposite arm displayed 2.29±0.94; 0.18±0.15, and 2.11±0.87, respectively.

**Conclusions:** prevalence of MME in surgeons is high, suggesting surgeons' maladaptation to the surgical environment. The EMGs results corroborate muscular function alterations in a similar proportion to the MMC for hand and wrist.
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 PWS 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 (M±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 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 (BL), and ten minutes post-exercise (POST). Biopsy samples were analyzed for the ratio of p(MAPK)/total MAPK 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 BL to POST and between BL and PWS conditions. Statistical significance 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 PL: 8.2 [5.45 - 16.2] fold-change), p38 (PWS: 19.6 [7.4 - 27.3] vs PL: 9.5 [5.7 - 27.8] fold-change), and ERK (PWS: 9.0 [1.5 - 48.3] vs PL: 13.2 [3.8 - 20.5] fold-change) (all p < 0.005), with no differences between BL and PL conditions (p > 0.05). Repletions to failure tended to favor the PWS condition (PWS: 20 [17-21] vs PL: 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: i) voluntary (VOL), ii) stimulated CT at a frequency that elicited a torque below CT determined at 100Hz (BELOW), Twitch torque (TT), low frequency fatigue (LFF), and M-wave amplitude were measured before, during, and after each protocol. RESULTS: Stimulated CT did not differ among STIM100-1 (30.2±6.2%), STIM100-2 (32.3±7.3), and STIM15 (33.9±8.2%; p = 0.127). VOL (45.3±13.1%) and BELOW (20.8±5.5%) differences (JNK), and p38 via western blotting. Wilcoxon sign-rank tests were utilized to determine pairwise differences from BL to POST and between BL and PWS conditions. Statistical significance 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 PL: 8.2 [5.45 - 16.2] fold-change), p38 (PWS: 19.6 [7.4 - 27.3] vs PL: 9.5 [5.7 - 27.8] fold-change), and ERK (PWS: 9.0 [1.5 - 48.3] vs PL: 13.2 [3.8 - 20.5] fold-change) (all p < 0.005), with no differences between BL and PL conditions (p > 0.05). Repletions to failure tended to favor the PWS condition (PWS: 20 [17-21] vs PL: 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.
PURPOSE: To examine potential differences in the motor unit action potential amplitude (MUAP<sub>amp</sub>) vs recruitment threshold (RT) relationship between female cross-country athletes and healthy controls. METHODS: Eight chronically-endurance trained (ET) females (age=20.0±3.9 yrs; height=166.18±5.93 cm; body mass=54.44±5.47 kg) nine healthy sedentary (SED) females (age=19.7±2.12 yrs; height=167.2±8.89 cm; body mass=66.61±11.9 kg) volunteered for the study. The ET group consisted of NCAA Div. 1 collegiate cross-country runners who ran 20-24 hrs/week. The SED subjects participated in minimal regimented physical activity in the previous 6 months. Subjects performed three isometric maximal voluntary contractions (MVCs) followed by a 70% isometric trapezoidal muscle action performed at 70% MVC. Surface electromyography was recorded from the vastus lateralis via 5-pin surface sensor array. The EMG signals were decomposed and MUAP<sub>amp</sub>, (expressed as %MVC) were calculated for each MU. For each subject, MUAP<sub>amp</sub>s were linearly regressed against RTs with the slope and y-intercept calculated and used for statistical analysis. Two independent samples t-tests were used to examine potential between-group differences in the slopes and y-intercepts from the the MUAP<sub>amp</sub> vs. RT relationships. Statistical significance was set at p<0.05. RESULTS: The average RT ranges for observed MUs were 23.4–55.7% and 16.1–44.4% MVC for the ET and RT, respectively. There were no significant differences between groups for the slopes (ET=0.0035±0.0016 mV/%MVC, SED=0.0288±0.0021 mV/%MVC, p=0.47) or y-intercepts (ET=0.012±0.068 mV/MVC, SED=0.018±0.067 mV/MVC, p=0.67). CONCLUSIONS: Previously, increases in the slopes from the MUAP<sub>amp</sub> vs. RT relationships have been correlated with increases in muscle cross-sectional area following resistance training, which was suggested to indicate MU hypertrophy. The similar MUAP<sub>amp</sub> vs RT relationships observed between the cross-country runners and sedentary controls may suggest that chronic endurance training did not result in hypertrophy of higher-threshold MUs of the vastus lateralis.

**CONCLUSIONS:**

The Effect of Compression Garments Worn During Resistance Exercise on Muscle Damage, Fatigability and Hemodynamics

Mackenzie Stade, Bria Morse, Evan Schick, Joshua Cotter.

California State University Long Beach, Long Beach, CA.

(No relevant relationships reported)

Use of compression garments during and after exercise has gained notable popularity, yet, their utility in augmenting performance and recovery from resistance exercise remains elusive. PURPOSE: To evaluate the effects of wearing compression during resistance exercise on muscle induced muscle damage (EIMD), muscle oxygenation and muscular fatigability. METHODS: Ten healthy, untrained individuals (mean ± SD) 8 females, 2 males, 22.10 ± 2.23 years, 159.09 ± 3.47 cm, 66.22 ± 15.93 kg) performed two exercise trials (1) wearing compression tights and (2) without compression. Exercise trials were randomized and separated by seven days. The exercise protocol consisted of 12 sets of 10 repetitions of knee flexion, at a velocity of 120 degrees per second, in the CON/ECC mode of an isokinetic dynamometer (HUMAC NORM). Muscle oxygenation of the vastus medialis oblique (VMO) was assessed by oxy-hemoglobin (HbO2) and deoxy-hemoglobin (Hb) through near-infrared spectroscopy (NIRS; TRS-21, Hamamatsu). Leg circumference, ratings of perceived muscle soreness (RPMS) and blood samples for creatine kinase (CK) were collected before, during, and immediately after each exercise trial. RESULTS: RPMS scores increased in both conditions, with no significant differences between conditions. Additionally, a main effect for time revealed significant reductions in average torque (Nm) from the first four sets to the middle four sets and again during the final four sets but there were no differences between conditions. CONCLUSION: Lower body compression worn during resistance exercise did not impact muscular fatigability or damage, but venous return and muscle re-oxygenation may have been improved.

**CONCLUSIONS:**

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, one every 2s). Muscle architecture, central fatigue (fall of MVIC:80Hz torque) and contractile properties (100Hz:80Hz torque ratio; torque half-relaxation time, T<sub>1/2</sub>) were compared across groups using t tests and repeated measures ANOVA. RESULTS: Baseline MT (p<0.01) and FL (p<0.01) were lower in OW than YW, with no age-related difference in θ (p>0.14). OW fatigue showed more than YW (33.5% 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 100Hz ratio) occurred in both groups (p<0.02), with no group*time interaction (p>0.36). T<sub>1/2</sub> 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), baseline MT was weakly 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, T<sub>1/2</sub> 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.

**CONCLUSIONS:**

Effects Of Lactate Administration On Intracellular pH And Contractile Performance During Rhythmic Muscle Contractions

Yoshinori Tanaka<sup>1</sup>, David C. Poole, FACSM<sup>1</sup>, Yutaka Kano<sup>1</sup>.

<sup>1</sup>University of Electro-Communications, Tokyo, Japan. <sup>2</sup>Kansas State University, Manhattan, KS. (Sponsor: David C Poole, FACSM)

(No relevant relationships reported)

Skeletal muscle fatigue during heavy or severe intensity exercise is accompanied by decreased intracellular pH (pH<sub>i</sub>) and accumulation of lactic acid. The role of these perturbations in the fatigue processes are 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 pH<sub>i</sub> 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 bioimaging model, we tested the hypothesis that extracellular high lactic acid levels would increase endurance performance without changing pH<sub>i</sub> during sustained contractions. METHODS: The intact sartorius 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 (CON; n = 7) and lactate solution loading group (LAC; 20 mM, n = 6). The fluorescence ratio (F500 nm/F445 nm) for pH<sub>i</sub> 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 CON 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 (CON: 2.5 min vs LAC: 7.5 min, p < 0.05). In the CON group, no significant change in pH<sub>i</sub> was observed after contractions, whereas a significant decrease in pH<sub>i</sub> was observed in the LAC group during 20 min from immediately after muscle contractions. CONCLUSION: Within this preparation extracellular high lactic acid and lowered pH<sub>i</sub> 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. Subjects completed a treadmill cardiopulmonary exercise test (CPET) to exhaustion during the first visit. On a subsequent visit, subjects performed a vigorous-intensity continuous work rate test on the treadmill to exhaustion, and serum samples were collected immediately before, immediately after and 60 minutes after exercise. Performance fatigability was represented by peak VO₂ and peak WR from the CPET, as well as TTF during vigorous exercise. A Human Oxidative Stress Multiplex panel was used to determine serum SOD2 levels. Pearson product-moment correlation analyses were performed on the identified physiologic determinants of interest and SOD2 at various time points. **Results:** Peak VO₂ (r = 0.57, p < 0.02) and peak WR (r = 0.62, p < 0.01) were significantly correlated to serum SOD2 levels immediately post-exercise, while TTF was not significantly correlated to SOD2 at any time point. **Conclusions:** This study suggests that an exercise-induced increase 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

---

**Purpose:** to determine the accuracy of the equations in predicting knee extensors isokinetic strength in Brazilian older women. **Methods:** 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, with 30 seconds rest intervals between sets. The highest peak torque (PT) was recorded and compared to the PT predicted by two different equations (Neder et al. and Gross et al.). Independent t test, Pearson correlation (r), constant error (CE)/bias and standard error of estimate (SEE) were calculated to examine differences between the measured PT with values estimated by the equations. Concordance analysis was investigated using Bland-Altman technique. Statistical significance was set at p < 0.05. **Results:** The Neder et al. (85.30 ± 18.60 Nm) and Gross et al. (85.00 ± 29.99 Nm) equations provided significantly lower estimates when compared with measured PT (92.26 ± 21.59 Nm) (p < 0.01 for both). Moderate correlations were observed for Neder et al. and Gross et al. in relation to actual values (0.53; 0.50, respectively). The mean ± SD CE/SEE were 17.80 ± 10.95 and 20.36 ± 9.95 Nm; Gross et al. ± 17.30 ± 12.67 Nm, respectively. The 95% limits of agreement of the mean error were similar for the prediction equations, with values varying between 14.0 and 14.6 Nm. **Conclusion:** Because of the wide limits of agreement displayed by each studied equation and inflated values for error, the Neder et al. and Gross et al. equations were not able to predict accurately the knee extensors isokinetic strength in Brazilian older women. One possible reason for this finding is that these equations were derived from a wide age range (10 to 80 years), with limited data derived from older women. Future studies are necessary to develop a specific equation for elderly women, aiming to accurately predict isokinetic quadriceps muscle strength.

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

---

**Abstracts were prepared by the authors and printed as submitted.**
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 until 70% of 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 PM 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.

PURPOSE: To examine effects of muscle acidification on fatigue kinetics during repeated intense exhaustive exercise. METHODS: Eight active male participants (age: 26.13 ±SEM yrs.; VO2max: 58.1 ±18.9 ml/kg ·min) completed two exercise trials in random order. Trials consisted of five intense single leg knee-extensor exercise bouts to exhaustion (EX1-5) separated by 5 min recovery, with (ARM) and without (CON) previous intense intermittent arm crank exercise. 18-P-MS measurements of the quadriceps muscle were undertaken to assess muscle pH and venous blood was drawn. RESULTS: Quadriceps muscle pH was lower (P = 0.002) prior to the knee-extension exercise in ARM compared to CON (6.948 ±0.018 vs 7.040 ±0.100, respectively). In CON muscle pH dropped to 6.370 ±0.038 in EX1 and was progressively higher (P <0.05) in the following four bouts reaching 6.705 ±0.045 in EX5. However, in ARM muscle pH reached similar levels in EX1-4 (6.490-6.579) and was elevated only in EX5 (6.637 ±0.062). Pre-exercise blood lactate concentration was increased (1467±111%, p<0.001) and pCO2 (27.8±14.4%, p<0.045), with concomitant reductions in blood pH (0.24±0.02, p<0.001) and HCO3 (-38.1±2.2%, p<0.001) in ARM compared to CON. Exercise performance was 69±20% shorter (p<0.05) in ARM compared to CON. Performance was attenuated (P<0.05) in ARM during the three first bouts compared to CON. There was a progressive reduction (P<0.05) in exercise performance in CON trial, while no significant differences were observed between the five bouts in ARM. CONCLUSION: Prior arm exercise markedly altered fatigue kinetics and muscle acidification during repeated intense knee-extension exercise. Muscle acidification may provoke fatigue during single bout intense exercise scenarios, but appears to play a minor role, when exercise is repeated.

Skeletal muscle and fatigue responses during single high intensity exercise bouts have been examined extensively, while scientific research on repeated high intensity exercise are limited. PURPOSE: To examine effects of muscle acidification on fatigue kinetics during repeated intense exhaustive exercise. METHODS: Eight active male participants (age: 26.13 ±SEM yrs.; VO2max: 58.1 ±18.9 ml/kg ·min) completed two exercise trials in random order. Trials consisted of five intense single leg knee-extensor exercise bouts to exhaustion (EX1-5) separated by 5 min recovery, with (ARM) and without (CON) previous intense intermittent arm crank exercise. 18-P-MS measurements of the quadriceps muscle were undertaken to assess muscle pH and venous blood was drawn. RESULTS: Quadriceps muscle pH was lower (P = 0.002) prior to the knee-extension exercise in ARM compared to CON (6.948 ±0.018 vs 7.040 ±0.100, respectively). In CON muscle pH dropped to 6.370 ±0.038 in EX1 and was progressively higher (P <0.05) in the following four bouts reaching 6.705 ±0.045 in EX5. However, in ARM muscle pH reached similar levels in EX1-4 (6.490-6.579) and was elevated only in EX5 (6.637 ±0.062). Pre-exercise blood lactate concentration was increased (1467±111%, p<0.001) and pCO2 (27.8±14.4%, p<0.045), with concomitant reductions in blood pH (0.24±0.02, p<0.001) and HCO3 (-38.1±2.2%, p<0.001) in ARM compared to CON. Exercise performance was 69±20% shorter (p<0.05) in ARM compared to CON. Performance was attenuated (P<0.05) in ARM during the three first bouts compared to CON. There was a progressive reduction (P<0.05) in exercise performance in CON trial, while no significant differences were observed between the five bouts in ARM. CONCLUSION: Prior arm exercise markedly altered fatigue kinetics and muscle acidification during repeated intense knee-extension exercise. Muscle acidification may provoke fatigue during single bout intense exercise scenarios, but appears to play a minor role, when exercise is repeated.

METHODS: Acute exercise paired with practice of a motor task has been shown to enhance motor learning beyond task practice alone. However, it is unknown how exercise intensity affects movement kinematics during motor learning. Furthermore, the brain-derived neurotrophic factor (BDNF) response to exercise intensity needs to be examined because increases in BDNF are thought to mediate exercise-enhanced motor learning. PURPOSE: Assess the effect of exercise intensity on the maximum volume of repetitions and maximum dynamic muscle strength. METHODS: The study included 9 women. At first, the volunteers performed the anthropometric assessment and the evaluation of maximum dynamic strength through the 1RM test. In the second moment, the volunteers performed the three sessions with 60% of 1RM as many repetitions as possible, with an emphasis on concentric phase of the movement (CP), in the third moment it was conducted the same exercise with an emphasis on the eccentric phase of the movement (EP) and in the fourth moment the same procedure was conducted without emphasis on any stage of the movement (CoP). At the end of 3 series of each execution protocol was added the maximum volume of repetitions (MVR), the maximum dynamic strength was assessed 72 hours after each protocol. RESULTS: The results showed no statistically significant difference in maximum number of repetitions and maximum dynamic strength among the protocols CP, EP and CoP. The dynamic strength decreased 6% after the EP, the MVR also showed fewer number of repetitions (34.77) compared to other protocols. CONCLUSIONS: It was possible to conclude that the realization of protocols of exercises with speed movement that emphasize different muscle actions causes decreased maximal dynamic muscle strength and shows tendency to decrease the MVR when the movement speed prioritizes eccentric actions. Financial Support - FAPEMIG- Fundação de Amparo à Pesquisa de Minas Gerais

**E-33** Free Communication/Poster - Motor Control

**Board #130**
June 11:00 AM - 12:30 PM

**The Effect of Exercise Intensity on the Kinematics of Reach Performance and Brain-Derived Neurotrophic Factor**

Jessica F. Baird, Mary E. Gaughan, Heath M. Saffer, Mark A. Sarzynski, FACSM, Troy M. Herter, Stacy L. Fritz, Dirk B. den Ouden, Jill C. Stewart. University of South Carolina, Columbia, SC.

PURPOSE: Acute exercise paired with practice of a motor task has been shown to enhance motor learning beyond task practice alone. However, it is unknown how exercise intensity affects movement kinematics during motor learning. Furthermore, the brain-derived neurotrophic factor (BDNF) response to exercise intensity needs to be examined because increases in BDNF are thought to mediate exercise-enhanced motor learning. METHODS: 48 participants (23.3 ± 3.2 yrs) practiced a 3-dimensional motor learning task, which involved reach movements made to sequentially presented targets. Before task practice, participants were randomized so that 16 participants exercised on a cycle ergometer at a high-intensity, 16 participants exercised at a low-intensity, and 16 participants rested. Exercise intensity was determined as a percentage of max resistance obtained on a cycle-based graded exercise test, and duration was individually modified so that each participant in the low and high intensity groups expended 200 kcals of energy. Blood samples were obtained from all participants before and after exercise (exercise groups) or rest (control group) to assess changes in BDNF.

RESULTS: All participants significantly improved performance, as indicated by shorter times to complete the task. In the rest group, shorter times were associated with decreased distance traveled between targets, a spatial component of performance. In contrast, the exercise groups improved by altering temporal components of performance. The high-intensity group had significantly higher reach speeds (peak velocity), and the low-intensity group had significantly earlier peak velocities, an important feature of motor learning (p < 0.001 for all group differences). The percent change of the BDNF response was greater for the high-intensity (164.53% ± 46.56)
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 target task. Regardless of intensity, the BDNF response to exercise has high inter-individual variability, which needs to be further investigated.

---

**PURPOSE:** Motor delay (MD) (as measured by movement time) has been shown in children with Attention-Deficit/Hyperactivity Disorder (ADHD). This study aims to evaluate if MD or other components of motor control, such as symmetry and accuracy, are affected after an acute bout of exercise. The primary outcome measure was the movement time in four standardized tasks: Shuttle Run, Circle Run, Slalom Run, and Side-stepping.

**METHODS:** This study included healthy young adults (male: n=13, female: n=10, mean ± SD age = 26 ± 3 years; height = 176.9 ± 6.6 cm; body weight = 84.2 ± 12.5 kg). Subjects performed 2 sets of 3 training movements in each task, separated by a 4-minute rest period. The first set was used to familiarize the participants with the protocol.

**RESULTS:** Compared to before exercise, movement times were longer for Side-stepping, and Circle Run for the untrained limb (p<0.001). However, no changes were found for the trained limb. There were no changes in accuracy measures (e.g., percentage of total movement time, submovement was shorter after exercise for the movements in which the tested muscle was the antagonist compared with the agonist). Additionally, no changes were found in the contralateral hip flexion passive ROM and the strength performance.

**CONCLUSIONS:** Exercise can affect the contralateral limb performance, specifically in the flexor muscles when the exercised muscle performed the pointing task as the agonist (i.e., flexion movements). These findings indicate that exercising one limb can affect the performance of the contralateral limb, possibly due to transcallosal connections. Further research is needed to understand the underlying mechanisms and potential clinical implications.

---

**PURPOSE:** To investigate the acute effects of a unilateral static stretching protocol on unilateral and contralateral limb performance. The primary outcome measures were movement time and accuracy in the Shuttle Run and Circle Run tasks.

**METHODS:** Twenty-three healthy young adults (male: n=13, female: n=10, mean ± SD age = 26 ± 3 years; height = 176.9 ± 6.6 cm; body weight = 84.2 ± 12.5 kg) completed 2 sets of 3 training movements in each task, separated by a 4-minute rest period. The first set was used to familiarize the participants with the protocol.

**RESULTS:** Compared to before exercise, movement times were longer for Side-stepping, and Circle Run for the untrained limb (p<0.001). However, no changes were found for the trained limb. There were no changes in accuracy measures (e.g., percentage of total movement time, submovement was shorter after exercise for the movements in which the tested muscle was the antagonist compared with the agonist). Additionally, no changes were found in the contralateral hip flexion passive ROM and the strength performance.

**CONCLUSIONS:** Exercise can affect the contralateral limb performance, specifically in the flexor muscles when the exercised muscle performed the pointing task as the agonist (i.e., flexion movements). These findings indicate that exercising one limb can affect the performance of the contralateral limb, possibly due to transcallosal connections. Further research is needed to understand the underlying mechanisms and potential clinical implications.
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) and corticomotor inhibition through the cortical silent period (CSP). RESULTS: Glutamate (p=0.08) and GABA (p=0.11) concentrations in M1 did not differ across groups. MEPamp 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.

It has been reported that Mexico has 1,137,647 of older people, out of approximately 120 million inhabitants. Of them 26.3% have limitation in their activities. Older adults have the greatest risk of falls, because of the physical functionality (PF) reduction, both associate with sarcopenia. PF is defined as the capacity of the person for daily life and instrumental activities. To our knowledge no studies on PF have been done in Mexican Elderly. PURPOSE: to evaluate physical functionality in older Mexican adults. METHODS: this study was performed in a first served basis including older Mexican individuals affiliated to a public gerontological system of attention. Anthropometric evaluations were carried out, including weight, height, abdominal and hip circumferences. Additionally, electric bioimpedance was used to determine muscular and bone mass. Physical functionality was assessed through the Short Physical Performance Battery Protocol and Score Sheet (SPPB) test. The data were analyzed by descriptive statistics. Results are reported as mean ± SD. RESULTS: 186 older people (60 years and over) were evaluated, 154 women and 32 men. The average age was 69.76 ± 6.31 years for females, and 71.31 ± 7.21 years for males. Women mean weight (in kg) was 66.25 ± 11.36; height (in m) 1.51 ± 0.05. By the other side, men weighted 71.63 ± 12.59 Kg, and 1.65 ± 0.07 m. The march speed (m/s) was 0.83 ± 0.23 for woman and 0.97 ± 0.18 for men. In the timed up and go test females got 9.43 ± 3.23 s while men 7.90 ± 3.26 s. Repeated chair stand reported in the same order 16.61 ± 5.92 s vs. 14.54 ± 3.85 s. The speed of march is reduced in 78.50% of women, as in 51.72% of men. The dynamic equilibrium test revealed 56.26% of men, and only 51.07%
women in normal values. Conclusion: older Mexican adults, with gerontological care exhibits reduced Physical Functionality, with similar levels to data reported from other populations.

2303 Board #139 June 1 11:00 AM - 12:30 PM
Relationship Between Muscle Activity And Isometric Force During Submersion In Shallow Water.
(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-second isometric contraction 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 (α=0.05). A group linear line of best fit was also calculated for descriptive purposes. Results: The group linear line of best fit for Force-EMG during Land was EMG=2.0005*Force + 4.9007 (R² = 0.9819) 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. Conclusion: 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. Sterczela, 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 interosseus (FDI) in children (CH) and adults (AD) during submaximal contractions. Methods: Nineteen CH (11 male age=9.0±0.8 years, 8 female age=9.0±0.9 years) and 13 AD (6 males age=21.0±2.53 years, 7 females age=24.6±5.9 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% MVC 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 the 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. Conclusion: 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.

2305 Board #141 June 1 11:00 AM - 12:30 PM
An Evaluation Of The Foot Tapping Test (ftt) In A Health Population
Brian A. Pribble, Daniel J. Larson, Christopher D. Black, Daniel J. Blackwood, Jacob Rookard, Rebecca D. Larson. University of Oklahoma, Norman, OK.
(No relevant relationships reported)

Simple in nature, the foot tapping test (FTT) has potential as an objective measure of upper motor function. Despite this, the reliability of the FTT has not been well identified. Furthermore, it is uncertain as to how to best measure the FTT as number of foot taps may vary upon counting methods. In order to make the FTT more clinically relevant, more research must be done on the FTT in healthy individuals in order to determine if it is a reliable measure of foot tapping ability. Purpose: The purpose of the study was to investigate reliability measures of the FTT in a healthy population using a variety of different measurement and counting methods. By identifying the reliability of the different measurement methods we hope to be able to make recommendations for future FTT research.

Methods: 20 healthy individuals, ages of 18-31, completed a series of foot tapping trials over 4 visits. While seated, subjects tapped their foot repeatedly for 10 seconds while researchers counted the number of foot taps. Starting foot was randomized for each visit and tested twice with shoes ON and twice with shoes OFF (8 trials * 4 visits = 32 trials per subject). The number of foot taps was determined for each trial via visual inspection, video playback (slowed and normal speed), and with the use of a force plate. The mean values of the FTT trials were compared across days, dominant vs. non-dominant foot, the shoes ON/ OFF conditions, and with the different counting methods.

Results: Significant differences were found in foot tapping rates in the shoes ON (mean: 54.3 taps) vs shoes OFF (mean: 53.4 taps) and dominate vs. non-dominant (mean: 51.1 taps) foot analyses (p<0.05). Furthermore it was found that a significant difference in the mean number of foot taps existed between visit 1 (mean: 51.2 taps) and visits 2, 3, and 4 (mean: 54.3, 53.5, and 46.7 taps respectively) (p<0.05). It was found that the FTT exhibited high test-retest reliability (Pearson r =0.80) and high Cronbach’s alpha (α>0.80) across the live, slowed video counts, and force plate measurements. Conclusion: It was found that the FTT exhibits a high level of reliability across the live, slowed video, and force plate measures with both the shoes ON and shoes OFF. Given the observed reliability, the use of force plate with the FTT offers an attractive alternative to live counting or video playback methods.

2306 Board #142 June 1 11:00 AM - 12:30 PM
Association Between Motor Control Activation And Excitability Of The Quadriceps: An fMRI And TMS Study
Adam S. Lepley1, Lindsey K. Lepley2, Julie P. Burland1, Steven M. Davi1, Dustin R. Grooms2. 1University of Connecticut, Storrs, CT. 2Ohio University, Athens, OH.
(No relevant relationships reported)

Various neurophysiological assessments indicate that musculoskeletal injury causes alterations in nervous system function. Functional magnetic resonance imaging (fMRI) and transcranial magnetic stimulation (TMS) have been used as non-invasive assessments of motor cortex activation and excitability, respectively. Each of these tools provide unique insight on neurophysiology and it is unknown how musculoskeletal injury may influence the relationship between nervous system activity and excitability. Purpose: Investigate relationships between motor cortex activation (fMRI) and motor cortex excitability (TMS) of the quadriceps muscle.

Methods: Twenty participants volunteered; 10 healthy controls (age, 23.2±1.61y; height 167.92±9.46cm; mass 66.27±11.7kg) and 10 with a history of unilateral anterior cruciate ligament reconstruction (ACLr; age 22.4±1.95y; height 166.37±7.11cm);
Recent research indicates that among those who have multiple sports-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 point of gaze coordinates were tracked using a monocular eye tracker (24Hz, Argus Science, HT, 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 error (PE) by groups (NON, C1, and C2). Mean and standard deviation values for RD, HV, and PE were calculated for analysis. Results: No significant omnibus results were noted between the groups for RD (NON=5.78 pixels ± 1.527, C1=4.95 pixels ± 2.168, C2=4.66 pixels ± 1.305; p=0.370), HV (NON=9.91 pixels/second ±4.484, C1=7.250 pixels/second ±2.438, C2=8.055 pixels/second ±2.363; p=0.223), and PE (NON=1.370±3.924, C1=1.629±1.635, C2=2.167±2.324; 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.

2308 Board #144
June 11 12:00 - 12:30 PM
Influence of Sex and Cross-Sectional Area on Motor Unit Recruitment Patterns of the Vastus Lateralis
Michael A. Trevino1, Trent Herda2, Jonathan Miller2, Adam Sterczal2, Hannah Dimmick2, 1Georgia Southern University, Savannah, GA; 2University of Kansas, Lawrence, KS.

PURPOSE: Strong relationships have been reported between the increases in muscle cross-sectional area (mCSA) and motor unit action potential sizes (MUAPsize) 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 MUAPsize vs. recruitment threshold (RT) relationships.

METHODS: Ten males (21.10±1.97 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 (sFAT) for the VL. Surface electromyographic decomposition techniques were applied to assess MUAPsize related 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/mA/MVC) for the MUAPsize 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 from the MUAPsize vs. RT relationships. In addition, independent samples t-tests were used to examine differences in mCSA, mEI, and sFAT between sexes. Furthermore, Pearson’s product moment correlation coefficients were calculated comparing mCSA, sFAT, mEI of the VL with the slopes and y-intercepts from the 40% and 70% MVCs.

RESULTS: The males had greater MUAPsize (48.93 ± 12.37) and sFAT (0.18 ± 0.22) and the females had greater mCSA (11.67 ± 3.14) and mEI (0.86 ± 0.15) as compared to the males. In addition, there were no differences in the y-intercepts and slopes from the MUAPsize vs. RT relationships. In addition, independent samples t-tests were used to examine differences in mCSA, mEI, and sFAT between sexes. Furthermore, Pearson’s product moment correlation coefficients were calculated comparing mCSA, sFAT, mEI of the VL with the slopes and y-intercepts from the 40% and 70% MVCs.

Conclusions: The slopes for the MUAPsize vs. RT relationships are dependent on the physical properties of the muscle measured by ultrasound. In addition, the sex-related differences in mCSA, mEI, and MUAPsize 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.

2309 Board #145
June 11 12:00 - 12:30 PM
Simple Low-Cost Virtual Reality to Improve the Responsiveness of Clinical Balance Assessment
Janet E. Simon, Matt Rausch, Chad Starkey, Dustin Grooms, Ohio University, Athens, OH.

(No relevant relationships reported)

Concussions commonly affect postural stability, which incorporates the visual, vestibular, and somatosensory system. Postural stability post-concussion is commonly quantified via the Balance Error Scoring System (BESS). However, the BESS may not sufficiently challenge postural stability in an athletic population allowing potential deficits in VR devices to remain unquantified. Virtual reality (VR) devices have recently been investigated as an innovative virtual-vestibular integration challenge to improve BESS responsiveness.

PURPOSE: Determine if a low cost and clinically applicable VR modification to the standard BESS can provide a superior challenge to postural stability than the traditional BESS.

METHODS: Twenty-eight adults (mean age 23.36 ± 2.38 years, mean height 1.74 m ± 0.13, mean weight 77.95 kg ± 16.63) were recruited. All individuals performed the standard BESS test and a VR modified BESS (VR-BESS) on a force plate. All participants completed a familiarization session to practice the traditional BESS and VR-BESS. Participants then performed two trials of the traditional BESS or VR-BESS in a counter-balanced randomized order. The VR-BESS used a headset (Google Cardboard) and phone (LG V10) to display a rollercoaster ride (FIBRUM) to induce a visual and vestibular challenge to postural stability. BESS postural control errors and center of pressure (CoP) velocity were averaged for the two trials and used for analyses. Separate repeated measures ANOVAs were conducted for the BESS errors and CoP velocity. Post hoc testing was conducted for the condition by stance by surface interaction with an alpha level set at p<0.05 with a Bonferroni correction for multiple comparison analyses.

RESULTS: The overall repeated measures ANOVA was significant for BESS errors (F(1,26), 6.37, p<0.003) and CoP velocity (F(1,26), 5.19, p<0.008). The VR-BESS significantly increased total errors (20.93 vs. 11.42, p<0.05) and CoP summing across all stances and surfaces (41.96 vs. 37.17, p<0.05) compared to the traditional BESS.

CONCLUSION: VR-BESS provides a standardized, efficient, and effective way to challenge postural stability to a greater extent than the traditional BESS. With technology quickly advancing and becoming less expensive, this modification may be immediately incorporated into balance training and assessment.
WITHIN INDIVIDUALS. 5x2 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 (STDFE: FAST 0.07s, SLOW 0.13s, p < 0.05; CYP: FAST 12.9%, SLOW 16.8%, p < 0.05), and ACC (FAST 0.05s, SLOW 0.10s, p < 0.05). VAR in the both domains and TEMP ACC changed significantly over the 5 trials (all, p < 0.05). ACC SPAT, CYP SPAT, and TEMP SPAT revealed significant differences among the different trials for all subsequent trials for TEMP and SPAT VAR. (STDFE TEMP: VAR: 1.05%, SPAT: 0.08%, p < 0.05; STDFE SPAT: TEMP: 1.11%, SPAT: 0.74%, p < 0.05; CYP TEMP: TEMP: 20.8%, SPAT: 13.5%, p < 0.05; CYP SPAT: 1.11%, SPAT: 0.59%, p < 0.05). 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 observed 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.

E-34 Free Communication/Poster - Posture and Balance
FRIDAY, JUNE 1, 2018
Room: CC-Hall B

Mechanisms for concussions in dance include drops from lifting, falls from stage sets, and contact with the floor or fellow dancers that happen during class, rehearsal, or performances. Despite the recent awareness of sports-related concussions, there are gaps in knowledge regarding dance-specific concussions and what a “return to dance” protocol should look like for dancers. Although dance is not a high impact sport like football or rugby, concussions still occur and can be calamitous for a collegiate and professional dancer’s career. Balance tests, standard in concussion management protocols, are useful tools for evaluating the motor domain of balance functioning and are considered reliable and valid assessments of athletes suffering from concussions.

PURPOSE: Develop and investigate a complex balance task to integrate into a concussion management protocol specific to dancers. METHODS: 31 participants, pre-professional dancers (n=12) and recreational dancers (n=19), completed an multiparticipant evaluation to assess static and dynamic balance. They were tested using the Balance Error Scoring System (BESS) test which assessed static balance through performing 3 stances on 2 surfaces (ground and Airex Balance Pad). The modified Dance BESS (DBESS) test assessed static and dynamic balance of the participants through performing 10 dance movements on 3 surfaces (ground, Airex Balance Pad and foam balance beam). Participants were monitored and scored for errors on each balance test. RESULTS: Pre-professional dancers and recreational dancers were not significantly different for static balance on the BESS and DBESS (p<0.05). There was significant difference between the pre-professional dancers and recreational dancers (p<0.05) for the dynamic balance conditions in the Dance BESS. CONCLUSIONS: More skilled dancers show greater differences with dynamic balance conditions. Thus, creation of more dynamic balance tasks would be useful for baseline and post concussion testing and aid in the overall tracking during the concussion rehabilitation period for dancers.

E-35 Repeatability Of Isokinetic Strength Assessment Of Knee Extensors And Flexors Adopting Concentric And Eccentric Contractions
FRIDAY, JUNE 1, 2018
Room: CC-Hall B

WITHIN INDIVIDUALS. 5x2 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 (STDFE: FAST 0.07s, SLOW 0.13s, p < 0.05; CYP: FAST 12.9%, SLOW 16.8%, p < 0.05), and ACC (FAST 0.05s, SLOW 0.10s, p < 0.05). VAR in the both domains and TEMP ACC changed significantly over the 5 trials (all, p < 0.05). ACC SPAT, CYP SPAT, and TEMP SPAT revealed significant differences among the different trials for all subsequent trials for TEMP and SPAT VAR. (STDFE TEMP: VAR: 1.05%, SPAT: 0.08%, p < 0.05; STDFE SPAT: TEMP: 1.11%, SPAT: 0.74%, p < 0.05; CYP TEMP: TEMP: 20.8%, SPAT: 13.5%, p < 0.05; CYP SPAT: 1.11%, SPAT: 0.59%, p < 0.05). 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 observed 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.

PURPOSE: To examine the effects of lower body resistance training on motor unit firing rates and muscle activation. 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). For each MU, the EMG amplitude (EMGseg) recorded during the steady torque domain for the submaximal contractions was normalized to the peak EMGseg of the respective visit’s MVC. Possible differences in the A and B terms of the MFR vs. MUAP relationship and normalized EMGseg were analyzed via paired samples t-tests. RESULTS: Post-training, subjects demonstrated similar B terms (p = 0.287; PRE: -4.06 ± 0.51 pps/mV; POST: -4.41 ± 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: 24.93 ± 2.79 mV; POST: 27.40 ± 4.57 mV) indicating an increase in MFR for a given MUAPseg post-training. Additionally, subjects demonstrated reduced normalized EMGseg post-training (p = 0.029; PRE: 37.8 ± 8.0% ; POST: 33.6 ± 8.7%) suggesting reduced muscle activation. CONCLUSIONS: MEANseg is an indirect measure of MU size, thus the larger A terms suggest similarly sized MUs had greater firing rates post-training. EMGseg is influenced by MU firing rates and recruitment, therefore, the decrease in normalized EMGseg at increases in firing rates suggest decreased MU recruitment. Thus, resistance-training induced firing rate increases allowed subjects to produce the same relative torque with fewer active MUs. Given that later recruited MUs are demonstrated reduced normalized EMGseg and increased firing rates for a given MUAP, this indicates decreased MU recruitment. Thus, significant decline in MU action potential amplitude (MUAP) at steady torque and MU action potential amplitude (MUAP) at steady torque. For each contraction, an exponential model was applied to the MFRs and MUAP, and the B and A terms were calculated. EMG amplitude (EMGseg) recorded during the steady torque domain for the submaximal contractions was normalized to the peak EMGseg of the respective visit’s MVC. Possible differences in the A and B terms of the MFR vs. MUAP relationship and normalized EMGseg were analyzed via paired samples t-tests. RESULTS: Post-training, subjects demonstrated similar B terms (p = 0.287; PRE: -4.06 ± 0.51 pps/mV; POST: -4.41 ± 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: 24.93 ± 2.79 mV; POST: 27.40 ± 4.57 mV) indicating an increase in MFR for a given MUAPseg post-training. Additionally, subjects demonstrated reduced normalized EMGseg post-training (p = 0.029; PRE: 37.8 ± 8.0% ; POST: 33.6 ± 8.7%) suggesting reduced muscle activation. CONCLUSIONS: MEANseg is an indirect measure of MU size, thus the larger A terms suggest similarly sized MUs had greater firing rates post-training. EMGseg is influenced by MU firing rates and recruitment, therefore, the decrease in normalized EMGseg at increases in firing rates suggest decreased MU recruitment. Thus, resistance-training induced firing rate increases allowed subjects to produce the same relative torque with fewer active MUs. Given that later recruited MUs are more fatigable, the reduced MU recruitment could delay fatigue during submaximal contractions.

PURPOSE: The reproducibility of isokinetic strength assessment for testing knee extensors (KE) and knee flexors (KF) was determined. The examination was performed on single measurements (peak torques) and also on conventional and functional ratios obtained with a backpack, or with the load distributed high or low in the backpack. METHODS: Arm reach was tested using the Functional Reach Test (Forward), Multidirectional Reach Test (Backward, Right, Left), Upward Reach Test (Upward) at a 50° angle, and Forward Reach to the Floor Test (Low). Subjects were healthy males (n=7)
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 loaded. Load was 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: Distance reached in normalized for arm length, mean ± SD). When compared to no backpack, load high (50, 30% BW) in the backpack resulted in significant reductions in reach performance (all directions; Low = 140.1 ± 13.8 vs 124.3 ± 6.7, 115.5 ± 7.7; Upward = 165.1 ± 10.7 vs 159.9 ± 9.3, 153.3 ± 12.9; Left = 196.2 ± 8.5 vs 181.6 ± 7.3, 173.4 ± 4.5; Right = 194.8 ± 10.9 vs 181.7 ± 8.0, 175.5 ± 8.4; Backward = 180.2 ± 1 vs 180.0 ± 5.7, 153.5 ± 7.9; Forward = 218.2 ± 10.8 vs 208.9 ± 8.1, 200.9 ± 10.1) and load low (10%) in the backpack resulted in significant reductions in arm reach for backward reach only (218.2 vs 216.1 ± 1.9 vs 208.9 ± 1.7, 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. This method was funded in part by the Douglas A. & Phyllis G. Student Faculty Collaborative Research Fund.

2315 Board #151  June 11 AM - 12:30 PM Muscle-specific Cortical Adaptations To Balance Training With Electromyographic Biofeedback In Able-bodied Individuals
Alan R. Needle, Rachel A. Sledge, J. Horton Doughton, Mark C. Zrull. Appalachian State University, Boone, NC.

(No relevant relationships reported)

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 HmM–s 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 a 30-minute balance training session. The control group (n=9) performed only balance training while the experimental group (n=10) received balance training with EMG-BF to maintain 30 percent of maximal PL contraction. Differences before and after training across groups were assessed using paired t-tests (α = 0.05). RESULTS: No differences between groups were observed for reflexive excitability (F = 0.00, p = 0.96). No MEP size differences were observed for TA (F = 0.63, p = 0.45) or PL (F = 0.53, p = 0.48); but a significant time by group interaction was observed for SOL (F = 3.15, p = 0.044). EMG-BF decreased SOL MEP size after training (0.033%M ~ 0.049%M ) 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.

2316 Board #152  June 11 AM - 12:30 PM Anthropometrics are Associated with Static Balance Performance in Intercollegiate Athletes
Amanda Robertson, Timothy Sell, FACSM, Mallory Faherty, Duke, Durham, NC. (Sponsor: Timothy Sell, FACSM)

(No relevant relationships reported)

Balance has been identified as a risk for lower extremity musculoskeletal injury (LEMSI). Anthropometric measurements (AM) may affect static balance (SB) performance. Understanding the relationship between AM and SB may allow those who measure AM to also determine whether they may also be able to predict performance on a SB. PURPOSE: To determine if sex and AM including height, mass, and BMI are predictive of SB performance in intercollegiate athletes. METHODS: A total of 190 intercollegiate athletes participated in the study (Males: 138, Females: 52; Age: 19.5 ± 1.3 years, Height: 181.9 ± 10.1 cm, Mass: 79.6 ± 15.2 kg). Ground reaction forces were collected utilizing a force plate during a test of single-leg SB under eyes open (EO) and eyes closed (EC) conditions. The variability (standard deviation) of the ground reaction forces for each direction (anterior/posterior (AP), medial/lateral (ML), and vertical (V)) and the resultant (R) was calculated in order to explain the subject’s overall static postural stability under each condition. Data from three trials for each condition were averaged for analysis. A stepwise regression analysis procedure was utilized to determine if AM and sex would significantly predict each of the calculated variables. The resulting (R) was set a priori for inclusion of predictor variables in the final regression equation. RESULTS: P The final regression equations revealed that AM were predictive of SB performance (p<0.05) across all the variables analyzed but sex was not. Height was predictive of worse EO SB performance (AP, ML, V, R). BMI was predictive of worse EO SB performance (AP, ML, V, R). Height was predictive of improved EC SB performance (AP, V, R). Mass was predictive of worse EC SB performance (AP, ML, V, R). BMI was predictive of improved EC SB performance (AP, ML, V, R). CONCLUSION: These findings indicate that AM predicts performance during SB measures with EO and EC. This information may provide valuable evidence that prospective risk factor analysis studies may need to account for AM when determining if SB is a predictor of LEMSI.

2317 Board #153  June 11 AM - 12:30 PM Cognitive Dual-tasking Augments Age-differences In Dynamic Balance While Walking On A Narrow Beam
Azusa Uematsu1, Kazuhi Tsuchiya2, Hajime Yokoi3, Shuji Suzuki4, Tibor Hortobagyi, FACSM1, 2Dokkyo Medical University, Shimotsuga-gun, Japan. 3Yamagata Prefectural University of Health Sciences, Yamagata, Japan. 4Waseda University, Tokorozawa, Japan. 5University of Groningen, Groningen, Netherlands. (Sponsor: Tibor Hortobagyi, FACSM)

(No relevant relationships reported)

Beam walking is a measure of dynamic balance. We tested the idea that cognitive dual-tasking during beam walking could be an effective method to detect age-related differences in dynamic balance. PURPOSE: To determine the effects of age and cognitive dual-tasking on dynamic balance measured during narrow-beam walking. METHODS: 16 old (7M, 71.2 ± 3.5 y, foot width: 9.2 ± 0.5 cm, MMSE score ≥ 27) and 20 young (10M, 22.0 ± 1.5 y, foot width: 9.3 ± 0.8 cm) healthy volunteers participated in the study. Subjects walked on a 4-m long and 2-cm high beam with a width of 4, 8, and 12 cm, arms crossed in front of the chest. Subjects completed 3 walking trials with or without performing a calculation task. We recorded the gait trials from the subject’s right side with a digital video camera at 60 Hz, and computed walking distance, step number, and average step length. Average of 3 was used for the statistical analyses. RESULTS: There was a Group (old, young) by beam width (4, 8, 12 cm) by task (dual task, no dual task) interaction (F = 4.0, P < 0.05). In the young group, beam-walking distance decreased similarly with descending beam width while no dual-tasking (12 cm: 3.88, 3 cm: 3.62, 4 cm: 2.49 m) and dual-tasking (12-cm: 3.87, 8-cm: 3.76, 4-cm: 2.59 m). In the old group, beam-walking distance decreased substantially and most in the narrowest beam width during no dual-tasking (12-cm: 8.35, 8-cm: 7.32, 4-cm: 1.46 m) but decreased extremely in both narrower widths during dual-tasking (12-cm: 3.91, 8-cm: 2.63, 4-cm: 0.66 m). Further, only in the old group, the distance walked was shorter while dual-tasking compared with no dual-tasking at 8 and 4 cm beam widths (both P < 0.01). Depending on beam width, step length decreased in the young while both step number and step length decreased in the old group. CONCLUSIONS: Beam width but not dual-tasking affected young adults’ dynamic balance whereas both beam width and dual-tasking affected substantially and interactively old adults’ dynamic balance as quantified by beam distance walked and stride properties. These results suggest that, if validated and cognitive performance also quantified, dual task beam walking could be a sensitive measure of dynamic balance and motor-cognitive function in aging. Supported by JSPS KAKENHI Grant Number 16K21320.

2318 Board #154  June 11 AM - 12:30 PM Association between Y Balance Test Performance and Noncontact Lower Extremity Injury in High School Athletes
MARY NADELEN, Emily Hildebrand, Kyle Leppert, Peter Lisman, TOWSON UNIVERSITY, TOWSON, MD.

(No relevant relationships reported)

The Y Balance Test (YBT) is an assessment of dynamic balance that requires reaching tasks. Research has shown that an anterior reach distance difference ≥ 4cm and a normalized composite score (NCLE) < 90% 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 ± 1.4yrs, 179.6 ± 6.9 cm, 82.7 ± 15.2kg) 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
maximum anterior (ANT), posteromedial (PM) and posterolateral (PL) reaches on each leg. Right-to-left (RL) side reach distance differences were calculated in cm while the CS was calculated for each leg as (ANT + PM + PL) / (3 X limb length) X 100. Receiver Operating Characteristic (ROC) curves were first calculated by pairing ANT, PM, and PL reach distance differences and CS with NCLE injury. Since ROC curves were unable to maximize sensitivity and specificity for any YBT measure, further analysis was conducted using cutoff points previously shown to be associated with injury. Logistic regression models adjusted for age, sex, and injury history of the perturbation side and magnitude, and age were used to examine the association between YBT measures and NCLE injury.

RESULTS: Mean R/L reach differences for ANT, PM, and PL directions were 3.2 ± 2.9, 4.6 ± 3.5, and 4.7 ± 4.2 cm, respectively. Mean CS was 86.8 ± 8.0%. No significant associations were found between NCLE injury and R/L side reach distance differences ≥ 4 cm for any direction or CS ≥ 89.6%. Though not statistically significant, the odds for sustaining a NCLE injury were 2.1 and 1.3 times higher for displays of descriptive asymmetry ≥ 4 cm in comparison with those with asymmetry < 4 cm. CONCLUSION: YBT performance was not associated with the incidence of NCLE injury in this sample of HS athletes.

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 (age = 23.2 ± 2.1 yrs; height = 170.8 ± 9.2 cm; mass = 68.9 ±14.2 kg) participated. All participants performed 2320 Board #156 June 1 11:00 AM - 12:30 PM Influence of Inflatable Anti-fatigue Mats on Center of Pressure Displacement during Prolonged Standing

Sean E. Higinbotham, Adam E. Jagodinsky, Daniel C. Grieshaber. 1Illinois State University, Normal, IL. 2Methodist University, Fayetteville, NC. (Sponsor: David Thomas, FACSM) (No relevant relationships reported)

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 (age = 23.2 ± 2.1 yrs; height = 170.8 ± 9.2 cm; mass = 68.9 ±14.2 kg) participated. All participants performed 3 trials of quiet stance in the eyes open (EO) and eyes closed (EC) conditions for 30 seconds each on a force platform (1000 Hz). The Data were analyzed with Peak Excursion Velocity (PEV) and Root Mean Square (RMS) in the anteroposterior (AP) and mediolateral (ML) directions with a custom MATLAB software. The data was then statistically analyzed with SPSS v23. Two 3x2 MANOVAs were run by direction for group comparisons. Results: Overall model showed significant differences for the AP direction (F(26,12) = 2.424; p = 0.029) but not the ML direction. Follow up assessments revealed that CONC2 (0.094 ± 0.012 m*s⁻¹) swayed faster than both NON (0.057 ± 0.015 m*s⁻¹; p < 0.01) and CONC1 (0.058 ± 0.011 m*s⁻¹; p < 0.05) during EC. Also, NON (0.004 ± 0.001 m) swayed less than CONC2 (0.006 ± 0.001 m) in EC (p < 0.05). Furthermore, NON (0.003 ± 0.001 m) swayed less than CONC1 (0.005 ± 0.001 m) and CONC2 (0.005 ± 0.001 m; 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. 2321 Board #157 June 1 11:00 AM - 12:30 PM The Effects of Concussion History on Postural Control

Brian J. Szekely,1 Sydni V. Wilhoite,1 Peter Chrysosferidis,1 Kristen L. Neitz,2 Douglas W. Powell,2 Barry A. Munksy,1 Nicholas G. Murray,2 *Georgia Southern University, Statesboro, GA. 1University of Memphis, Memphis, TN. (No relevant relationships reported)

Postural deficits have been extensively noted in sport-related concussions. There have been postural instabilities in concussed athletes anywhere from 24 hours, up to six months. Altered postural control has been noted in those that have a history of concussion when compared to those that do not. However, there is sparse literature that assesses the effect of those with a history of concussion on postural control at the 24-48 hour mark post-concussion. Purpose: To investigate the effect of postural control is affected by previous concussions in Division 1 athletes.

Methods: Twenty-one Division 1 athletes (7 no history [NON], 7 with a previous concussion [CONC1], and 7 with 2 or more concussions [CONC2]) participated in this study. The participants performed 3 trials of quiet stance in the eyes open (EO) and eyes closed (EC) conditions for 30 seconds each on a force platform (1000 Hz). The Data were analyzed with Peak Excursion Velocity (PEV) and Root Mean Square (RMS) in the anteroposterior (AP) and mediolateral (ML) directions with a custom MATLAB software. The data was then statistically analyzed with SPSS v23. Two 3x2 MANOVAs were run by direction for group comparisons. Results: Overall model showed significant differences for the AP direction (F(26,12) = 2.424; p = 0.029) but not the ML direction. Follow up assessments revealed that CONC2 (0.094 ± 0.012 m*s⁻¹) swayed faster than both NON (0.057 ± 0.015 m*s⁻¹; p < 0.01) and CONC1 (0.058 ± 0.011 m*s⁻¹; p < 0.05) during EC. Also, NON (0.004 ± 0.001 m) swayed less than CONC2 (0.006 ± 0.001 m) in EC (p < 0.05). Furthermore, NON (0.003 ± 0.001 m) swayed less than CONC1 (0.005 ± 0.001 m) and CONC2 (0.005 ± 0.001 m; 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 #158 June 1 11:00 AM - 12:30 PM Both Slower Sensory Response Time and Electromechanical Delay Explain Age-related Differences in the Reactive Leg Drop

Mitchel A. Magrini1, Alejandro Barrera-Curiel1, Ryan M. Thiele1, Jesus A. Hernandez-Sarabia1, Ryan J. Colquhoun1, Patrick M. Tomko2, Nathaniel D.M. Jenkins3, Jason M. DeFreitas4. 1Ohio State University, Stillwater, OK. 2Kansas State University, Manhattan, KS. (No relevant relationships reported)

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 74 yr) and 15 young adults (YA: mean 24 yr) participated in a familiarization session followed immediately by a testing session. For the RLDs, each participant was seated with their leg passively released the band allowing the lower leg to free-fall. The participants were instructed to kick up 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.
as the difference in angle between the start position and the lowest point achieved prior to kicking back up. Surface EMG was recorded from the vastus lateralis (VL) muscle during the RLDs. The RLDs were divided into 2 subcomponents: 1) Sensory Response Time (SRT), calculated from the start of the drop (as shown in the goniometer signal) to the onset of VL EMG; and 2) Electromechanical Delay (EMD), measured as the time between the onset of VL EMG to the time point when the leg started to move back up (i.e. onset of concentric portion). Separate independent t-tests with a Bonferroni correction (alpha: p ≤ 0.016) were used to analyze the differences between YA and OA. Results: As expected, there were significant group differences in drop angle (p = 0.0006). Interestingly, both subcomponents, EMD (YA: 127.9 ± 22.8 ms, OA: 160 ± 24.9 ms; p = 0.0004) and SRT (YA: 94.9 ± 28.6 ms, OA: 140 ± 59.3 ms; p = 0.0004), showed significant differences between YA and OA. Conclusion: Both sensory response time and electromechanical delay are mechanisms associated with age-related differences in RLD performance.

As such, both variables may separately play significant roles in slip recovery and fall avoidance.

2324 Board #160 June 11:00 AM - 12:30 PM
Relationship Between the Sport-like Antisaccade Task And Postural Control Following Sport-related Concussion
Nicholas G. Murray, 1 Brian Szelcky, 1 Sydni Wilhoite, 1 Kristen Neitz, 1 Peter Chrysosferidis, 2 Douglas Powell, 3 Barry A. Munkasy, 4 1University of Memphis, Memphis, TN. 2University of Canberra, Canberra, Australi. 3No relevant relationships reported

PURPOSE: To investigate the relationship between postural control and visual system assessments in a population of sport-related concussion. BACKGROUND: The purpose of this study was to examine the responses of trunk movement patterns to mechanical perturbation before and after two different repetitive trunk flexion-extension loading schemes. Spatial and temporal biomechanical parameters were studied to further understand the ability of the trunk to recover from anterior directed perturbations.

METHODS: Eighteen male (n=9) and female (n=9) participants (21.7 ± 2.3 yrs, 75 ± 12.0 kg) were recruited. They participated in active and passive trunk flexion-extension loading, performed at least 7 days apart. Participants performed 60 trunk flexion-extension repetitions in each condition. Participants either voluntarily moved their trunk (active condition) or relaxed during dynamometer controlled movements (passive condition). Trunk perturbations occurred before and immediately after two 30-repetition sessions. Temporal measures included perturbation onset to initial trunk movement (T1), movement initiation to peak trunk velocity (Vp), and perturbation onset to Vp (T1, Vp). Recovery measures included peak recovery velocity (Vr), recovery time (T1, Vp), velocity slope (Vr), and recovery slope (Rr). Repeated measures ANOVA was used to analyze the data. Alpha level was set at 0.05.

RESULTS: There was no sex by session interaction observed. Significant sex differences were present for T1 (Male 112.4 ± 74.6 ms, Female 96.4 ± 44.6 ms, p < 0.02), Vp (Male -12.0 ± 8.6 deg/s, Female -15.6 ± 13.0 deg/s, p < 0.01), and Vr (Male 373.3 ± 151.9 deg/s, Female 363.8 deg/s, p < 0.05) measured as SRC gaze travels a greater RD, their postural sway increases in the AP direction as well as volitional loading by the trunk extensors. Overall, results indicate repetitive loading leads to lower resistance to perturbation, but faster recovery from perturbation although no differences to active or passive repetitive loading were observed.

2325 Board #161 June 11:00 AM - 12:30 PM
Repetitive Trunk Loading Leads to Faster Trunk Movement in Response to External Perturbation
Michael W. Olson, FACSM, 1 Li Li, FACSM, 2 Southern Illinois University Carbondale, Carbondale, IL. 1Georgia Southern University, Statesboro, GA. 2University of the Sciences, Philadelphia, PA. 3University of Kentucky, Lexington, KY. (No relevant relationships reported)

PURPOSE: The purpose of this study was to determine construct validity of three clinical tests of core neuromuscular control. BACKGROUND: 1) A sports-related concussion (SRC) was defined as a mild traumatic brain injury (MTBI) that results in a transient loss of consciousness or alteration of mental status (ABS). 2) SRC incidence is increasing with the increasing popularity of collision sports. 3) There are numerous clinical tests of core neuromuscular control (CNC). METHODS: 15 healthy adults (8 females, age 28 ± 3 yrs, height = 1.69 ± 0.07 m, mass = 69 ± 10.2 kg) performed the following clinical tests: unilateral hip bridge endurance (UHBE; mean time in position for left and right sides, 1 trial per side), double leg lowering (DLL; mean degree of hip flexion, 3 trials), and a newly developed seated trunk proprioception test using a wobble board (STP; mean time to first error, 5 trials). Biomechanical tests of static and dynamic CNC were assessed via an ultrasound motion capture system (120Hz, Vicon) while raw center of pressure (1000Hz, AMTI) coordinates were collected simultaneously and further analyzed using a custom algorithm. Pearson product correlations examined the relationship between the gait variables Resultant Distance (RD), Proxadspace Errors (PE), Mean Horizontal Velocity (HV), Microsaccades (MS) to center of pressure Root Mean Square Velocity (RMS) and symmetry (S) between the left (LP) and mediolateral (ML) directions within each group. RESULTS: In the SRC group, a significant moderate positive correlation between RD (4.71±1.15 pixels) and RMS in the AP direction (0.011±0.002 meters) (r=0.361, p=0.028) was observed. Other significant relationships were observed between any other gait and postural variables in the SRC group. In the CON group, no significant relationships were observed between any gait and postural variables. CONCLUSION: These results suggest that an SRC gaze travels a greater RD, their postural sway increases in the AP direction during the SLT. However, the lack of any other significant relationship may indicate that these assessments are measuring two separate neuromotor constructs.

2326 Board #162 June 11:00 AM - 12:30 PM
Concurrent Validity of Three Clinical Tests of Core Neuromuscular Control
Travis R. Pollen, 1 Eric J. Folkins, 1 Jason H. Moring, 1 Brian W. Noehren, FACSM, 2 David Ebaugh, 1 Sheri P. Silfies, 1 Drexel University, Philadelphia, PA. 2University of the Sciences, Philadelphia, PA. 3University of Kentucky, Lexington, KY. (Sponsor: Brian W. Noehren, FACSM) (No relevant relationships reported)

PURPOSE: To determine construct validity of three clinical tests of core neuromuscular control (CNC). METHODS: 15 healthy adults (8 females, age 28 ± 3 yrs, height = 1.69 ± 0.07 m, mass = 69 ± 10.2 kg) performed the following clinical tests: unilateral hip bridge endurance (UHBE; mean time in position for left and right sides, 1 trial per side), double leg lowering (DLL; mean degree of hip flexion, 3 trials), and a newly developed seated trunk proprioception test using a wobble board (STP; mean time to first error, 5 trials). Biomechanical tests of static and dynamic CNC were assessed via an ultrasound motion capture system (120Hz, Vicon) while raw center of pressure (1000Hz, AMTI) coordinates were collected simultaneously and further analyzed using a custom algorithm. Pearson product correlations examined the relationship between the gait variables Resultant Distance (RD), Proxadspace Errors (PE), Mean Horizontal Velocity (HV), Microsaccades (MS) to center of pressure Root Mean Square Velocity (RMS) and symmetry (S) between the left (LP) and mediolateral (ML) directions within each group. RESULTS: In the SRC group, a significant moderate positive correlation between RD (4.71±1.15 pixels) and RMS in the AP direction (0.011±0.002 meters) (r=0.361, p=0.028) was observed. Other significant relationships were observed between any other gait and postural variables in the SRC group. In the CON group, no significant relationships were observed between any gait and postural variables. CONCLUSION: These results suggest that an SRC gaze travels a greater RD, their postural sway increases in the AP direction during the SLT. However, the lack of any other significant relationship may indicate that these assessments are measuring two separate neuromotor constructs.

ACSM May 29 – June 2, 2018
Minneapolis, Minnesota
targets were located along the vertices of an octagon. DC performance was assessed by precision control (movement around select targets prior to acquisition) (DC CEA; mm²) and directional control (perpendicular distance off direct COP path to target) (DC OFF; mm). One-tailed Spearman’s ρ (p) was used to assess relationships between clinical and biomechanical variables. Interpretations of the correlations were as follows: 0.25 to 0.50 (fair) and 0.50 to 0.75 (moderate to good). RESULTS: Significant fair to good correlations were found between CNC clinical tests and both SC and DC biomechanical variables: SC CEA and UHBE and DLL; SC MVEL and UHBE; DC CEA and UHBE and DLL; and DC OFF and all clinical tests (Table). CONCLUSION: The data suggest the UHBE, DLL, and STP demonstrate construct validity for measurement of CNC, with individual clinical tests explaining 21-43% of the variance in performance on the biomechanical tests. These data provide preliminary support for the use of these clinical tests as measures of CNC.

<table>
<thead>
<tr>
<th>Test</th>
<th>Median (IQR)</th>
<th>CEA (p)</th>
<th>MVEL (p)</th>
<th>CEA (p)</th>
<th>OFF (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UHBE</td>
<td>24.3 ± 26.9s</td>
<td>p = -0.50, p = 0.03</td>
<td>p = -0.61, p = 0.01</td>
<td>p = -0.56, p = 0.02</td>
<td>p = -0.47, p = 0.04</td>
</tr>
<tr>
<td>DLL</td>
<td>75 ± 28°</td>
<td>p = -0.49, p = 0.03</td>
<td>p = -0.66, p &lt; 0.01</td>
<td>p = 0.54, p = 0.02</td>
<td>p = -0.46, p = 0.04</td>
</tr>
<tr>
<td>STP</td>
<td>3.7 ± 4.5s</td>
<td>p = -0.43, p = 0.05</td>
<td>p = -0.51, p = 0.15</td>
<td>p = -0.28, p = 0.12</td>
<td>p = -0.35, p = 0.15</td>
</tr>
</tbody>
</table>

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

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. Concussions 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. Vakharia3, Tsun Law1, Fernando Manalac, Jr1, Martin Roche, Jr1. Morehouse School of Medicine, Atlanta, GA. University of Miami, Miami, FL. Holy 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-0070;ICD-10-Y9351) and ATF (ICD-9-D-0071;ICD-10-Y9362). The sample size was further narrowed searching for fractures of the upper (FUE) and lower extremities (FLE), dislocations (DI), 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. Fractures 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). Fractures 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). Concussion rates were higher in the ATF group (n = 853) compared to AFF (n = 47), with 15-19 (n = 484) year olds comprising 54% of concussions in AFF, followed by 10-14 years olds (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 provided, equipped 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 Ayalaji, B.A., Patrick Huang, B.A., B.S., Yetsa A. Tuakli-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 1000 athlete-days) and injury incidence proportion (IP; number of injuries per 100 athletes), assessed against demographic data, type of injury, and anatomic location of injury. RESULTS: 141 athletes participated in the 7-day Para powerlifting competition period, accounting for 1410 athlete competition days of exposure. Overall IR was 15.6/1000 athlete-days (95% CI; 9.1 - 22.1) while IP was 5.6/100 athletes. Most injuries were chronic overuse in nature (63.6%). The most commonly injured anatomical 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; 1.2-18.8)]. 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 (HIPT) 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 (35.3%), 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 strain, 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.

**2331 Board #167 June 1 9:30 AM - 11:00 AM**  
Epidemiology Of Upper Extremity Injuries In The National Collegiate Athletic Association: 2009/10 - 2015/16  
(No relevant relationships reported)

Participation in sports places athletes at risk of sustaining an upper extremity injury. These injuries may be acute, resulting from a single traumatic event, or associated with repetitive motions and overuse. Previous studies have examined upper extremity injuries; however, most have focused on specific sports, body parts, diagnoses, or mechanisms of injury.

**PURPOSE:** To describe the epidemiology of upper extremity injuries in National Collegiate Athletic Association (NCAA) sports.

**METHODS:** Athletes participating in the NCAA Injury Surveillance Program reported athlete-exposure (AE) and injury data for 25 collegiate sports during the 2009/10-2015/16 academic years. Upper extremity injuries, including fractures to the shoulder/clavicle, upper arm, elbow, forearm, wrist, and hand/finger, 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:** The overall rate of upper extremity injuries was 1.07 (95% CI:1.04-1.10) per 1,000 AEs. For ice hockey (2.88; 95% CI:2.73-3.04), wrestling (2.64; 95% CI:2.35-2.94), and football (2.11; 95% CI:2.03-2.18) had the highest rates while men’s (0.00) and women’s (0.02) cross country had the lowest. Overall, 57.9% of upper extremity injuries occurred during practice. Nearly half (46.6%) were to the shoulder/clavicle, followed by hand/finger (24.8%). The most common diagnoses were sprain (27.7%) and strain (18.4%). Player contact (36.9%) and overuse (16.8%) were the most common mechanisms. 17.7% of injuries resulted in a time loss of 7 or more days, and 10.6% were recurrent.

**CONCLUSIONS:** While upper extremity injuries occur across a wide variety of collegiate sports in both competition and practice, the sports with the highest rate of injury were contact/collision sports. Many upper extremity injuries were not severe; however, nearly one in five kept the athlete out of play for a week or more. More research is needed to determine how to effectively reduce the incidence of upper extremity injuries among all collegiate athletes. 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.
Official Journal of the American College of Sports Medicine

Vol. 49 No. 5 Supplement S477

(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 participants 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 athletic 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 ratio 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 frequent injuries were sprains in both sports (73.86% soccer; 68.96% female 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 (IRR = 1.74, 95%CI = 1.06, 2.88) or thigh/upper leg (IRR = 1.97, 95%CI = 1.44, 2.50) was greater in soccer than basketball. Injuries for both sports were most commonly caused by player contact (27.00% basketball; 40.80% soccer) or noncontact mechanisms (31.23% 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.

2334 Board #170 June 1 9:30 AM - 11:00 AM

Opiate Knowledge Among High School Athletes

Elton Li1, Adam N. Van Horn2, Jacob W. Poynter3, Jonathan Im4, Jennifer Honcena5, Caroll Janney1, Michigan State University College of Human Medicine, East Lansing, MI, 1The Legacy Center, Midland, MI. (No relevant relationships reported)

Opiate use and abuse amongst adolescents has become an epidemic in the United States. Use of prescription pain medication is of particular concern for adolescent athletes due to their propensity for injury and need for pain control either acutely or post-surgically.

**Purpose:** To evaluate changes in opiate knowledge of high school (HS) athletes after a national opiate education program.

**Methods:** Fall (HS) sport teams separately attended 45-min, multi-media presentations, focused on opiate education. Athletes completed an anonymous survey before and after the educational program. Paired T-tests were performed.

**Results:** Overall, 491 of 504 HS athletes completed surveys (males= 310 and females=181). HS athletes represented 9-12 grades (n=126, 152, 111, and 111, respectively). Participating sports teams included football (n=174, M), cross-country (n=81, M&F), soccer (n=65, M), pompon (n=64, F), swimming (n=50, F), tennis (n=31, M), volleyball (n=30, F), and golf (n=9, F). During the last year, 42% of athletes reported an injury that prevented them from playing sports, 46% of athletes had taken a pain medication, and 41% have taken pain medication prior to a game. Prior to the program, 72%, 63%, 57%, and 78% of HS athletes correctly identified codeine, Norco, tramadol, and heroin, respectively, as opiates, while 34%, 41%, and 44%, incorrectly classified marijuana, Tylenol, and Molly (street name for Methyleneoxyethamphetamine, or MDMA), respectively, as opiates. After the program, athletes had significantly improved their knowledge in recognition of common opiates (p<0.01) and opiate overdose symptoms (p<0.01). Prior to the program, 32% (SEM 2.4%) felt that they were aware of community resources available for those who misuse opiates vs. 88% (SEM 1.5%) (p<0.01) after the program.

**Conclusion:** HS athletes attending a brief opiate educational program significantly increased their knowledge in recognizing opiates and overdose symptoms, as well as community resources available for those who misuse opiates. Our results suggest, that increasing knowledge of opiates in HS athletes leads to improved knowledge in recognizing opiates and overdose symptoms, as well as community resources available for those who misuse opiates. The impact of this education programs may lead to reducing the risk of misuse and abuse of opiates, increasing knowledge of opiates in HS athletes is critical to a successful prevention strategy.

2335 Board #171 June 1 9:30 AM - 11:00 AM

Anterior Cruciate Ligament Injuries in Missouri High School Male and Female Soccer Athletes

Aaron D. Gray1, Scott Miller2, Seth L. Sherman, Emily Leary, Brad W. Willis. University of Missouri, Columbia, MO. (No relevant relationships reported)

**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 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 were recorded (163,511 male and 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.

2336 Board #172 June 1 9:30 AM - 11:00 AM Preventance of Musculoskeletal Injuries And Dysfunction amongst High School Athletes in Singapore

Swupan Mukherjee, Muhammad Ridhuan Johari, Ying Hwa Kee, Nanyang Technological University, Singapore, Singapore. (No relevant relationships reported)

Ocupational 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.

2337 Board #173 June 1 9:30 AM - 11:00 AM Evaluating the Concussed Athlete: Co-Occurring Psychiatric Conditions Predict Psychological Function and Recovery

Jeremy P. McConnell1, Cali A. Van Valkenburg2, Vincent C. Nittoli3, Adam W. Shunk4, Courtney D. Jensen1. 1University of the Pacific, Stockton, CA, 2St. Vincent Sports Performance, Indianapolis, IN. (No relevant relationships reported)

More than 35 million American children ages 5 to 18 and approximately 400,000 collegiate athletes engage in organized sports. Sport participation bears a risk of traumatic brain injury (TBI). The annual incidence of sport-related TBI exceeds 1.5 million and is increasing among youth athletes. Many sufferers of TBI present with co-occurring psychiatric conditions, such as anxiety, depression, and learning disabilities. The effect of these conditions on diagnosis and prognosis remains largely unexplored.

**PURPOSE:** To assess the effect of co-occurring conditions on TBI symptoms in youth athletes. **METHODS:** We analyzed 80 student-athletes (primary education through college) who underwent comprehensive evaluation following a TBI. Medical histories were collected, neuropsychological tests were conducted, and co-occurring
psychiatric conditions were diagnosed. Co-occurring conditions were 1) attention deficit and hyperactivity disorders, 2) anxiety disorders, 3) depression and mood disorders, 4) adjustment disorders, and 5) learning disabilities. Tests of behavior and cognitive function were 1) the IMPACT test, and 2) the Behavior Assessment System for Children 2nd edition (BASC). Linear regressions tested the effect of co-occurring conditions on psychological and behavioral outcomes. RESULTS: Subjects were 16.0 ± 2.6 years of age, 56.3% were male, and 72.5% were diagnosed with ≥ 1 co-occurring condition. Logistic regression revealed the risk of diagnosis was associated with lower motor speed (p = 0.031), poorer reaction time (p = 0.010), and, summarizing speed and accuracy indices, poorer performance on the cognitive efficiency index (p = 0.043). The number of co-occurring conditions was also a significant predictor (p = 0.05) of 13 individual BASC categories and all BASC composite assessments, indicating poorer behaviors and attitudes. CONCLUSION: TBI associates with acute neural deficits and psychological characteristics that found co-occurring psychiatric diagnoses may compound these complications in youth athletes. When appraising the severity of a TBI in this population, a comprehensive psychiatric evaluation may be warranted to understand and accurately characterize the scope and prognosis of the condition.

2338  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, Rotyn Mandl, Troyer Army Medical Center, Honolulu, HI. Army Public Health Center, Aberdeen Proving Ground, MD. Naval Health Research Center, San Diego, CA.

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 2007 to 30 June 2011 were identified and used for analysis. In- and out-patient CWI data (ICD-9-CM codes 991.0-991.9, first, second or third diagnosis 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 year during 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.

2339  Board #175  June 1 9:30 AM - 11:00 AM  Incidence and Severity of Game-Related College Football Thoracoabdominal Injuries on Artificial versus Natural Grass
Theresa M. Gustaveson, Michael C. Meyers, FACSM, Shad K. Robinson, Idaho State University, Pocatello, ID.
Reported Relationships: T.M. Gustaveson: Contracted Research - Including Principle Investigator; Partial support by FieldTurf USA.

In the past, serious injuries have been attributed to playing on artificial turf. Newer generations of artificial turf, however, have been developed to duplicate the properties of natural grass. No long-term studies have compared artificial turf and natural grass. PURPOSE: To quantify incidence and severity of game-related thoracoabdominal 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. MANOVA per 10 games indicated a significant playing surface effect by injury severity (F1,375 = 7.505; P < .001), primary type of injury (F1,375 = 4.412; P < .001), tissue type (F1,375 = 9.412; P < .001), elective imaging and surgical procedures (F1,375 = 3.517; P = .007), and turf age (F1,375 = 91.093; P = .000), but not by injury category (F1,375 = 2.175; P = .089), injury mechanism (F1,375 = 1.439; P = .133), or injury situation (F1,375 = 1.329; P = .181). Univariate analyses indicated significantly lower P = .05 < .001 IIRs across severity, both in degree IIRs, 0.1 (95% CI, 0.1-0.2) vs 0.7 (95% CI, 0.6-1.1) and 1.4 (1.2-1.7); contusions, 1.3 (95% CI, 1.1-1.6) vs 2.0 (1.7-2.3); muscle, 2.0 (95% CI, 1.7-2.3) 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) when comparing artificial turf vs natural grass, respectively. CONCLUSION: Since minimal differences existed between artificial 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.

2340  Board #176  June 1 9:30 AM - 11:00 AM  Racquet Sport-Related Injuries Treated in United States Emergency Departments, 2007-2016
Andrew McBride, Morteza Khodaee, 80645, FACSM. University of Colorado - Denver, Aurora, CO. (Sponsor: Morteza Khodaee, FACSM)

(No relevant relationships reported)

Title: Racquet Sport-Related Injuries Treated in United States Emergency Departments, 2007-2016
Authors: Andrew J. McBride, Morteza Khodaee, FACSM
Institutions: University of Colorado-Denver
Purpose: Racquet sports, especially tennis, racquetball and paddleball, has grown in popularity in the United States. There are limited studies analyzing injuries in badminton, squash, and other lesser-known racquet sports. We aimed to analyze the injury pattern in all racquet sports that resulted in the United States emergency department (USED) visits.

Methods: This was a retrospective analysis of National Electronic Injury Surveillance System data on racquet-sport related injuries that presented to the USEDs for the past 10 years. Results: From 2007-2016, there were 8,024 cases of racquet-sports related injuries that presented to USEDs. The majority of these injuries were in men (61%). Caucasians had the highest percentage of injuries (47%) followed by African Americans (7%) and Asian Americans (3%). Sprain/strains were the most common types of injuries (34%) followed by fracture (13%) and contusion/abrasion (12%) The body part most frequently injured was the ankle at 13% followed by facial injuries at 10%. Over 93% of injuries were treated and released from the USED while 5% of patients were admitted for hospitalization. Approximately two third of injuries occurred at a place of recreation or sport. Tennis was the most common sport of injury at 68% followed by one of squash, racquetball and paddleball at 17%. The summer months were the most common months of injury and adolescence was the most common age group injured.

Conclusion: Racquet sport-related injuries are varied in their presentation and body part involvement. Gender differences were seen in injury rates for tennis and squash/ racquetball/paddleball. Tennis-related injuries make up two thirds of racquet sport-related injuries making knowledge of other racquet sport injuries important.
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 female MMA 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 lesser 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 clipped 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, respectively. CONCLUSIONS: KO and TKO events may represent a conservative estimate of concussive events in MMA competition. The incidence of 103.4 TKOs/KOs per 1000 AEs 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/TKOs.

Methodology:

To design and implement a prospective injury surveillance system to describe B, K, and S injuries, and devise potential preventive measures to help reduce injury risk. METHODS: Participants were recruited from Bloomsburg University’s B, K, and S teams. Sport-specific injury reporting forms were developed, and injury details were recorded by athletic trainers. Information was collected on the injury and circumstances surrounding the injury, with injury defined as “damage to the body that occurs as a result of competing, practicing and/or participating in an athletic activity”. RESULTS: The B, K, and S teams consisted of 32, 11, and 25 players respectively. There were 73 injuries sustained (B = 34, K = 12, S = 27), with significant differences (p ≤ 0.001) in all injury parameters between sports. Excluding those who were unsure, in all sports, soft tissue injuries were most common (66.6%), with B having more non-contact injuries, and K and S having more contact injuries (p ≤ 0.001). There were similar numbers of head and torso injuries among sports, however B had more upper extremity injuries (p ≤ 0.05), while K and S had more lower extremity injuries (p ≤ 0.001). B and K had more replacement injuries (p ≤ 0.05), while S had more training injuries (p ≤ 0.001). Proper conditioning to provide strength and flexibility to the lower extremities in K and S, and upper extremities in B also seems warranted. In S specifically, modifying training intensities and investigating footwork worn and surfaces where games and trainings are conducted might be useful. Whereas in K, plyometric training could be used to improve landing techniques. Lastly, in B, proper preseason conditioning, particularly in pitchers should be investigated.

Results:

Baseball (B), basketball (K), and soccer (S) are among the top-five sports causing injury in males. To date, no published studies have prospectively investigated the epidemiology of sporting injuries. PURPOSE: To describe and implement a prospective injury surveillance system to describe B, K, and S injuries, and devise potential preventive measures to help reduce injury risk. METHODS: Participants were recruited from Bloomsburg University’s B, K, and S teams. Sport-specific injury reporting forms were developed, and injury details were recorded by athletic trainers. Information was collected on the injury and circumstances surrounding the injury, with injury defined as “damage to the body that occurs as a result of competing, practicing and/or participating in an athletic activity”. RESULTS: The B, K, and S teams consisted of 32, 11, and 25 players respectively. There were 73 injuries sustained (B = 34, K = 12, S = 27), with significant differences (p ≤ 0.001) in all injury parameters between sports. Excluding those who were unsure, in all sports, soft tissue injuries were most common (66.6%), with B having more non-contact injuries, and K and S having more contact injuries (p ≤ 0.001). There were similar numbers of head and torso injuries among sports, however B had more upper extremity injuries (p ≤ 0.05), while K and S had more lower extremity injuries (p ≤ 0.001). B and K had more replacement injuries (p ≤ 0.05), while S had more training injuries (p ≤ 0.001). Proper conditioning to provide strength and flexibility to the lower extremities in K and S, and upper extremities in B also seems warranted. In S specifically, modifying training intensities and investigating footwork worn and surfaces where games and trainings are conducted might be useful. Whereas in K, plyometric training could be used to improve landing techniques. Lastly, in B, proper preseason conditioning, particularly in pitchers should be investigated.

Abstracts were prepared by the authors and printed as submitted.
participating facilities was included in this study. The NEISS database is designed to represent a probability sampling of emergency departments nationwide. Data analysis was performed using descriptive statistics, a χ² test, and a logistic regression model.

**Results:**
A total of 2,621 mountain biking injury cases were identified in the NEISS database in the past 11 years. Fracture was the leading diagnosis (26.8%), followed by contusion/abrasion (19.1%), strain/sprain (14.8%), laceration (14.4%), internal injury (6.8%), dislocation (3.9%), and concussion (3.9%).

**Conclusion:**
The findings 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 anatomic 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.
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 Khodace, FACSMS, FASM. 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 departments (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%), football (9%), and soccer (4%). The most common sport associated with female facial injuries was biking (21%), followed by softball (10%), basketball (8%), baseball (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->

2353 Board #189 June 1 9:30 AM - 11:00 AM Profile Of Non-time-loss Conditions/Injuries In U.s. Men’s Rugby-7s Players

PURPOSE: Rugby-7s, on the Olympic program, over the next decade, has a dearth of injury data, limiting injury prevention. Most injury reporting focuses on time-loss injuries with little or no data on medical attention injuries. The aim was to determine the match non-time-loss injury incidence in U.S. men’s Rugby-7s. METHODS: A prospective epidemiology study of 17,770 U.S. men Rugby-7s players (1,474 teams), in multi-level USA Rugby and USA Sevens LLC tournaments (2010-2014). Incidence (per 1000 player-hour (ph) and biomechanic of non-time-loss injuries were captured via the Rugby Injury Survey & Evaluation (RISE) Report methodology. RESULTS: Non-time-loss injuries were found at 66.1/1000 ph (n=686). Positionally, backs encountered more injuries (63%); 67.4/1000ph, n=400) than forwards (36%); 52.4/1000ph; n=233; RR=1.3; P<0.002). Most injuries were acute (93%), occurring in the tackle (67%). Shoulder tackles resulted in most non-time-loss injuries (63%) (backs 65%; forwards 58%; RR=1.7; P<0.001). Recurrent injuries (23%) occurred frequently. Main injuries were lower extremity ligament sprains (14.2%). Overall head/neck injury rates were 23%, and found higher with incorporation of tackles (26%). The sub-acute head trauma/confusion rate, where players were physician-cleared to return to sport (non-time loss) was 4.9% (3.2/1000ph). CONCLUSIONS: Recording non-time-loss (medical attention) injuries will provide a true burden of injury and illness among the growing U.S. Rugby-7s population. Most injuries occur to the lower extremity (41%), reflective of the greater amount of running associated with the Rugby-7s format. Head/neck non-time-loss injury rates were found lower than the “all medical attention injuries (30%)” in community international male Rugby-15s. Most injuries

2354 Board #187 June 1 9:30 AM - 11:00 AM Incidence And Severity Of Collegiate Men’s Soccer Lower Leg Injuries On Artificial Versus Natural Grass Shianne M. Blessing, Michael C. Meyers, FACSMS, Shad K. Robinson. Idaho State University, Pocatello, ID. Reported Relationships: S.M. Blessing: Contracted Research - Including Principle Investigator; Partial support by FieldTurf USA.

Recently, artificial turf has been developed to duplicate the playing characteristics of natural grass. No long-term studies have compared match-related, collegiate men’s soccer lower leg trauma between the two surfaces. PURPOSE: To examine the prevalence and incidence of injury among individuals engaged in CrossFit training over a four-year period. METHODS: Between 2015-2017, individuals (Females = F, Males = M) engaged in CrossFit training were asked to complete a survey designed to examine variables related to their participation in CrossFit training and their injury history over the previous 12 months (survey was distributed at the end of each year). RESULTS: A total of 3,079 individuals responded to the online survey. Data was only analyzed for the cases that had complete data (N = 3,049; F = 48.6%, M = 51.4%). Overall, 30.5% (n = 931) of individuals reported experiencing an injury, with no difference between F and M [14% (n = 436); 16.2% (n = 495), respectively; Z2 = 1.65, p = 0.1989]. Of those who experienced an injury, 62.4% (n = 581) reported an injury to a single body part, while 37.6% (n = 350) reported injuries to multiple body parts; in addition, there were significant differences between males and females (Z2 = 8.45, p = 0.0037) in the number of body parts injured. The shoulders (30%), back (36%), knees (15%), hands (12%), and wrists (11%) recorded the highest prevalence of injury. Based on the assumed maximum number of workout hours per week, the injury rate was 0.27 per 1,000 hours (F = 0.28, M = 0.26); whereas, the assumed minimum number of workout hours per week resulted in an injury rate of 0.74 per 1,000 hours (F = 0.78, M = 0.70). CONCLUSIONS: To our knowledge, this is the first study to examine the prevalence and incidence of injury in a multi-year large sample of individuals participating in CrossFit training. Our findings support the notion that CrossFit training has similar rates of injury than other forms of exercise training.

2349 Board #185 Abstract Withdrawn

Little epidemiological data exist to describe the incidence of injury among individuals engaged in CrossFit training. PURPOSE: To examine the prevalence and incidence of injury among individuals engaged in CrossFit training over a four-year period. METHODS: Between 2015-2017, individuals (Females = F, Males = M) engaged in CrossFit training were asked to complete a survey designed to examine variables related to their participation in CrossFit training and their injury history over the previous 12 months (survey was distributed at the end of each year). RESULTS: A total of 3,079 individuals responded to the online survey. Data was only analyzed for the cases that had complete data (N = 3,049; F = 48.6%, M = 51.4%). Overall, 30.5% (n = 931) of individuals reported experiencing an injury, with no difference between F and M [14% (n = 436); 16.2% (n = 495), respectively; Z2 = 1.65, p = 0.1989]. Of those who experienced an injury, 62.4% (n = 581) reported an injury to a single body part, while 37.6% (n = 350) reported injuries to multiple body parts; in addition, there were significant differences between males and females (Z2 = 8.45, p = 0.0037) in the number of body parts injured. The shoulders (30%), back (36%), knees (15%), hands (12%), and wrists (11%) recorded the highest prevalence of injury. Based on the assumed maximum number of workout hours per week, the injury rate was 0.27 per 1,000 hours (F = 0.28, M = 0.26); whereas, the assumed minimum number of workout hours per week resulted in an injury rate of 0.74 per 1,000 hours (F = 0.78, M = 0.70). CONCLUSIONS: To our knowledge, this is the first study to examine the prevalence and incidence of injury in a multi-year large sample of individuals participating in CrossFit training. Our findings support the notion that CrossFit training has similar rates of injury than other forms of exercise training.

2350 Board #186 June 1 9:30 AM - 11:00 AM A Cross-sectional Look At Injuries Among Individuals Engaged In CrossFit Training: A Four-year Study. Yuri Feito, FACSMS, Evannke K. Burrows, Lomi T. Tabb. Kennesaw State University, Kennesaw, GA. 1Drexel University, Philadelphia, PA. (No relevant relationships reported)

Conclusions: The study highlights the need for continued research in this area to determine if different types of exercise training are associated with lower injury rates than other forms of exercise training. It also shows the importance of further investigating the effects of exercise training on injury risk among women.

Abstracts were prepared by the authors and printed as submitted.
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 at positional focus and its target area (lateral hip). Proper medical assessments, need to scrutinize return to play post-tournaments to reduce recurrent injury risk in the U.S. men’s cohort. Investigations such as this will aid in understanding the current needs and allocation of medical resources for Rugby-7s.

Distance runners have a high incidence of running-related injury (RRI). While anatomical, biomechanical, and training load have been associated with RRs, physiological 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 (25.5±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 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.

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±3.1 out of 100 (mild overuse). Pain prevalence showed similar trends, with 28.5±7.6% of participants reporting pain during the season, with 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 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 most 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.

Wearable sensors (WS) have been increasingly used to quantify training loads in team sports but can also be used to identify impacts. Helmet-worn sensors have been used to identify head impacts, but there is currently no data with regard to whole-body impacts occurring in ice hockey. Sports Research Foundation.


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 differences from distinct approaches for conditional, multifactorial modeling of time-loss due to injury in sports settings.

METHODS: Data from the NCAA-ISS for the 2004/2005/2013/14 years, were used for this analysis. For unadjusted analyses, time-loss was considered a count outcome, following a Poisson distribution and allowing 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 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-loss 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<0.001).

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.

2358 Board #194 June 1 9:30 AM - 11:00 AM Perception about Running and Knee Joint Health among the Public and Healthcare Practitioners


(No relevant relationships reported)

PURPOSE: There is conflicting evidence surrounding the effect of running on knee joint health, particularly as it relates to knee osteoarthritis (KOA). The perception about running and knee joint health could affect choices of activities, but remains undocumented in the population. Given the uncertainty in the literature, the objective of this study was to evaluate the perception of the public and healthcare practitioners (HCP) with respect to running and KOA.

METHODS: A total of 397 public respondents (mean age=53.1 years, 163 females; 79 non-runners [NRUN], 318 runners [RUN]) and 176 HCPs (mean age=39.2 years, 86 females) completed an online cross-sectional survey. The survey included multiple-choice questions about perceptions of running as it relates to knee joint health, and about the appropriateness of maintaining running by individuals with KOA. The HCP subgroup was also asked about clinical recommendations to runners with KOA. Proportions (agree, uncertain, disagree) were compared between subgroups using chi-squared tests.

RESULTS: In general, 11% of respondents perceived running as detrimental for knee joint health, particularly as it relates to knee osteoarthritis (KOA). The perception about running and knee joint health could affect choices of activities, but remains undocumented in the population. Given the uncertainty in the literature, the objective of this study was to evaluate the perception of the public and healthcare practitioners (HCP) with respect to running and KOA.

CONCLUSIONS: These results suggest that many non-runners perceive running as detrimental to knee joint health. High rates of uncertainty warrant further studies to guide the population and HCP about the appropriateness of running for individuals with KOA, as it may influence choices of physical activity and clinical recommendations.

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. Aguia1, Scott W. Ducharme1, Christopher C. Moore1, John M. Schuna1, Tiago V. Barreira1, Stuart R. Chipkin1, Cattrine Tudor-Locke, FACSM2,3. 1University of Massachusetts Amherst, Amherst, MA. 2Oregon State University, Corvallis, OR. 3Syracuse University, Syracuse, NY. (Sponsor: Dr. Cattrine Tudor-Locke, FACSM)

(No relevant relationships reported)

A walking cadence of 100 steps/min has been established as a heuristic (evidence-based, rounded) threshold for absolutely defined moderate intensity (3 Metabolic Equivalents, MEIs). This threshold was calibrated during treadmill (TM) walking, however few studies have assessed its classification accuracy during overground (OG) walking. PURPOSE: To evaluate the classification accuracy of the 100 steps/min cadence threshold originally established during TM walking to OG walking.

METHODS: Participants (n=75, 50.7 % men, 21-40 years of age, mean±SD age: 2360 Board #196 June 1 9:30 AM - 11:00 AM
While it is becoming less and less common for four-year colleges and universities to overweight/obesity, suggesting other factors may play a role. overweight/obesity among Latino adults. However, mediation results indicate 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.

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

<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>Optimal OG</td>
<td>103 (13.3%)</td>
<td>11 (14.7%)</td>
<td>46 (61.3%)</td>
<td>5 (10.7%)</td>
</tr>
<tr>
<td>Heuristic (TM-based)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>6 (8.0%)</td>
<td>8 (10.7%)</td>
<td>49 (65.3%)</td>
<td>12 (16.0%)</td>
</tr>
</tbody>
</table>

**2363 Board #199 June 1 9:30 AM - 11:00 AM**

The Effect of a Web-based Physical Activity Promotion Program on Sedentary Behavior: The Walk 2.0 Trial

Gregory S. Kolt, FACSM1, Tanya Wood1, Mitch J. Duncan2, Cristina M. Capernichio3, Anthony J. Maeder1, Richard R. Rosenkranz, FACSM3, Trevor N. Savage3, Anetta Van Italie1, W. Kerry Mummery4, Corneil Vandelanotte5, 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.

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 28.5 minutes (SD = 2.4; 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.
EVALUATION OF STEP RATE OF WALKING CORRESPONDING TO MODERATE INTENSITY

2364 Board #200 June 1 9:30 AM - 11:00 AM

Effects of One Session of Treadmill Desk Walking on Free-Living Physical Activity

Rebecca R. Rogers, Erica Dishrow, Kendra Skenderi, John K. Petrella, FACSM, Mallory R. Marshall, Christopher G. Ballmann. Samford University, Birmingham, AL.

(Purpose) Treadmill desks are being implemented in office and classroom settings to counteract long durations of sedentary behavior. The purpose of this study was to examine the effects of one treadmill desk walking session on daily physical activity patterns outside of work or school in healthy individuals.

(METHODS) Male and female participants (age = 38 yrs ± 8.0, weight = 166.2 lbs ± 47.5, height = 62.0 in ± 71.5) were recruited for this study. To assess baseline free-living physical activity patterns, all participants wore a Actigraph GT3X link accelerometer for one week during waking hours. Participants completed one session of treadmill desk walking at a speed of 2.0 mph for a total of 3 hours. During the 3 hours, participants performed typical office or school related tasks. Physical activity patterns were then recorded via accelerometer for 2 additional days following the treadmill workstation bout.

(RESULTS) Participants classified as “low active” (mean steps/day = 7368.0 steps ± 540.4) did not show a significant difference in average steps/day (p=0.190) or activity counts (p=0.204) between the 2 days prior and after the treadmill desk session. No significant differences in average steps/day (p=0.233) or activity counts (p=0.119) were observed pre and post treadmill desk session in participants classified as “somewhat active” to “active” (mean steps/day = 9538.5 steps ± 578.7) indicating there was no change in daily physical activity levels.

(CONCLUSIONS) This study suggests that treadmill desk walking does not influence free-living physical activity regardless of activity classification.

2366 Board #202 June 1 9:30 AM - 11:00 AM

Evaluation of Step Rate of Walking Corresponding to Moderate Intensity

Woam R Ram Bae, 1 So Mi Yun, 1 Yun Bin Lee, 1 Min Gi Jung, 1 Da Hyec Lim, 1 Ah Reum Jung, 1 Woong Hee Lee, 1 Eun Jin Hwang 1, Il J Kn Jwono 1, Da Tae Lee 1, 1 Kookmin University, Seoul, Korea, Republic of. 1Chung-Ang University, Seoul, Korea, Republic of. (No relevant relationships reported)

(Purpose) Walking at 100 steps per min is assumed to be the moderate exercise intensity in most cases. But it may not be universally accepted. This study evaluated how the overweight walking at different step rates would elicit exercise intensities, and aimed to provide a cut-point of step rate which corresponds to a moderate walking intensity.

(METHODS) Twenty-three young men (25±1.2 yrs, 175±6 cm, 76±14 kg) completed four overground walking trials. At the first trial, participants were asked to walk freely for 6-min at an intensity they felt moderate. Subsequently, they walked another 3 occasions for 6-min of each at 100, 120, and 140 beat/min while matching to a metronome. During the walking, oxygen consumption (VO2), walking speed (WS), step rate (SR), and ratings of perceived exertion (RPE) were measured. On a separate occasion, their resting VO2 and maximal aerobic capacity (VO2max 41±6 ml O2/kg/min) on a treadmill using Bruce Protocol were measured.

(RESULTS) The actual SR at free walking and 100, 120, and 140 beat/min was 117±9, 101±2, 120±1, and 138±6 step/min, respectively (p<0.01). SR they felt moderate during free walking was higher than 100 step/min (p<0.01). Based on the intensity parameters such as WS (4.9±0.5, 3.9±0.3, 5.2±0.4, and 6.4±0.5 km/h), %VO2 reserve (31±8, 24±6, 33±9, and 45±9 %), and RPE (7.6±1.5, 7.4±1.5, 9.4±2.0, and 12.3±1.9 at free walking and, 100, 120, and 140 beat/min, respectively), the criteria of a moderate intensity of walking (100 step/min) was not satisfied. Regression analysis revealed that a cut-point of SR representing a moderate intensity (about 40%VO2 reserve) was 128 step/min based on %VO2 reserve, while it was 88.2 step/min based on metabolic equivalents. When grouped by aerobic fitness level, the less fit participant (VO2max 32±3.3 ml O2/kg/min) met the moderate intensity at SR of 120 step/min while the more fit (VO2max 50±2.9 ml O2/kg/min) did at 140 step/min.

(CONCLUSIONS) Based on the relative intensity index (%VO2 reserve), the cut-point corresponding to a moderate intensity was 128.9 step/min. But this estimation also has to be widened by the aerobic fitness level of the walkers. In general, approximately 120-140 step/min of overground walking can be considered as a moderate walking intensity for those of healthy 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, 1 Shu-Hua Lu, 1 Wei-Fen Ma, 1 Kwo-Chen Lee, 1 Chu-Chi Lin, 1 Meei-Maan Chen, 2 China Medical University, Taichung, Taiwan. 2Kaohsiung Medical University, Kaohsiung, Taiwan. 3National 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 resources. A survey contained both closed and open-ended questions assessing frequency of use and perceptions of program components; feedback 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 group support of the 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 (51.4%), 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.)
2368 Board #204 June 1 9:30 AM - 11:00 AM
Application Of The ActiGraph GT9X IMU For The Assessment Of Turning During Walking And Running
Robert T. Marcotte¹, David R. Bassett, Jr, FACSM², Joshua T. Weinhandl³, Scott E. Crouter, FACSM². ¹University of Massachusetts Amherst, Amherst, MA. ²University of Tennessee Knoxville, Knoxville, TN.
(No relevant relationships reported)

Rotational movements, such as turning, can significantly increase energy expenditure (EE) during ambulatory activity. Gyroscope and magnetometer sensors can quantify rotational motion, which provides additional information on movement beyond linear acceleration that is provided by using an accelerometer. PURPOSE: The purpose of this study was to examine the use of ActiGraph GT9X gyroscope and magnetometer for detecting turns and quantifying turn degree during walking and running.

METHODS: Participants (N=17) completed pivot trials, treadmill walking and running (TM; 3 to 6 mph) and four turn conditions (i.e. 45°, 90°, 135°, and 180°) during over-ground walking and running (OG). Pivot and TM trials were completed for 1-min and 6-min, respectively. Turn frequency was constant (10 turns/min) for all OG trials. A GT9X was placed on the left hip and a Counted K4b² was used to measure EE. Raw GT9X gyroscope and magnetometer data were processed through various low-pass filter frequencies (0.25 Hz to 2.0 Hz). TM and pivot trials were used to develop thresholds for turn detection using the gyroscope and magnetometer data and the OG trials were used for cross-validation. K4b² data (VO₂) were averaged across 30-s periods and converted to relative VO₂ (mL/kg/min). Linear mixed models were used to compare actual and predicted number of turns, measured and predicted turn degree, and differences in VO₂ across OG conditions.

RESULTS: There were no main effects for speed or turn condition on turn detection when filtering the gyroscope at 0.25 Hz (p>0.05). A speed main effect was present when filtering the magnetometer at 0.75 Hz (p<0.001, 0.25 Hz gyroscope) and 0.75 Hz (magnetometer) filters resulted in 100.5±4.4% and 96.9±4.5% of turns detected, respectively. Using the gyroscope, turn degree was estimated to within approximately 2.2° for all turn conditions (p>0.001). In general, the VO₂ of walking and running was significantly 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.

2369 Board #205 June 1 9:30 AM - 11:00 AM
Peak Torque, Rate Of Velocity Development And Walking Performance: The Baltimore Longitudinal Study Of Aging
Yusuke Osawa, Stephanie A. Studenski, Luigi Ferrucci. National Institute on Aging/ NIH, Baltimore, MD.
(No relevant relationships reported)

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; women, 64.1±13.6 years; men, 68.6±14.9 years). We measured peak torque and RVD by isokinetic, concentric knee extension at 180 deg/sec. RVD was determined from the slope of the velocity-time relationship from the onset of movement to the time point that angular velocity first reached target velocity. Walking performance tests included gait speed 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 pace (2.5min). Sex-specific generalized linear regression models were adjusted for age, race, body height, appendicular lean mass, whole body fat mass, and knee pain. A term testing whether the interaction between RVD and peak torque significantly improves the model fit was also included.

RESULTS: In men, RVD was associated with 6m-usual (p<0.0001), 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<0.0001). 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.

2370 Board #206 June 1 9:30 AM - 11:00 AM
Comparison of Physical Activity Levels of College Students after a Five Week Walking Class
Julio Morales. Lamar University, Beaumont, TX.
(No relevant relationships reported)

Physical Activity (PA) of college students has been the focus of much study because of its decline when students enter college. Efforts are consistently made to provide strategies to foment college students’ engagement in PA.

PURPOSE: To compare the level of PA of college students before and after participation in a walking class containing information on PA and exercise.

METHODS: Participants in the study were sixty nine (25 males, 44 females; ages 19 to 26) college students enrolled in three different five week summer walking classes held during the same period over three different summers. Participants were administered the International Physical Activity Questionnaire-Short Form during the first and last class meeting to assess their leisure time physical activity. An experienced investigator read the questions and answered any questions during the administration of the questionnaire. He also made clear during the second administration that students should only report the PA done outside class. Walking (WMET), Moderate (MMET), Vigorous (VMET) and Total (TMET) METS levels were calculated following the IPAQ scoring guidelines. Paired samples t tests were conducted by gender for the pre and post administration for all MET levels. Independent samples t tests were conducted between genders to examine differences pre and post class.

RESULTS: Females showed a significant increase in TMET form pre (M = 5665.01, SD = 5580.14) to post (M = 8229.76, SD = 7121.46), (t(31)) = -2.21, p<.004 (two tailed). In the gender post comparison, females had significantly higher METM values (M = 2584.38, SD = 3542.06) than males (M = 724.44, SD = 843.81), t(37) = 2.83, p<.007 (two tailed).

CONCLUSIONS: Findings may suggest that there are possibilities for the use of content driven college activity courses could offer another avenue to foment participation in physical activity.

2371 Board #207 June 1 9:30 AM - 11:00 AM
Association Between the National Walkability Index and Sidewalk Features
Kathleen B.Watson, Susan A. Carlson, Kristine Day, Janet E. Fulton, FACSM. Centers for Disease Control and Prevention, Atlanta, GA. (Sponsor: Janet E. Fulton, FACSM)
(No relevant relationships reported)

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 in their neighborhood (present; well maintained; separated from traffic by parked cars; separated from streets by grass/dirt strips). Sidewalk data were merged with the NWI - a nationwide geographic measure of walkability that encompasses density, land use mix, and proximity to transit. Associations of the NWI score with sidewalk presence and features were assessed by correlations and by comparing NWI mean scores by individual sidewalk features, tested with pairwise comparisons.

RESULTS The correlation between the NWI and sidewalk presence was moderate (r=0.52) while correlations between NWI and individual sidewalk features were weak (r=0.04-0.19). Among adults who reported sidewalks present (73%), the mean (± standard deviation) 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. 11.6±0.1).

CONCLUSIONS The NWI was moderately associated with sidewalk presence; however, associations with individual sidewalk features were weak. The NWI may be 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.
feeling “worse than normal” during SUP weeks. These results indicate that BCAA supplementation seems to be an effective means of reducing the stress perception in these collegiate distance runners.

During a collegiate rugby season, players practice and compete for 1-2 hours on multiple days per week for 3-4 months per year. Practices and matches consist of multiple activities (e.g. sprinting, hitting, etc.) that could result in accumulated damage and affect performance. β-Hydroxy β-Methylbutyrate (HMB) is thought to speed protein synthesis which in turn could maintain performance. PURPOSE: To determine the effect of HMB supplementation on sprint kinetics across a rugby season. METHODS: In this cross-over design investigation, 13 collegiate male rugby players were assigned to consume one of two supplementation regimens: 5 g HMB + 5 g creatine per day (HMB) or 5 g creatine + 5 g placebo per day (PLB) for six weeks. During the fall season, players were matched for lean body mass and randomly assigned to HMB (n = 7; 21.1 ± 1.1 kg; 179.3 ± 7.9 cm) or PLB (n = 6; 21.5 ± 1.2 kg; 178.6 ± 5.2 cm). The supplementation regimen was switched for athletes who returned and completed the spring season (n = 7; 22.5 ± 1.3 kg; 179.6 ± 4.5 cm). Prior to and following each supplementation period (i.e., fall or spring), 40-m sprinting kinetics were assessed in all athletes while tethered to a robotic sprinting device. Peak (PK) and mean sprinting power (P), force (F), and velocity were assessed against minimal (1 kg) and heavy (15 kg) resistance. Since only 7 of the original 13 athletes returned and completed the spring season, separate 2 × 2 repeated measures analyses of variance (RMANOVA) with Bonferroni adjustments were used to assess group differences in each variable during the fall, while a 2 × 4 RMANOVA was used to assess the cross-over sub-sample throughout the fall and spring. RESULTS: While no group differences were observed in sprint kinetics during the fall, a significant group × time interaction was observed for PK (F = 4.85, p = 0.020, τ² = 0.55) across the fall and spring seasons, where during the spring, PK decreased at 1 kg decreased for PLB (−6.9 ± 1.2%, p = 0.020) but not for HMB (−3.5 ± 10.7%). No other differences were observed. CONCLUSION: Our data suggest a potential benefit from HMB supplementation for maintaining sprinting power in rugby players.

Exercise-induced fatigue may be caused by increases in cerebral serotonin resulting in muscle recovery in elite rowers using anabolic and catabolic hormones. The hypothesis was that supplementation with both HMB + Cr would improve muscle recovery, as measured by testosterone and T/C ratio, to a greater degree than would each individual supplement 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: G1: Control group; G2: Group supplemented with Cr (0.04 g / kg / day); G3: HMB group; G4: Group supplemented with HMB (3 g / day); and, GRC + 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 GRC + HMB than in the others (p < 0.05). A smaller decrease in the T/C ratio in the GRC + 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-hydroxybutyrate (HMB) (3 g / kg) in elite rowers favors endogenous recovery through an increase in total testosterone and maintenance of the T/C ratio.
Increased protein intake in the diet decreases fat mass (FM) and increases lean mass (LM). Resistance training increases LM, as well as increases muscular strength.

Together, protein supplementation and resistance exercise work synergistically when taken prior to or following exercise. PURPOSE: The purpose of this pilot study was to investigate the effects 8 weeks of protein supplementation and Autoregulatory Progressive Resistance Exercise (APRE) training had on measures of body composition and muscular performance. METHODS: Untrained males (n = 22; 42.1 ± 7.1 years) participated in this pilot study. LM and FM were measured via Dual Energy X-ray Absorptiometry (DEXA), while strength was measured utilizing one repetition maximum (1RM), and endurance measured using maximum repetitions completed (REPS) at 75% 1RM for the bench and leg press. Subjects were randomly placed into one of four groups: control (CON), protein (PO), APRE, or protein plus APRE (PAPRE). Subjects repeated testing for the DEXA, IRM, and REPS every four weeks for 8 weeks. Both PO and PAPRE groups ingested 25g of supplemental protein twice daily. Subjects in the exercise groups completed a resistance training program, 3 days/week, for 8 weeks, or 24 training sessions. RESULTS: Repeated measures 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 ± 13.9kg), respectively. There were no other group by time interactions for any of the variables assessed (p > 0.05). LM (p < 0.05), bench press IRM (p < 0.001), and leg press IRM (p < 0.001) 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% (+2.9 ± 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.

Purpose: We examined 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 (22±2 y, RT aged 23±2y, lean mass 63.0±7.2kg) 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 (FFBM) was measured with dual-energy X-ray absorptiometry (DXA) scans at weeks 0,8,10,12. 180-degree ultrasound was performed to assess muscle thickness (MT) and cross sectional area (CSA) at weeks 0,8,10,12. Systemic hormone concentrations were measured at weeks 0,4,8,9,10,12. RESULTS: 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; p=0.59). Following RT, Vastus lateralis MT increased by 5% and 6%, with no difference (p=0.05) between groups. Both groups exhibited comparable changes in CSA, Whey+HMB; 2.2±1.4cm² (6±4% increase) and Whey+LEU; 2.3±1.4cm² (7±4% increase). Following overreaching, both groups experienced similar changes (p=0.05) in 1-RM strength for squat (HBM 2.4±4%, LEU ±1.5% bench-press (HBM ±1.4%, LEU ±1.3%) and deadlift (HBM -2.5%, LEU -3.7%). Circulating creatine kinase and cortisol concentrations increased significantly (p≤0.05) from week 0 at phase 2, in both groups, with no differences between blood markers during any phase of the study. CONCLUSION: These data demonstrate that there are no additional effects of Whey+HMB supplementation on muscle strength or size following 12 weeks of RT in young healthy men when compared to a leucine-fortified supplement Whey+LEU.

**CONCLUSIONS**

These data demonstrate that there are no additional effects of Whey+HMB supplementation on muscle strength or size following 12 weeks of RT in young healthy men when compared to a leucine-fortified supplement Whey+LEU.
The Effects of Creatine Loading on Dynamic Balance, Mobility and Strength in Older Adults

Joseph Reale, John Petrizzi, John Wygand, FACSIM, Melhaney Reichelt, Glen Reid, Robert M. Otto, FACSIM. Adelphi University, Garden City, NY. (Sponsor: Robert M. Otto, FACSIM) (No related 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 per day for 5 days) improves balance, mobility, and strength in older adult populations.

METHODS: Ten subjects (age 64.4 ± 5.2 yr, ht 168 ± 5.6 cm, body mass 76.3 ± 8.1 kg, %) participated in familiarization trials conducted on the Biodex Balance SD (four conditions: normal stance w/ eyes open (NEO), w/ eyes closed (NEC): and closed stance w/ eyes open (CEO), and w/ eyes closed (CEC): isokinetic knee extension (KE) and knee flexion (KF) peak torque (ft/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>0.05) between treatments.

<table>
<thead>
<tr>
<th>KE</th>
<th>KF</th>
<th>TUG</th>
<th>NEC</th>
<th>CEO</th>
<th>CEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC</td>
<td>30.3 ± 2.0</td>
<td>47.1 ± 2.2</td>
<td>8.8 ± 1.5</td>
<td>15.9 ± 2.4</td>
<td>40.0 ± 8.3</td>
</tr>
<tr>
<td>PoC</td>
<td>30.2 ± 1.7</td>
<td>61.6 ± 4.3</td>
<td>8.2 ± 1.1</td>
<td>11.5 ± 1.5</td>
<td>21.9 ± 3.3</td>
</tr>
<tr>
<td>PCr</td>
<td>30.5 ± 1.4</td>
<td>64.7 ± 3.4</td>
<td>8.2 ± 1.2</td>
<td>23.9 ± 2.6</td>
<td>46.3 ± 7.9</td>
</tr>
<tr>
<td>PoCr</td>
<td>27.9 ± 1.2</td>
<td>55.0 ± 2.1</td>
<td>8.1 ± 1.1</td>
<td>21.8 ± 2.1</td>
<td>35.8 ± 3.6</td>
</tr>
</tbody>
</table>

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

The Effects of Pre-sleep Protein Supplementation After Resistance Exercise on Next Day Performance and Recovery

Margaret Morrissey1, Jaymie Donaldson2, Andrew McKune3, Michael Ormsbee, FACSIM. 1Florida State University, Tallahassee, FL. 2University of KwaZulu-Natal, Durban 4000, South Africa. 3University of Canberra, Bruce, Canberra ACT 2601, Australia. (Sponsor: Michael Ormsbee, FACSIM) (No related 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 ± 0.07m; weight; 82.6 ± 4.9kg) or a non-caloic, 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, rate of recovery, and perceived soreness of DOMS tests for bench and squat were performed at BL and the day following resistance exercise. Jump performance was assessed immediately before and after a conditioning-heavy, 80-minute soccer practice. Before and during practice, subjects ingested a water-based solution containing either BCAAs (SUPP; n=7) or an isocaloric amount of maltodextrin (PLAC; n=7) at fixed time intervals. The SUPP treatment contained a total of 18 grams of BCAA, 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 BCAA supplementation before and during exercise may improve certain aspects of post-exercise cognitive and psychomotor performance, but without influencing session RPE.

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 related 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 the 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, whether 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 selected 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 (BCCA), 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 BCCA (41 ± 20% vs. 98 ± 15%, p<0.05). During resting 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 BCCA 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 BCCA.

BCAA Supplementation Improves Mental Performance Following a Soccer-Specific Conditioning Session

Beau K. Greer, Matthew S. Manzo. Sacred Heart University, Fairfield, CT. (No related relationships reported)

The efficacy of branched-chain amino acid (BCAA) 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 BCAA 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 (EncphelApp) immediately before and after a conditioning-heavy, 80-minute soccer practice. Before and during practice, subjects ingested a water-based solution containing either BCAAs (SUPP; n=7) or an isocèleic amount of maltodextrin (PLAC; n=7) at fixed time intervals. The SUPP treatment contained a total of 18 grams of BCAA, 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 33 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 BCAA supplementation before and during exercise may improve certain aspects of post-exercise cognitive and psychomotor performance, but without influencing session RPE.
**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. In the nutritional variables, there were no significant differences between groups at the beginning nor at the end of the study. Nonetheless, CRA group showed a significant decrease in energy and total protein intake (Table 1).

**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 players in CRA group decreased and they still had a significant increase in strength.

### Table 1. Strength and nutritional variables compared by group (CRB vs CRA) and by time (PRE vs POST)

<table>
<thead>
<tr>
<th>Strength</th>
<th>PRE CRB</th>
<th>POST CRB</th>
<th>p CRB by time</th>
<th>PRE CRA</th>
<th>POST CRA</th>
<th>p CRA by time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biceps</td>
<td>37 ±4</td>
<td>35 ±4</td>
<td>0.49</td>
<td>38 ±3</td>
<td>36 ±4</td>
<td>0.50</td>
</tr>
<tr>
<td>Back</td>
<td>99 ±19</td>
<td>93 ±14</td>
<td>0.55</td>
<td>97 ±18</td>
<td>102 ±13</td>
<td>0.58</td>
</tr>
<tr>
<td>Legs</td>
<td>85 ±16</td>
<td>85 ±12</td>
<td>0.88</td>
<td>104 ±17</td>
<td>100 ±7</td>
<td>0.60</td>
</tr>
<tr>
<td>Right forearms</td>
<td>43 ±8</td>
<td>44 ±6</td>
<td>0.86</td>
<td>43 ±6</td>
<td>42 ±6</td>
<td>0.80</td>
</tr>
<tr>
<td>Left forearms</td>
<td>42 ±7</td>
<td>40 ±7</td>
<td>0.73</td>
<td>41 ±6</td>
<td>39 ±6</td>
<td>0.31</td>
</tr>
<tr>
<td>Kcal</td>
<td>3312 ±1137</td>
<td>3541 ±783</td>
<td>0.65</td>
<td>2558 ±428</td>
<td>2793 ±813</td>
<td>0.51</td>
</tr>
<tr>
<td>CHO (g/day)</td>
<td>479 ±181</td>
<td>443 ±86</td>
<td>0.64</td>
<td>359 ±85</td>
<td>345 ±79</td>
<td>0.73</td>
</tr>
<tr>
<td>Protein (g/day)</td>
<td>94 ±41</td>
<td>123 ±60</td>
<td>0.65</td>
<td>64 ±19</td>
<td>95 ±64</td>
<td>0.86</td>
</tr>
<tr>
<td>Fat (g/day)</td>
<td>155 ±57</td>
<td>167 ±46</td>
<td>0.26</td>
<td>135 ±41</td>
<td>132 ±32</td>
<td>0.23</td>
</tr>
<tr>
<td>CH (g/kg/day)</td>
<td>7.1 ±3</td>
<td>5.6 ±2</td>
<td>0.69</td>
<td>5.4 ±5</td>
<td>5.0 ±1</td>
<td>0.68</td>
</tr>
<tr>
<td>Protein (g/kg/day)</td>
<td>1.4 ±1</td>
<td>1.9 ±1</td>
<td>0.79</td>
<td>0.9 ±0.3</td>
<td>1.4 ±1</td>
<td>0.94</td>
</tr>
<tr>
<td>Fat (g/kg/day)</td>
<td>2.3 ±1</td>
<td>2.5 ±1</td>
<td>0.33</td>
<td>2.0 ±0.5</td>
<td>1.9 ±1</td>
<td>0.56</td>
</tr>
</tbody>
</table>

**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. In the nutritional variables, there were no significant differences between groups at the beginning nor at the end of the study. Nonetheless, CRA group showed a significant decrease in energy and total protein intake (Table 1).

**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 players in CRA group decreased and they still had a significant increase in strength.
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 amateur endurance athletes reduce their time to complete a 10 km 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 tests 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 during the previous four days. After remaining seated for 10 minutes blood pressure and cardiac rhythm was measured. A 10ometer 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 stationary bicycle was performed, during which oxygen volume, cardiac rhythm and pedaling power was measured. Subjects were asked periodically at what level in the stationary bicycle was performed.

**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 (26.7-287.3) 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 Kms 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.

---

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 vasodilation. Also, given evidence for the detrimental effects of environmental hypoxia on exercise due to decreases in partial pressure of arterial oxygen (P\text{O}_2), as well as hypoxia-induced reductions in NO, increases in NO production via dietary nitrate supplementation may serve to enhance performance in hypoxia.

**PURPOSE:** To investigate the effects of 3 day supplementation of beetroot juice on oxygen consumption (VO\text{2}), arterial oxygen saturation (SpO\text{2}), and average workload (W) during 15 minute time trial (TT) in both normoxic and simulated hypoxic conditions (P\text{O}_2 = 15%)

**METHODS:** Ten recreationally active healthy males participated in the study. Subjects were assigned in a double-blind randomized, crossover design consuming 140 ml of beetroot juice (2 shots) containing ~8.4mmol of nitrate (N\text{O}_3) and nitrate depleted placebo (PL) for 2 days prior to testing and 2.5 hours prior to testing in both normoxic and hypoxic conditions. A 24 hour fast was utilized during the crossover. Prior to testing subjects completed a maximal effort protocol to determine Maximal Power Output (W_{max}). During testing, subjects completed a 5 minute warm-up, a 15 minute steady state normoxic preload at 50% W_{max} and finished with a 15 minute cycling time trial (TT) at 70% W_{max} in either normoxia or simulated hypoxia (P\text{O}_2=15\% O\text{2}).

**RESULTS:** No significant difference was found for BR vs PL group by condition in mean workload of 164.5±20.7 vs. 166.5±18.7 watts in normoxia and 162.6±13.9 vs. 161.0±22.1 watts in hypoxia, p=0.769. **CONCLUSION:** The present research found no significant differences in average workloads during a 15 minute cycling TT performed in either normoxia or moderate simulated hypoxia after chronic supplementation of beetroot juice (140 ml X 3 days) vs. placebo. A 3-day chronic dosing protocol of 8.4 mmol N\text{O}_3 per day in the form of BR may not be beneficial to athletes competing in cycling time trials of ~15 minutes in duration at either sea level, or following acute altitude exposure at ~2500m.

---

Nitric oxide (NO) plays a critical role in regulating blood flow to skeletal muscle. NO production in humans is 1) oxygen-dependent via NO-synthases that convert L-arginine-dependent NO and 2) oxygen-independent via the nitrate-nitrite-NO pathway. The latter can be augmented via beetroot juice supplementation (BR). **Purpose:** The purpose of this study was to investigate the effect of BR during vigorous intensity aerobic exercise.

**METHODS:** Using a double-blind, repeated measures crossover design, 11 Division III collegiate distance runners (mean ± SD: age = 20.3 ± 1 yr, VO\text{2peak} = 55.5 ± 8.1 ml·kg\text{-1}·min\text{-1}, consumption either 120 ml·day\text{-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 (VO\text{2R}) separated by 2 minutes each. BR and PL supplementation protocols were separated by a 7-day washout period. Two breaths repeated measures ANOVAs were used to determine the effect of treatment (BR or PL) and exercise intensity (65%, 85%, and 100% VO\text{2R}) on VO\text{2R}, 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 VO\text{2R}, HR, RER, or RPE. The main effect of treatment was not statistically significant for HR (F(1, 10) = 0.531, p = 0.490; RER, F(1, 9) = 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 VO\text{2R}, where BR (2.43±0.18 L·min\text{-1}) was lower compared to placebo (2.31±0.17 L·min\text{-1}). **CONCLUSION:** The present research found no significant differences in average workloads during a 15 minute cycling TT performed in either normoxia or moderate simulated hypoxia after chronic supplementation of beetroot juice (140 ml X 3 days) vs. placebo. A 3-day chronic dosing protocol of 8.4 mmol N\text{O}_3 per day in the form of BR may not be beneficial to athletes competing in cycling time trials of ~15 minutes in duration at either sea level, or following acute altitude exposure at ~2500m.

---

**Effect of Inorganic Nitrate Supplementation on Q, Uptake And Quadriceps Deoxygenation During The Onset And Offset Of Exercise.**

Brymnor Breeze\textsuperscript{1}, David Poole, FACSM\textsuperscript{3}, Dai Okushima\textsuperscript{1}, Stephen Bailey\textsuperscript{2}, Andrew Jones, FACSM\textsuperscript{3}, Narihiko Kondo\textsuperscript{1}, Tatsuro Amano\textsuperscript{1}, Shinzaku Koga\textsuperscript{2}, \textsuperscript{1}Plymouth University, \textsuperscript{2}Plymouth, United Kingdom, \textsuperscript{3}Kansas State University, \textsuperscript{4}Manhattan, KS. Kobe Design University, Kobe, Japan. \textsuperscript{5}Loughborough University, Loughborough, United Kingdom. \textsuperscript{6}Exeter University, Exeter, United Kingdom. \textsuperscript{7}Kobe University, Kobe, Japan. \textsuperscript{8}Niigata University, Niigata, Japan.

**PURPOSE:** To investigate the effect of inorganic nitrate (N\text{O}_3) supplementation on Q, uptake (V\text{O}_2) and deoxygenation detected through multimodal (N\text{Hb}+Mb) 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 V\text{O}_2 over 4-day supplementation periods with N\text{O}_3-rich beetroot juice (BR; providing 8.4 mmol N\text{O}_3·day\text{-1}) and N\text{O}_3-depleted placebo (PL). beetroot juice. Pulmonary V\text{O}_2 was measured and absolute deoxy-[Hb + Mb] was determined in the superficial and deep vastus lateralis (i.e. VL-s and VL-d, respectively).

**RESULTS:** Whereas primary V\text{O}_2 kinetics (i.e. on versus off) were symmetrical, the primary deoxy-[Hb + Mb] mean response time (MRT\text{O}) 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 PL and BR trials in the deoxy-[Hb + Mb] MRT\text{O} within the VLs 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 ± 34 vs. BR: 16 ± 20 μM) or offset (PLA: 37 ± 44 vs. BR: 31 ± 20 μM).

**CONCLUSIONS:** Dietary N\text{O}_3 supplementation does not affect the dynamic asymmetry of muscle deoxygen (Hb+Mb) kinetics (and by extension the matching between O\text{2} delivery to O\text{2} utilization) within deep and superficial sites during intense submaximal exercise.
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. 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.

**Purpose:** To determine the response of an acute dietary nitrate supplement in LVEw via noninvasive pulse wave analysis (PWA).

**Methods:** A double-blind, crossover 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 fraction, Ps and Pi represent central systolic pressure and the central incident pressure from reflecting pressure wave, respectively, and ΔTp is the round trip travel time of the reflecting pressure wave. PWA was measured noninvasively with a cuff-based PWA device (Sphygmocor Xcel®). A two-way repeated measurements ANOVA (time x sex) was performed and significance was set at α=0.05.

**Results:** LVEw ranged from 736 ± 64 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 supplement 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.

**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 old, participated 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 (800mg 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 no significant difference in NOx concentration following nitrate supplementation. However, this acute increase in NOx bioavailability did not result in acute benefits to arterial stiffness or endothelial function measured via PWV and FMD respectively.

**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.

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 µM; Active: 176±74 vs. 171±59 µM, p=0.84) or in RMR (Placebo: 1839±308 vs. 1790±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.
The increase in prevalence of super foods, such as beet root, in popular culture has necessitated research into their effectiveness. Betalains, a prominent phytonutrient 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 muscle repair and recovery. As such, betalains hold the potential to provide improvement in recovery from exercise induced muscle damage.

**Conclusion:**
This evidence suggests that BRJ has the potential to provide improvement in recovering from exercise induced muscle damage.

---

**Nitrates and Nitrites:**

**Purposes:**
- To determine if beet root concentrate and beet juice supplements contain adequate amounts of nitrate and nitrite.
- To determine if beet root concentrate and beet juice supplements reduce the rate of glycogen use during exercise.
- To determine if beet root concentrate and beet juice supplements improve exercise performance.

**Methods:**
- Analysis of beet root concentrate and beet juice samples using HPLC to measure nitrate and nitrite concentrations.
- Participants performed aerobic exercise to exhaustion on a cycle ergometer.
- Heart rate, blood lactate, and muscle glycogen concentrations were measured before and after exercise.

**Results:**
- Beet root concentrate and beet juice supplements were found to contain adequate amounts of nitrate and nitrite.
- Exercise performance was improved with the consumption of beet root concentrate and beet juice supplements.
- Muscle glycogen concentrations were increased with the consumption of beet root concentrate and beet juice supplements.

**Conclusion:**
Beet root concentrate and beet juice supplements have the potential to improve exercise performance and muscle recovery.

---

**Nitric Oxide:**

**Purposes:**
- To determine the effect of beet root concentrate and beet juice supplements on nitric oxide production.
- To determine the effect of beet root concentrate and beet juice supplements on exercise performance.

**Methods:**
- Analysis of beet root concentrate and beet juice samples using HPLC to measure nitric oxide concentrations.
- Participants performed aerobic exercise to exhaustion on a cycle ergometer.

**Results:**
- Nitric oxide production was increased with the consumption of beet root concentrate and beet juice supplements.
- Exercise performance was improved with the consumption of beet root concentrate and beet juice supplements.

**Conclusion:**
Beet root concentrate and beet juice supplements have the potential to improve nitric oxide production and exercise performance.

---

**Nitrate Supplementation:**

**Purposes:**
- To determine the effect of nitrate supplementation on exercise performance.
- To determine the effect of nitrate supplementation on muscle recovery.

**Methods:**
- Analysis of beet root concentrate and beet juice samples using HPLC to measure nitrate and nitrite concentrations.
- Participants performed aerobic exercise to exhaustion on a cycle ergometer.

**Results:**
- Nitrate supplementation was found to improve exercise performance and muscle recovery.

**Conclusion:**
Nitrate supplementation has the potential to improve exercise performance and muscle recovery.

---

**Nitrate and Nitrite Concentrations:**

**Purposes:**
- To determine the nitrate and nitrite concentrations in beet root concentrate and beet juice samples.
- To determine the effect of beet root concentrate and beet juice supplements on exercise performance.

**Methods:**
- Analysis of beet root concentrate and beet juice samples using HPLC to measure nitrate and nitrite concentrations.
- Participants performed aerobic exercise to exhaustion on a cycle ergometer.

**Results:**
- Nitrate and nitrite concentrations were found to be within the recommended serving sizes.
- Exercise performance was improved with the consumption of beet root concentrate and beet juice supplements.

**Conclusion:**
Beet root concentrate and beet juice products have the potential to improve exercise performance when consumed within the recommended serving sizes.

---

**Nitrate Metabolism:**

**Purposes:**
- To determine the effect of nitrate supplementation on nitric oxide production.
- To determine the effect of nitrate supplementation on exercise performance.

**Methods:**
- Analysis of beet root concentrate and beet juice samples using HPLC to measure nitrate and nitrite concentrations.
- Participants performed aerobic exercise to exhaustion on a cycle ergometer.

**Results:**
- Nitrate supplementation was found to increase nitric oxide production and improve exercise performance.

**Conclusion:**
Nitrate supplementation has the potential to improve exercise performance through increased nitric oxide production.
greater variability between products, with nearly a 20-fold range in nitrate content between the lowest (1.0±0.6 mmol/serving) and highest (17.9±0.8 mmol/serving). The amount of nitrate in all products was very low (i.e., <0.5 mmol/serving), except for one that contained 10.2±1.1%. Over half of the products contained less nitrate (or nitrite) per serving than appears necessary to enhance exercise capacity in most individuals. Interestingly, among bulk juices there was no difference between certified organic and non-organic products in terms of nitrate content (i.e., 2.3±6.0 vs. 8.4±3.4 mmol/serving). CONCLUSIONS: The present results may be useful to coaches contemplating which (if any) beet juice product to utilize. These data may also offer some insight into variability in the literature with the respect to the effects of beet juice on exercise performance.

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 hypoxia and increased ventilation are believed to be two of the major contributors. METHODS: Forty participants with moderate to severe COPD (85%±9% FEV1) were recruited and stratified by BMI (38% overweight/obese). During a 2-hour protocol, participants performed 2 submaximal exercise tests (50% and 75% of predicted VO2pmax). During exercise, participants breathed through a face mask and expired into a respiration chamber while VO2 and CO2 were measured breath-by-breath and blood lactate, pH, bicarbonate and bicarbonate buffering capacity were measured every 2 minutes. As exercise tolerance is dependent largely on buffering capacity, we examined the relationship between buffering capacity and exercise tolerance. 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: 17.4 ± 0.4 mmol•L−1) than RES1 (AUC: 874.0; peak: 16.4 ± 0.4 mmol•L−1). There was no significant difference between the other treatments (RES1-RES2 < 8% vs. RES2-RES3 < 9%). There was a significant main effect of treatment on side-effects, with higher incidence in RES3 and GEL3 than RES1, GEL1 and PLA, with PLA showing a double-blind performance with the highest incidence of side-effects. CONCLUSIONS: The current study suggests that the use of sodium bicarbonate during exercise may be a promising treatment for improving exercise tolerance and quality of life.

Oral sodium bicarbonate has been used for decades as an ergogenic aid by buffering muscle acid production during exercise and subsequently delaying the onset of fatigue 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 effective in improving muscle buffering during exercise and subsequent performance improvements. METHODS: 20 trained cyclists (Category 1-3) and a professional triathlete participated in this randomized, cross-over, double-blinded, placebo-controlled study. After application of TSB or placebo lotions, subjects completed a variety of exercise and performance tests. On one day subjects completed a high-intensity series of exercise tests which included a 10-minute steady-state protocol until reaching a rating of perceived exertion (RPE) of 17 out of 20, a 30-second sprint performance test, and a 5-minute
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) but lower the following 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.

Sodium bicarbonate/alkalinization may reduce muscle mitochondrial damage caused by reactive oxygen species during intense exercise. Such damage can induce post-exercise inflammation and pain, which may be linked to delayed onset muscle soreness, or DOMS. However gastrointestinal side effects limit the use of oral 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 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-s sprint performance test, and a 5-min time trial with 5 minutes of recovery between tests. On a separate day subjects completed a 1-hr 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-hr 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.
Two additional pieces of Military Energy Gum for 5 min. Following the second pieces of Military Energy Gum [caffeine (CAFF) or placebo (PLA)] were administered in the fasted state between 0600 and 1200 hours. Subjects consumed a light breakfast two visits (experimental testing) subjects arrived at the Exercise Science Laboratory sessions. During the first visit, performance.

PURPOSE: To compare the effects of caffeine supplementation in subjects who self-report low (LOWCS) vs. moderate/high (MHCS) sensitivity to caffeine.

A comprehensive meta-analysis reported caffeine ingestion (CI) produces greater treatment effects were similar between the morning and afternoon trials, with no significant improvement (∆=7.17%) in free throw performance following exhaustive exercise may exacerbate cardiovascular drift. PURPOSE: The purpose of this study was to compare the effects of coffee and a commercially available pre-workout drink on cardiovascular drift during prolonged moderate intensity walking. METHODS: Eight healthy, recreationally active males consumed coffee (containing 120 mg caffeine), decaffeinated coffee, a pre-workout drink (containing 120 mg caffeine), or a placebo in a randomly assigned cross over design one hour before walking for 40 minutes on a treadmill at a workload that corresponded to 50% of their VO_{max}.

RESULTS: Heart rate gradually increased (P<0.05) from 123.2 ± 5.5 beats/min at 10 minutes to 132.8 ± 8.6 beats/min for all treatments, but there was no main effect of treatment or interaction effect of treatment X time on heart rate. Respiratory exchange ratio (RER) gradually decreased (P<0.05) from 0.76 ± 0.02 at 10 minutes to 0.73 ± 0.04 for all treatments, but there was no main effect of treatment or interaction effect of treatment X time on RER. Similarly, there was no main effect of treatment or interaction effect of treatment X time on oxygen consumption. CONCLUSIONS: The gradual increase in heart rate in the present study demonstrates cardiovascular drift during 40 minutes of walking at 50% VO_{max}, with no changes due to consuming coffee or a pre-workout drink 1 hour prior to exercise. Furthermore, the ingestion of coffee or a pre-workout drink 1 hour prior to exercise did not alter the RER indicating no effects on fat or carbohydrate use. The lack of difference in oxygen consumption indicates that ingesting coffee or a pre-workout drink 1 hour prior to exercise does not alter energy expenditure. Overall, the lack of effects of coffee or a pre-workout drink in the present investigation suggests that the caffeine dose does not present additional challenges to cardiovascular function, the caffeine dose does not influence exercise performance during 40 minutes of walking at 50% VO_{max}.

A comprehensive meta-analysis reported caffeine ingestion (CI) produces greater maximal voluntary contraction (MVC) force in lower body (LB) versus upper body (UB) musculature (Warren et al., Med. Sci. Sports Exerc. 42:1375-1387, 2010). However, research is lacking on direct comparisons between UB versus LB force generations. To compare the effects of caffeine supplementation in subjects who self-report low (LOWCS) vs. moderate/high (MHCS) sensitivity to caffeine during isokinetic and isometric muscle actions for the forearm flexor (FORE) and knee extensor (KNEE) muscles. METHODS: Sixteen recreationally trained males volunteered to participate in the study (M±SD, age=20.6±1.0 yrs; body mass = 73.2±5.8 kg; height = 172.8±6.0 cm; mass=83.5±11.48 kg, body fat=10.6±3.7%). Subjects were randomly assigned to either CAFF (5 mg•kg^{-1}) or placebo (NOCAF) treatments using a double-blind design with at least 48 h between testing sessions. Testing was conducted using a HUMAC NORM for both KNEE and FORE at 60°·sec^{-1} and two-6 sec isometric muscle actions. Testing began immediately after 45 min of either CAFF or NOCAF treatments. RESULTS: Statistical analysis indicated for isokinetic strength, there was a greater response for KNEE (CAF=213.84 ± 25.38 Nm; NOCAF 201.47 ± 24.07 Nm) compared to NOCAF (140.39 ± 29.7 Nm) collapsed across upper/lower body and group. CONCLUSION: Our data indicates caffeine (5 mg•kg^{-1}) increases peak force, and two-6 sec isometric muscle actions. Resistance training may be beneficial to habitual caffeine consumption. This suggests that ingestion of moderate doses of caffeine 45 min prior to sports and physical activity performance may enhance muscle strength independent of habitual caffeine use.

A randomly counterbalanced, double blind design was implemented to examine the efficacy of the CMR (versus PL) in the morning and the 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 ± 41 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 the 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.

Caffeine is a widely used stimulant that is often consumed in coffee. Caffeine is also the main ingredient in many “pre-workout” drinks, which are purported to enhance exercise performance. Due to the stimulatory effects of caffeine on the heart and the potential diuretic effects of caffeine, drinking coffee or a pre-workout drink before exercise may exacerbate cardiovascular drift. PURPOSE: The purpose of this study was to compare the effects of coffee and a commercially available pre-workout drink on cardiovascular drift during prolonged moderate intensity walking. METHODS: Eight healthy, recreationally active males consumed coffee (containing 120 mg caffeine), decaffeinated coffee, a pre-workout drink (containing 120 mg caffeine), or a placebo in a randomly assigned cross over design one hour before walking for 40 minutes on a treadmill at a workload that corresponded to 50% of their VO_{max}.

RESULTS: Heart rate gradually increased (P<0.05) from 123.2 ± 5.5 beats/min at 10 minutes to 132.8 ± 8.6 beats/min for all treatments, but there was no main effect of treatment or interaction effect of treatment X time on heart rate. Respiratory exchange ratio (RER) gradually decreased (P<0.05) from 0.76 ± 0.02 at 10 minutes to 0.73 ± 0.04 for all treatments, but there was no main effect of treatment or interaction effect of treatment X time on RER. Similarly, there was no main effect of treatment or interaction effect of treatment X time on oxygen consumption. CONCLUSIONS: The gradual increase in heart rate in the present study demonstrates cardiovascular drift during 40 minutes of walking at 50% VO_{max}, with no changes due to consuming coffee or a pre-workout drink 1 hour prior to exercise. Furthermore, the ingestion of coffee or a pre-workout drink 1 hour prior to exercise did not alter the RER indicating no effects on fat or carbohydrate use. The lack of difference in oxygen consumption indicates that ingesting coffee or a pre-workout drink 1 hour prior to exercise does not alter energy expenditure. Overall, the lack of effects of coffee or a pre-workout drink in the present investigation suggests that the caffeine dose does not present additional challenges to cardiovascular function, the caffeine dose does not influence exercise performance during 40 minutes of walking at 50% VO_{max}.

A randomly counterbalanced, double blind design was implemented to examine the efficacy of the CMR (versus PL) in the morning and the 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 ± 41 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 the 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.
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 Klsiszewicz. 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 either 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-recovery), 40-45-min post recovery (Post-recovery). 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-recovery to Post-recovery (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. The use of energy drinks among athletes has risen greatly. Reviews of energy drink related health complications have highlighted adverse cardiovascular events. It is known that menstrual status and oral contraceptive (OCS) use affects caffeine metabolism, but it is not clear whether these factors modulate the ergogenic effects of caffeine. 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 160 mg caffeine capsule one hour prior to each trial. Subjects were divided into 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 ± 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 Sackett1, Ahmed El-Sohemy2, Christopher J. Womack, FACSM1, 2Ball State University, Muncie, IN; University of Toronto, Toronto, ON, Canada; 1James 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 yrs; 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; PL = 32.2 ± 7.7 ml/kg/min), VO2 as a % of VO2max (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= 0.99 ± 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 VO2max (AA group 62.5 ± 6.6%, C allele = 67.2 ± 9.6% p=0.10, etai=0.17) and workload (AA group 196.4 ± 37.7, C allele = 214.1 ± 40.0 Watts, p=0.10, etai=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.
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) following heavy exercise impaired 3-km cycling performance the next morning. Because caffeine can mitigate fatigue and enhance physical and cognitive function, caffeine is a logical candidate to offset the negative impact of sleep restriction on next-day performance.

**PURPOSE:** The primary aim of this project was to determine the effects benefit of caffeine supplementation for exercise performance following one night of SR in trained cyclists. METHODS: Ten (8 male; 2 female) cyclists (age, 21 ± 3 yrs; VO2max, 61 ± 8 ml/kg/min) completed four experimental phases. Each phase consisted of an evening of heavy exercise (EX1: 3-km cycling trial followed by 60 min of high intensity cycling intervals) followed by a morning session (EX2) to evaluate perceived fatigue and 3-km time trial (EX2) to evaluate core body temperature before, during, or after exercise. Interestingly, caffeine consumption did elicit a diminished HR recovery within the first 5 min of recovery, potentially indicating a greater degree of heat stress in the caffeine group. CONCLUSION: Based upon this evidence, caffeine consumption does not impair normal thermoregulatory patterns during exercise in a hot, humid environment.
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 potent systemic stress marker, is regulated by the hypothalamic corticotropin-releasing hormone (CRH) through the CRH type 1 receptor (CRH1R), 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 (CRH1R 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, 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-affirming treatment differentially affect muscle strength in transmen vs. transwomen.

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 myocyte 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, adipoyce, 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.

The Wnt signaling pathway, an important regulator of skeletal development, is inhibited by several glycoproteins including sclerostin and Dickkopf-1 (DKK-1). Animal studies have reported Wnt 7b plays an important role in skeletal muscle growth and improving strength. However, to date, no studies have examined relationships between circulating levels of sclerostin and DKK-1 and muscle function in humans.

Purpose: This study investigated the relationship between sclerostin and DKK-1 with jump and strength variables in young (20–30 yrs, n=25) and middle-aged (35–45 yrs, n=25) women. Further, the effects of age group and physical activity level on muscle function variables were evaluated. Physical activity levels were based on the International Physical Activity Questionnaire.

Methods: Serum sclerostin and DKK-1 levels were measured in fasting morning blood samples by ELISA. Lower body strength and power were assessed by a two-leg press maximal strength test (1RM) and a vertical jump test (Just Jump Mat, Tendo Sports Machine), respectively.

Results: Two-way ANOVA showed a significant age group effect for JH, relative jump power (RJP), and 1RM (p<0.05), which were higher in young women (Table 1).

There were no significant differences in muscle performance variables based on physical activity levels. Jump height (JH) was negatively correlated (r = −0.27, p<0.05) with sclerostin levels.

Conclusion: Lower muscle strength and jump height in middle-age women supports an age-related decrease in muscle function. Generally, sclerostin and DKK-1 were not related to muscle performance variables.

Table 1. Muscle Function Variables based on Age Group and Physical Activity Levels

<table>
<thead>
<tr>
<th>Variable</th>
<th>Young (n=25)</th>
<th>Middle-aged (n=25)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>JH (cm)</td>
<td>11.5±2.3</td>
<td>8.7±1.9</td>
<td>0.001</td>
</tr>
<tr>
<td>RJP (kJ)</td>
<td>3.2±0.8</td>
<td>2.1±0.6</td>
<td>0.001</td>
</tr>
<tr>
<td>1RM (kg)</td>
<td>10.5±2.5</td>
<td>7.2±1.8</td>
<td>0.001</td>
</tr>
</tbody>
</table>

**CONCLUSIONS**: There were significant (p<0.05) group x time interactions at each angular velocity. Thus, while the transmen increased their strength over the four time points, strength levels were generally maintained in the transwomen. When averaging the three strength tests, knee extension (16%) and knee flexion (34%) strength increased from T1 to T4 in transmen. The corresponding changes in the transwomen group were -6% and 0%, respectively.
### Table: Ankle Dorsiflexion Range Of Motion Screen

<table>
<thead>
<tr>
<th>Variables</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>
</tr>
</thead>
<tbody>
<tr>
<td>JH (inches)</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>
</tr>
<tr>
<td>Velocity (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>
</tr>
<tr>
<td>Jump Power (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>
</tr>
<tr>
<td>RJP (watts/kg)</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>
</tr>
<tr>
<td>IRM (kg)*</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.

**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, 68.8 ± 7.3 kg, 27.3 ± 4.0% body fat, and trained women (TW) (N= 12), 25 ± 3.4 yr, 68.3 ± 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 (N= 12), 25 ± 3.4 yr, 168 ± 7.3 cm, 69.8 ± 6.3 kg, 19.3 ± 2.7% body fat gave informed consent. They were tested for 1 repetition maximum strength (1 RM) in the squat and were familiarized with the squat 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 tail tendon in vivo bioassay. 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. BGH showed an increase in response to training in both groups, with TW having significantly higher pre-exercise and post-exercise BGH (3900 ± 233 to 4100 ± 323 µg/L-1) than UT women (2500 ± 333 to 2100 ± 223 µg/L-1). BGH was significantly higher than IGH assays at all time points.

**CONCLUSIONS:** Resistance training impacts both the BGH and IGH secretion patterns from the anterior pituitary gland. IGH is acutely increased in response to acute resistance training, while BGH is significantly higher than IGH assays at all time points. BGH did not increase pre to post exercise in either group, and TW had significantly higher pre-exercise and post-exercise BGH (3900 ± 233 to 4100 ± 323 µg/L-1) than UT women (2500 ± 333 to 2100 ± 223 µg/L-1). BGH was significantly higher than IGH assays at all time points.

**Purpose:** Limited 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 before 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 behind 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 deficiencies.
Compensating instable 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 leg press 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±5yrs, height: 180±8cm, weight: 80±9kg, physical activity: 6.5±5wk) 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 (ECC) 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\text{p}, 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% (ECC) significantly (p<0.001), RMS of PL in CON and TA in CON and ECC 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 stance was collected pretreatment, post treatment, at a 48-hour follow up, and at a one week follow up. **Results:** Significant effect was found for WBLT Distance (F(2,21) = 54.8, p < .001), WBLT Angle (F(2,21) = 77.5, p < .001) Y-Balance Composite (F(2,11) = 6.1, p < .004), and WBT PSFS (F(2,11) = 12.9, p < .004). **Conclusions:** The results support the use of both the Mulligan Concept techniques to increase ankle dorsiflexion ROM. The immediate increases in ankle dorsiflexion ROM were maintained at one week follow-up.

Early sport specialization is a growing concern because it may lead to repetitive stress and excessive joint loading. Current data indicate that early specialization leads to injury, but its role in producing underlying tissue changes has not been examined. **PURPOSE:** To determine effects of sport specialization on upper extremity tissue characteristics. **METHODS:** Seventy-five collegiate baseball, softball, and tennis players (36 male, 39 female; age = 19.8 ± 1.4 years, height = 175.3 ± 10.4 cm; weight = 76.0 ± 13.9 kg) participated. Subjects completed surveys and were grouped based on age when they chose a primary sport and started competing for more than 8 months/year. Shoulder range of motion was measured with an inclinometer. Posterior capsule thickness, humeral retrotorsion, 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\text{sq} = .08, p = .23; External: R\text{sq} = .07, p = .26). No group differences were noted for posterior capsule thickness (R\text{sq} = .07, p = .28), humeral retrotorsion (R\text{sq} = .16, p = .07), or UCL thickness (R\text{sq} = .11, p = .09). Mean humeral retrotorsion (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 using 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 trochea. Moreover, post-imaging measurements were performed from the apex of the ulna to evaluate MJS. Changes to UCL thickness (mid-substance and apex of the trochea) and MJS were analyzed using paired samples t-tests.

RESULTS: There was no significant difference in mid-substance UCL thickness width before (5.72 ± 0.7mm) and after performance (5.70 ± 0.7 mm; t(9) = -0.36, p = .73). With respect to apex of trochea UCL width, no significant differences were found before (2.67 ± 0.7 mm) and after (2.61 ± 0.6 mm; p = .20). When assessing MJS, a significant change of ~4% was observed before (6.30 ± 1.5 mm) and after (6.06 ± 1.5; p<0.05). Controlling for the imnings pitch [F (1,7) = 1.10, p = .77] and pitch count [F (1,7) = 21, p = .66] did not affect the change in MJS.

CONCLUSIONS: A significant MJS widening occurred 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.

### Table - 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>
</tr>
</thead>
<tbody>
<tr>
<td>25-hydroxy-Vitamin D (ng/ml), mean±SD</td>
<td>26.2±9.2 ng/ml</td>
<td>26.5±12.4 ng/ml</td>
<td>0.7966</td>
</tr>
<tr>
<td>Hemoglobin A1c (Abnormal), mean±SD</td>
<td>6.5±1.1 %</td>
<td>7.5±1.7 %</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>ESR ≥20 mm/hr (n%), mean±SD</td>
<td>63(40%)</td>
<td>684 (53%)</td>
<td>0.0021</td>
</tr>
<tr>
<td>CRP ≥6 mg/L (n%)</td>
<td>61 (36%)</td>
<td>747 (47%)</td>
<td>0.006</td>
</tr>
<tr>
<td>Hbg (Abnormal)</td>
<td>138 (32%)</td>
<td>3854 (48%)</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

 Baseball athletes, especially pitchers, are prone to ulnar collateral ligament (UCL) injuries of the elbow. It is well documented that baseball athletes typically exhibit an increase in shoulder external rotation range of motion (ERRM) and a decrease in internal rotation range of motion (IRM) while maintaining total rotational range of motion (TROM) in the throwing extremity. Furthermore, loss of TROM and ERRM may be associated with increased risk for UCL injury. Ultrasound imaging allows clinicians to evaluate UCL thickness and medial joint space (MJS) opening non-invasively.

**PURPOSE:** To examine if shoulder joint motion (ERRM, IRRM, TROM), predicts medial elbow joint space (MJS) opening and UCL thickness in asymptomatic collegiate baseball pitchers at the start of the pre-season.

**METHODS:** Nineteen asymptomatic NCAA Division I collegiate baseball pitchers (age 20.4 ± 1.45 yrs) participated in this study. Ultrasound images were obtained of the medial joint space and UCL on the participant’s throwing arm using a GE LOGIQ e ultrasound unit. Participants were placed supine with a wedge placed underneath their pitching hand to maintain elbow position at 30 degrees. A 3 kg valgus force, as measured by a hand held dynamometer, was applied 20 cm distal to the medial epicondyle. Ligament thickness measurements were performed at the mid-substance of UCL and at the apex of the trochea. Imaging measurements to evaluate MJS opening were performed from the apex of the trochea to the apex of the ulna. Standard goniometric procedures were performed with the athlete supine to obtain ERRM, IRRM, and TROM values. Three stepwise linear multiple regression analyses were performed to determine if shoulder joint motion could predict UCL thickness and MJS.

**RESULTS:** Shoulder joint range of motion did not significantly predict MJS (R² = 0.05, F (2,16) = 0.44, p=0.65), UCL thickness at the mid-substance (R² = 0.01, F (2,16) = 0.12, p=0.89), or UCL thickness at the apex of the trochea (R² = 0.30, F (2,16) = 0.36, p=0.76).

**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 sensors to develop this 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 < 0.01). 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.

PURPOSE: 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 preformed 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=0.95) were all acceptable.

CONCLUSION: The single leg hurdle test shows excellent within and between days 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.

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 unilaterial ACLR (Wk0). Testing included the ACL-Retum to Sport After 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 maintained over the retention 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 jumping training that focuses on correcting aberrant landing movements is effective at addressing psychological factors in athletes who self-identified 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 sports participation because of limited confidence or high fear of reinjury. Funded in part by the Foundation for Physical Therapy.

Purpose: 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 reliably 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, 165.3 (7.62) cm, 59.8 (8.6) kg, participated in this study. Prior to the start of the season, the anterior, posteromedial, and posterolateral 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 unlimbed (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 (NLD) of healthy controls during common RTS tests. METHODS: 11 ACL (9 females, 2 males, 22±4.3 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 and 300 deg/sec (Biokin System 4 Dynamometer MVP). 3 Acceptable trials for each test and limb were recorded. The limb symmetry index (LSI) calculated 100(AL/UAL) and 100(DL/NLD) for ACLR and control groups respectively and was compared between groups using MANOVA (p<.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 significant differences between ACLR and control LSI scores were observed (F=1.691, p=0.293, n=0.844, Power=0.289). A clinically significant difference was observed in peak flexion torque at 120deg/s (118.7±55.3%) for controls. There were no clinically significant differences for the ACLR group (94.8±88.6% - 113.4±59.9%). Primarily small correlations were shown between AL and UAL tests. CONCLUSION: 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.

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 established half kneeling dorsiflexion test (HDT). It is proposed that there will be a relationship between MWLT dorsiflexion ordinal scoring and the HDT. 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.

CONCLUSIONS: 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 (ACL-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 (range: 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 (range: 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>.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.

Purpose: The Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST) in DIII collegiate baseball and softball players was studied as an alternative to the push-up test to examine upper extremity stability and function. However, no studies have investigated its use in division III collegiate baseball (BB) and softball (SB) players. The purpose of this study was to describe the normative values, power and normalized scores for the CKCUEST for this population.

Methods: Seventy-four division III collegiate athletes (SB n=24; BB n=50) between 18-21 years old signed an approved informed consent. Participants assumed a push-up (male) or a modified push-up (female) position and were instructed to alternately touch two pieces of tape placed on the ground 36 inches apart as many times as possible for 15 seconds. After one maximal warm-up, the average number of limbs touched (CKCUEST value) from three trials was calculated. Power and a normalized score were calculated based on the CKCUEST value and the participant’s weight or height, respectively. Additionally, shoulder strength was measured bilaterally for internal and external rotation using a handheld dynamometer in the standard testing position.

Results: There was a significant difference (p<.001) between the power of BB (71.3±14.4) and SB (53.3±11.6) players. However, there was no significant difference between the two groups in the CKCUEST value or the normalized score. There were small and nonsignificant correlations between the CKCUEST and shoulder internal (IR) or external rotation (ER) strength.

Conclusions: This study reported the normative values for the CKCUEST for division III SB and BB players with representation from all positions. The significant differences in power between BB and SB players may be linked to sex, training regimens and/or the physical requirements of each sport. The small correlation of shoulder IR and ER strength and the CKCUEST value may be related to the rotator cuff's primary stabilization function, which may not influence the CKCUEST value as much as the strength of the prime movers of the shoulder during the motion prescribed by the test. Strength of the pectoralis major and deltoid may better correlate with the values of the CKCUEST for this population and should be considered in future research.
Asymmetry Of Knee Extension Strength And Single-leg Landing Impact In ACL-reconstructed Athletes
Junya Aizawa, Kenji Hirohata, Shunsuke Ohji, Takehiro Omhi, Kazuyoshi Yagishita. Tokyo Medical and Dental University, Tokyo, Japan.

(Please note: No relevant relationships reported)

PURPOSE: Excessive magnitude, speed, and asymmetry of single-leg landing impacts contribute to re-injury risk in athletes after ACL reconstruction (ACLR). The limb symmetry index (LSI) of knee strength tends to decrease after ACLR even after return to sport. We analyzed relationships between the asymmetry of vertical ground reaction force (VGRF) parameters during single-leg jump landings and the knee isokinetic extension strength in athletes after ACLR. METHODS: Twenty-six double-bundle ACLR using a hamstring tendon autograft; completed athletic rehabilitation within the same protocol; and agreement to participate in single-leg hop exercise and basic noncontact practice of jump-landings and cutting sports. The isokinetic strength of the quadriceps was tested at an angle of 60°/sec. Participants were subdivided into groups according to LSI for quadriceps strength (low quadriceps [LQ], <85% LSI; N10; high quadriceps [HQ], >90% LSI; N12). A 20-cm step was placed 60 cm from the center of a force plate. The participants stood on one leg on the step with their arms crossed, then jumped forward without any intended upward action and landed as naturally as possible on the same leg in the center of the force plate. The VGRF was collected at a sampling rate of 1000 Hz, filtered using a low-pass Butterworth filter with a cut-off frequency of 50 Hz, and normalized by body weight. Loading rate was calculated as peak VGRF (pVGRF) divided by the time from initial contact to pVGRF. The LSI of pVGRF and loading rate were compared using non-parametric tests. RESULTS: The quadriceps strength LSI of the LQ and HQ groups were 76±6.7% and 96.5±7.2%, respectively. The pVGRF LSI of HQ were 104±0.1% and 98.0±8.7%, respectively. Loading rate LSI were 115.9±23.6% and 98.8±21.7%, respectively. Loading rate LSI of HQ was significantly larger than HQ (p<0.041). The pVGRF LSI of HQ tended to be larger than HQ (p=0.074). CONCLUSIONS: Smaller asymmetry in knee extension strength and loading rate is important for symmetrical landing impact during single-leg anterior jump-landings performed by athletes after ACLR. Supported by JSPS KAKENHI Grant number 26350606.

Relations Between Return to Play Unilateral Knee Extension Strength and Triple-Hop Tests
Lauren E. McIntosh1, Alexander J. Hron2, Benjamin C. Noonan2, Colin W. Bond2. 1North Dakota State University, Fargo, ND. 2Sanford Health, Fargo, ND.

(Please note: No relevant relationships reported)

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 relation between unilateral isokinetic knee extension (KE) strength and triple hop distance in post-operative ACLR reconstruction patients at the time of return to sport [RTS]). METHODS: Thirty patients (15 male; 18 ± 6 y; 1.75 ± 0.13 m; 76 ± 19 kg) were assessed for unilateral isokinetic KE strength at 180°/s and triple hop distance. Peak KE strength on the involved leg (IL) and uninjured leg (UIL) (U1L) were averaged to obtain an overall strength value and strength asymmetry values (low strength low asymmetry, low strength high asymmetry, high strength low asymmetry, and high strength high asymmetry). Pearson correlations were used to determine the relation between KE strength and triple hop distance. One-way analysis of variance was used to assess the effect of group on triple hop distance on IL and UIL. RESULTS: For all patients, the mean IL and UIL KE strength were 1.52 ± 0.59 Nm·kg⁻¹ and 1.68 ± 0.61 Nm·kg⁻¹, respectively, and the median KE strength asymmetry was 13.2%. The mean IL and UIL triple hop distance was 4.27 ± 1.09 m and 4.26 ± 1.27 m, respectively. No significant correlations were identified between IL KE strength and triple hop distance (r = 0.14, p > 0.05), but were identified for IL KE strength and triple hop distance (r = 0.40, p = 0.03). No significant effect of group for IL was identified (p > 0.05) but was identified for UIL (p = 0.03), though individual comparisons were not significant (p > 0.05). Among all groups, triple hop distance was not significantly different between IL and UIL (p > 0.05). CONCLUSION: The low explained variance between KE strength and triple hop distance suggests these tests should not be used in isolation during RTS testing. Additional parameters may have demonstrated similar triple hop distance because demand may be shifted to proximal or distal joints during unilateral hopping, which masks unilateral KE strength deficits and results in symmetrical unilateral failure.

Knee Extensor Strength In The Ununjured Leg: Following Anterior Cruciate Ligament Reconstruction: A Meta-analysis
Christopher M. Jeanfreau, Katherine A. Hamblin, Gordon L. Warren, FACSM, Sharon L. Leslie, Liang-Ching Tsai. Georgia State University, Atlanta, GA. (Sponsor: Gordon L. Warren, FACSM)

(Please note: No relevant relationships reported)

PURPOSE: After anterior cruciate ligament reconstruction (ACLR), the uninjured leg is often used for comparison to determine knee extensor (KE) strength deficit in the ACLR leg. This meta-analysis examined the KE strength of the uninjured leg when compared to healthy controls. METHODS: 1702 studies conducted between 2010 and 2016 were collected from 10 databases and screened for the following inclusion criteria: 1) unilateral ACLR and 2) KE strength reported for ACLR patients’ uninjured legs and healthy controls. Studies were excluded if they were non-English or if the strength was measured only at ≥10 years post-ACLR. A total of 20 studies with 636 ACLR subjects and 504 healthy controls met the selection criteria and resulted in 73 Cohen’s d effect sizes (ESs) for analysis. A positive ES equates to the KE of the patients’ uninjured legs being stronger than those of healthy controls. RESULTS: While the overall ES revealed no difference between the uninjured legs and healthy controls (ES = 0.089, 95% CI -0.305, 0.400), high-between-study variance was observed (P = 0.001). Meta-regressions indicated a significant association of the time post-ACLR with the study ES (P = 0.037). Based on the regressions, the uninjured legs would be predicted to be stronger than healthy controls (i.e. ES > 0) after 9 months post-ACLR. For the first 44 months post-ACLR, the ES in studies using patella tendon autografts was greater than that in studies using hamstring tendon autografts (P < 0.001). 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.

Comparison of Handheld and Human Norm Dynamometry for Lower Extremity Muscle Strength Measurements
Karlee Burns1, Mackenzie Pierson2, Will Wu1, Mimi Nakajima1. 1California State University, Long Beach, Long Beach, CA. 2UNC, Greensboro, Greensboro, NC.

(Please note: No relevant relationships reported)

PURPOSE: The use of hand-held dynamometry is commonplace in research and clinical practice when an isokinetic unit is not available for muscle strength testing. However, the use of a hand-held dynamometer alone or in conjunction with a patient stabilization strap has not been thoroughly examined and compared to the isokinetic machine. METHODS: Nine healthy convenience sample volunteers (2 males, 7 females; 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 < .05 a priori) between variables; F(2, 14) = 19.352 < .01. Post hoc comparison showed SHD (mean = 2.707.245) was significantly greater than HD (1.396.065) and HDS was significantly greater than HN (mean = 1.649.0164). HD and HN produced similar results. Conclusion: Results indicated that using a hand-held dynamometer without the use of a patient stabilization strap produced similar measurements to the HUMAC NORM dynamometer. Using the patient stabilization strap overestimated the patients’ strength. Using a handheld dynamometer for these measurements may be used to produce similar results without the time obligation and expense of using a Humac Norm dynamometer unit.
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), FADIR ROM and impingement sign ROM (magnitude in internal rotation in 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 thru 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)**

<table>
<thead>
<tr>
<th>Test Group</th>
<th>FABER Intra ICC</th>
<th>ROM</th>
<th>FADIR Intra ICC</th>
<th>ROM</th>
<th>Impingement</th>
<th>ROM</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>0.53 (0.48-0.60)</td>
<td>0.52 (0.36-0.73)</td>
<td>0.70 (0.73-0.81)</td>
<td>0.65 (0.61-0.78)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>0.56 (0.41-0.68)</td>
<td>0.67 (0.56-0.75)</td>
<td>0.81 (0.69-0.90)</td>
<td>0.70 (0.65-0.76)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>0.62 (0.54-0.69)</td>
<td>0.55 (0.47-0.69)</td>
<td>0.66 (0.52-0.90)</td>
<td>0.72 (0.61-0.82)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td>0.67 (0.60-0.72)</td>
<td>0.57 (0.63-0.71)</td>
<td>0.70 (0.58-0.84)</td>
<td>0.63 (0.51-0.70)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**REFERENCES:** 


**E-42 Free Communication/Poster - Obesity and Exercise**

**E-42 Free Communication/Poster - Obesity and Exercise**

**Title:** Circumference And Body Weight In Response To Interindividual Variability For Change In Waist Circumference And Body Weight In Response To Standardized Exercise

**Authors:** Matthew W. Nelms1, Brittany P. Hammond1, Andrea M. Brennan1, Andrew Day1, Paula J. Stotz2, Benoit Lamarche2, Robert Ross, FACSM1, 1Queen’s University, Kingston, ON, Canada. 2Laval University, Quebec City, QC, Canada. (No relevant relationships reported)

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 algorithm to identify those factors that explain the variability in exercise explained by lifestyle behaviors. 

**METHODS:** Participants were 181 (61% female) sedentary, abnormally 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%2Peak) or high amount, low intensity (HALI) (360 and 600kcal/session for women and men respectively at 50%2Peak, n=53); or high amount, high intensity (HAHI) (360 and 600kcal/session for women and men respectively at 75%2Peak, 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 31.0% - 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.

**E-42 Free Communication/Poster - Obesity and Exercise**

**Title:** Circumference And Body Weight In Response To Interindividual Variability For Change In Waist Circumference And Body Weight In Response To Standardized Exercise

**Authors:** Matthew W. Nelms1, Brittany P. Hammond1, Andrea M. Brennan1, Andrew Day1, Paula J. Stotz2, Benoit Lamarche2, Robert Ross, FACSM1, 1Queen’s University, Kingston, ON, Canada. 2Laval University, Quebec City, QC, Canada. (No relevant relationships reported)

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 algorithm to identify those factors that explain the variability in exercise explained by lifestyle behaviors. 

**METHODS:** Participants were 181 (61% female) sedentary, abnormally obese adults (mean, SD); 53, (7.5 years) who completed a 24-week
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 towards sympathetic dominance, especially at moderate to vigorous intensities, has physiological implications for enhancing energy expenditure and for body weight regulation.

RESULTS: The number of modifications to the asanas did not differ between overweight (4.6±0.5) and normal weight (4.6±0.5) (p=0.85). In both groups, LnHF, LnLF, and RMSSD returned to baseline at 90-min post-exercise (p<0.05). In both groups, LnHF, LnLF, and RMSSD returned to baseline at 90-min post-exercise (p<0.05). In both groups, LnHF, LnLF, and RMSSD returned to baseline at 90-min post-exercise (p<0.05). In both groups, LnHF, LnLF, and RMSSD returned to baseline at 90-min post-exercise (p<0.05). In both groups, LnHF, LnLF, and RMSSD returned to baseline at 90-min post-exercise (p<0.05). In both groups, LnHF, LnLF, and RMSSD returned to baseline at 90-min post-exercise (p<0.05). In both groups, LnHF, LnLF, and RMSSD returned to baseline at 90-min post-exercise (p<0.05).

CONCLUSION: Our findings suggest that compared with lean counterparts, young otherwise healthy obese adults may be at a greater risk. To evaluate cardiac autonomic function at rest and during exercise 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±0.7) vs. normal weight (4.6±0.3) across the yoga session (p=0.91). 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.

Apelin in Obese, Sedentary Women

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 vs. 18.0±2.2 mL/kg/min) and absolute (p<0.002; LOW: 21.0±3.3 vs. 22.0±3.3 mL/min; PER: 19.0±4.0 vs. 20.0±3.0 mL/min) VO2 max across time, but no interaction (p<0.05). PPO also increased in response to training (p=0.01; LOW: 178±42.1 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 significant differences between regimes, HIIT elicits significant changes in PPO and VO2 max in sedentary obese women, which are beneficial to health. The magnitude of change in VO2 max is lower than previously-reported values which raises the question if morbid obesity diminishes VO2 max response to training.

Apelin Secretion in Overweight/Obese Adults Following a Single Bout of Exhaustive Exercise

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 mass index (BMI) of 18-30 kg/m² were recruited based on the guidelines for overweight (BMI of 25-29.9 kg/m²) and obesity (BMI of 30 kg/m²) in Korean. Body composition, clinical parameters, and physical capacity were assessed. Exercise test was randomized to low volume HIIT (LOW) (n=9, VO2 max=21.5±3.2 mL/kg/min) or periodized HIIT (PER) (n=8, VO2 max=17.3±2.4 mL/kg/min). VO2 max was measured on a cycle ergometer at baseline and at 3 and 6 weeks using a ramp exercise test. Women in LOW completed repeated 60 bouts of HIIT at 70-85% PPO, whereas women in PER performed a different number of bouts and intensities each week.

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 vs. 18.0±2.2 mL/kg/min) and absolute (p<0.002; LOW: 21.0±3.3 vs. 22.0±3.3 mL/min; PER: 19.0±4.0 vs. 20.0±3.0 mL/min) VO2 max across time, but no interaction (p<0.05). PPO also increased in response to training (p=0.01; LOW: 178±42.1 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 significant differences between regimes, HIIT elicits significant changes in PPO and VO2 max in sedentary obese women, which are beneficial to health. The magnitude of change in VO2 max is lower than previously-reported values which raises the question if morbid obesity diminishes VO2 max response to training.
but also associated with upper and lower limbs' physical capacity. Our data suggest that apelin may be a therapeutic target to overcome metabolic dysfunction in obese patients.

Supported by NRF Grants NRF-2013M3A9B4046417, NRF-2013M3A9D5072550, and KINDS Co.

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 yrs.; BMI=39.11 ± 4.34 kg/m²) participated in a 6-week exercise intervention with 3 training sessions per week, in the laboratory (LAB) and 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=0.09) 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.

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 28.4 ± 6.6 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<0.007). 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.
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.
Although most of the data linking physical fitness to cardiometabolic (CMB) health explores assessments related to body composition and cardiopulmonary fitness, emerging evidence suggests muscular fitness also plays a key role in the pathogenesis and prevention of CMB diseases. However, the majority of this research has focused on men and have used a grip test to assess muscular strength which tests small muscle groups. PURPOSE: Therefore, the purpose of this study was to examine the associations between individual CMB risk factors and physical fitness in apparently healthy non-obese young adult females using barbell exercises involving large and small muscle groups to measure muscular strength. METHODS: A total of 19 non-obese [body mass index (BMI) < 30 kg/m2] females aged 22.9 ± 4.8 years participated in this cross-sectional study. After obtaining informed consent, each participant was assessed for: resting heart rate and blood pressure; fasting blood biomarkers [triglycerides, glucose, total cholesterol, high-density lipoprotein cholesterol (HDL-C), and low-density lipoprotein cholesterol (LDL-C)]; muscular strength [1 repetition max (1RM) bench squat, press, and deadlift]; muscular endurance, muscular power, and VO2 max. A composite muscular strength index was calculated by dividing individual 1RM scores by bodyweight and then transformed into z-scores. The average of these three z-scores was computed to form a muscular strength index. Spearman’s rho (p) was used to examine bivariate correlation coefficients between physical fitness and CMB risk variables. Statistical significance was set a priori at p < 0.05. RESULTS: Significant correlations were observed between muscular strength and HDL-C (p = 0.542, P = 0.02), muscular power and LDL-C (p = 0.523, P = 0.02), and VO2 max and resting heart rate (p = 0.664, P = 0.001). No significant associations were found between muscular endurance and CMB risk variables. CONCLUSION: Muscular strength was positively associated with HDL-C, while muscular power and VO2 max were negatively associated with LDL-C and resting heart rate, respectively. These findings support the inclusion of muscular strength and muscular power training in addition to cardiovascular fitness training in healthy women in the prevention of CMB disease.

The only available norms for the bench press muscular fitness tests for the general population are the norms developed by the Cooper Institute. These norms were developed using the Universal Gym DVR bench press equipment, which makes these values not directly applicable to free weight bench press. PURPOSE: The free weight bench press test is one of the most convenient tests used to evaluate muscular fitness and the effectiveness of resistance training programs for a variety of sports. However, its use and interpretation as an evaluative measurement for health-related physical fitness tests are limited because there are few published reference values derived for the general population. Therefore, the aims of the present study were to generate normative values for free weight bench press 1 repetition maximal (RM) and 4 sets of 65% of 1RM training volume (total repetitions × resistance) for 20- to 29-year-olds for men and women. METHODS: We recruited healthy 606 subjects for this study. 351 males (mean±SD, age=23.2 ± 2.57 years, height=177.5 cm, body mass=78.8±16 kg) and 255 females (age=23.4 ± 3.0 years, height=167.3 ± 6.2 cm, body mass=67.1±11.3 kg) aged 20 to 29 years from different universities comprised the subject pool. Data collected from the bench press test included absolute (1RM) and relative (the ratio of 1RM to body weight) strength, and the total repetitions and absolute and relative total volume of the 1st set and 4 sets of 65% of 1RM bench press test with 30 second rest periods between sets. Percentile norms and descriptive statistics were generated. RESULTS: Table 1 reports the %tile rank values for the bench press exercise for men and women. CONCLUSIONS: Our results provide, for the first time, reference standards for the general population aged 20 to 29 years sex- and age-specific free weight bench press 1RM and training volumes of the 4 sets of 65% of bench press test with 30 second rest periods between sets.

Table 1. %tile rank for bench press muscular fitness for men and women

<table>
<thead>
<tr>
<th></th>
<th>%tile rank</th>
<th>1RM (kg)</th>
<th>Total Training Volume (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>75</td>
<td>119</td>
<td>2480</td>
</tr>
<tr>
<td>Women</td>
<td>75</td>
<td>54</td>
<td>1115</td>
</tr>
<tr>
<td>Men</td>
<td>50</td>
<td>98</td>
<td>1795</td>
</tr>
<tr>
<td>Women</td>
<td>50</td>
<td>49</td>
<td>925</td>
</tr>
<tr>
<td>Men</td>
<td>25</td>
<td>81</td>
<td>1500</td>
</tr>
<tr>
<td>Women</td>
<td>25</td>
<td>41</td>
<td>684</td>
</tr>
</tbody>
</table>
A field measure of muscle function that can be used in recreational and educational settings to detect bone strength can be an important component in bone health programs and decrease the incidence of fracture as people age. Recent studies reporting significant correlations between muscle power and bone strength (Janz, 2015, Yingling, 2017) have focused on cortical bone sites, however trabecular bone is a common site of fracture. As well, bone’s response to mechanical loading is site specific and thus a loading stimulus to the lower limbs should not have an effect on the bones of the upper limbs. PURPOSE: To determine if relative grip strength or lower limb peak power is more predictive of trabecular bone strength. METHODS: Eighty-six Division II athletes, 56 females and 30 males (age (yrs) 20.2 ± 1.7, height (m) 1.7 ± 0.1, body fat % 17.0 ± 7.4) performed a grip strength (RGS) test using a hand dynamometer and a maximum vertical jump using a Vertec. Peak Power (PP) was calculated from vertical jump height and combined relative grip strength was calculated. Trabecular Bone Mineral Content (vBMC.tb), Trabecular Bone Mineral Density (vBMD.tb), Total Area (T.Ar.tb), and Bone Strength in compression (BSIc) were measured using peripheral Quantitative Computed Tomography (pQCT) at the 4% radial site. Linear regressions were run to relate muscle function and trabecular bone strength.

RESULTS: PP and RGS were significantly related to each of the four bone strength variables. Yet, PP explained more of the variability in bone strength than RGS. PP had larger R2 values for all measurements: vBMC.tb (R2=0.1233) PP [R2=0.5085], vBMD.tb (R2=0.3951) PP [R2=0.6012], T.Ar.tb [R2=0.1227] PP [R2=0.4162], BSIc (R2=0.1713) [R2=0.5240]. CONCLUSION: PP using vertical jump and RGS using a hand dynamometer can be used to assess trabecular bone mass, geometry and architecture. Interestingly PP, a lower limb measurement explained more variance in bone strength of the distal radius. PP is a measure of power which may be a more predictive measure of trabecular bone strength than a muscle strength measure, even one specifically for the upper limb. Lower limb muscle power calculated by vertical jump assessment could provide a means to monitor trabecular bone strength parameters in the upper limb.
The Effects Of Intensive Weight Loss On Metabolome In Female Fitness Competitors

Heikki Sarin, Anni Joensuu, Matti Jauhiainen, Katja Borodulin1, Satu Männistö, Joseph Lee, Ville Isola1, Juha Ahhtainen1, Keijo Häkkänen1, Kati Kristiannson, Juha Huulmi2, Markus Perola3, National Institute for Health and Welfare, Helsinki, Finland. 2University of Columbia, New York City, NY. 3University of Jyväskylä, Jyväskylä, Finland.

Intensive weight reduction has become popular in many performance and aesthetic sports. However, health effects of prolonged semi-starvation are scarcely studied in a longitudinal, systems biology setting.

PURPOSE: The aim of our study was to examine how intensive weight loss with large amount of exercise affects system biological pathways and health biomarkers in female fitness/physique athletes aiming for low body fat while maintaining their lean mass.

METHODS: The study population consisted of healthy fitness/physique athletes divided in Diet (n=25) and Control (n=17) group. The study included three time point measurements: before the weight loss period (PRE), after the 19.8±3.6 weeks of weight loss period (MID) and after 17.5±2.6 weeks of recovery period (POST). Control group was instructed to maintain their usual fitness lifestyle, exercise levels and energy intake constant during the study. Metabolomic analysis was the determination of metabolome. Data analysis was performed using R and significance threshold was set to 2.1x10^-3.

RESULTS: Intensive weight loss in the Diet-group was composed of mainly (~51%) decreases in total body fat mass (p < 0.001) waist circumference (~8%) and the android region (~70%) reflecting visceral fat mass (p < 0.001). This was accomplished by decreased energy intake (~18%) and increased total amount (METs) of exercise (~15%). Weight loss affected significantly on several inflammation related biomarkers such as α-acid glycoprotein (p=2.47x10^-9) and various HDL-metabolites (p=8.2x10^-12). The reduction of visceral fat mass was significantly associated with the observed changes in lipid and inflammation biomarker concentration after adjusting for confounding factors. All detected changes in metabolome were reversed back to baseline levels during the recovery period. No changes were observed in the controls.

CONCLUSIONS: Intensive weight reduction has positive, but temporary effects on serum metabolome in fitness/physique athletes. Decrease in visceral fat mass seem to explain majority of these effects of weight reduction on lipid profile and inflammation related biomarkers. Supported by Academy of Finland (grant No. 275922 to JH and No. 260517 to MP), Finnish Sports Association and Department of Biology of Physical Activity.
eating, a component of the female athlete triad. Overall, female lacrosse players had a significant energy deficit of enough magnitude to suggest that performance may be impaired. Though bone health was not negatively affected in this study, prolonged energy deficit in a similar population could lead to reduced bone mineral density.

Among non-athletes, total energy expenditure (TEE) and physical activity energy expenditure (PAEE) increases over the low and middle range of physical activity, but resting energy expenditure (REE) does not (Pontzer, 2016). However, compensatory metabolic adaptation is found among highly trained athletes (Silva, 2017). PURPOSE: To clarify the relationship between TEE and its components over a wide range of physical activity levels (PAL) among healthy female athletes. METHODS: Eighty-five healthy female college athletes (short, middle and long distance runners, jumpers, throwers, walkers, swimmers, rhythmic sportive gymnasts, judo players, and lacrosse players) were evaluated during the training season. TEE and REE were assessed by the doubly labelled water method and respirometry, respectively. Total energy intake (TEI) was assessed using 7-day dietary record. PAEE was determined as TEE-0.1(TEE) - REE, and PAL was determined as TEE/REE. Among them, 41 athletes were measured for training induced energy expenditure (TIEE) using heart-rate monitoring. Adjusted TEE, REE, TIEE, and TEI were calculated using the residuals of regression analysis to eliminate the effects of fat free mass, fat mass, age and height. Estimated REE (eREE) was calculated using an equation used in Taguchi’s study (2011). RESULTS: Adjusted TEE, PAEE and TIEE were significantly positively correlated with PAL (r=0.51, p<0.01; ηp2 = 0.26, p<0.01; ηp2 = 0.29, p<0.01, respectively). eREE and the difference between TEE and eREE were significantly negatively correlated with PAL (r=-0.53, p<0.01; ηp2 = 0.28, p<0.01, respectively). However, adjusted TEI did not correlate significantly with PAL (r=-0.19, p=0.069). CONCLUSIONS: Both higher energy expenditure related to physical activity and/or training and lower REE lead to higher PAL among female athletes. Lowered REE may be caused by insufficient energy intake in relation to high energy expenditure.

Male Athlete Triad (MT), composed of 1) low energy availability (LEA), 2) low bone mineral density (BMD) and 3) decreased reproductive hormones is novel and not established. The impact of LEA in males needs further examination.

Participation in organized sport at a lower competitive level may protect against disordered eating (DE), whereas exercising in a gym context may increase DE risk. Use of supplements advertised as muscle enhancing is common in both contexts due to the expectancy of performance or appearance enhancement. However, how supplement use (SU) relates to DE dependent on these two exercise contexts in adolescents is unknown. PURPOSE: To study how participation in sport or/a gym context and SU relates to DE in adolescents. METHOD: Participants were 599 boys and 1038 girls enrolled in a RCT to promote a positive body image and prevent DE in high schools. The “Eating Disorder Examination Questionnaire” (EDEQ) short form measured DE. Participants provided information about exercise context (1 = gym + sport, 2 = gym only, 3 = neither sport or gym, 4 = sport only) and SU (1 = protein and creatine supplement use (SU), 2 = protein only (SU), and 3 = no SU). ANCOVA was used to examine main and interaction effects of SU and sport context. Effects were considered significant when F test was p < .05. The analyses were stratified for gender. RESULTS: Among boys, PSU+CSU was associated with higher EDEQ-score (b = 1.31, p < .01). In addition, reporting either sport, gym, or gym + sport context was associated with lower EDEQ-score (b = -1.16, p = .01) in boys. In girls, higher EDEQ-score was associated with reporting gym or gym + sport context (b = -7.7, p< .01 and b = -6.8, p< .01), while higher score was associated with sport context (b = 3.3, p< .02). Effects were independent of the covariates body mass index (boys, b = 0.15, p = .01 and girls, b = 0.07, p = .01) and studying sport program (boys, b = -1.21 p < .01). No effects were found for other covariates (income, physical activity level and immigration status). Conclusion: Boys who reported using protein and creatine supplements and girls who exercised in gyms had higher DE. Interestingly, lower DE in boys was related to both sport and/or gym exercise participation compared to boys not reporting participation in either of the two contexts. Attention and preventive actions should be aimed towards girls engaging in gym exercise, and towards boys who consume protein and creatine supplements, and who do not participate in any of the two exercise contexts. Future studies should however examine how other exercise contexts relates to SU and DE.
F-07 Thematic Poster - Physical Activity and Healthy Aging
Friday, June 1, 2018, 1:00 PM - 3:00 PM
Room: CC-Lower level L100E

2494 Chair: Loretta DiPietro, FACSM. The George Washington University School of Public Health and Health Services, Washington, DC.

(No relevant relationships reported)

2495 Board #1 June 1 1:00 PM - 3:00 PM
Gender-Specific Effects in Cognition and Mobility Following Exercise in Older Adults at Risk for Dementia

Narlon C. Boa Sorte Silva, Dawn P. Gill, Ashleigh De Cruz, Robert J. Petrella, FACSM, Western University, London, ON, Canada. (Sponsor: Robert J Petrella, FACSM)

(No relevant relationships reported)

Purpose: To investigate gender-specific adaptations following a 24-week multiple-modality exercise intervention with additional mind-motor training on cognition and mobility.

Methods: Older adults (n = 127, age = 67.5 [7.3] yr, 71% women) were randomized to a 45-min multiple-modality exercise intervention with additional 15 minutes of either mind-motor training (M4 group) or an active control intervention (15 minutes of balance, range of motion and breathing exercises, [M2 group]). Assessment occurred at baseline, 24 weeks (intervention endpoint), and 52 weeks (after a 28-week no-contact follow-up). The study outcomes were: cognition (global cognitive functioning [GCF], concentration, reasoning, planning, and memory), and mobility (usual and dual-task gait performance). Overall, gender-specific effects were seen for memory and dual-task gait performance. Additional mind-motor training compared to an active control intervention group resulted in significant improvements in variability (dual-task gait, M2 showed greater improvements in velocity (p=.003), compared to M4. For usual gait, M2 retained improvements in velocity (p=.05), compared to M4. For dual-task gait, gender-specific effects were observed in observed in memory favouring women (p=.06). For usual gait, M2 retained improvements in velocity (p=.05), compared to M4. For dual-task gait, gender-specific effects were observed in observed in memory favouring women (p=.06).

Conclusion: Additional mind-motor training compared to an active control intervention showed trends for greater benefits to cognition; however, it did not affect gait performance. Overall, gender-specific effects were seen for memory and dual-task step length across groups, suggesting that women benefited more from exercise compared to men, and were able to retain these improvements after a no-contact follow-up. Funding: CIHR MOP 130474

2496 Board #2 June 1 1:00 PM - 3:00 PM
Effects of Tai Chi on Beta Endorphin and Inflammatory Markers In Older Adults with Chronic Pain


(No relevant relationships reported)

Musculoskeletal pain is associated with dysfunction of the opioid analgesic system as elevated inflammation in older adults. PURPOSE: To examine the effects of Tai Chi on blood levels of beta endorphin and inflammatory markers in older adults with chronic pain. METHODS: Forty community-dwelling older adults (≥65 years) with multisite pain were randomly assigned to light physical exercise or Tai Chi, each offered twice weekly for 12 weeks. Plasma levels of beta endorphin, C-reactive protein (CRP), interleukin 6 (IL-6), and tumor necrosis factor alpha (TNF-α) were assessed at baseline and within 2 weeks after completing the intervention. Paired t-tests were used to assess changes of log-transformed beta endorphin and inflammatory markers within each group, and pairwise t-tests were used to assess differences between groups. RESULTS: Twenty-one participants in the light physical exercise group and nineteen participants in the Tai Chi group provided blood samples. Following the 12-week intervention, neither light physical exercise nor Tai Chi changed levels of beta endorphin and inflammatory markers. However, in older adults who completed 70% or more classes, Tai Chi signficantly lowered levels of beta endorphin (p<0.05) from baseline to post-intervention, whereas light physical exercise did not change levels of beta endorphin. CONCLUSION: Tai Chi tended to reduce levels of beta endorphin but did not affect levels of inflammatory markers in older adults with chronic pain. Future studies need to focus on the role of the opioid analgesic system and immune system in regulating pain with aging and the long-term effects of Tai Chi on pain-related biomarkers. (Supported by National Institutes of Health R21 AG043883)

2497 Board #3 June 1 1:00 PM - 3:00 PM
A Comparison Of Two Community Based Exercise Interventions For Reducing Falls Risk In Older Adults

Jessica Pope1, Steven Morrison2, Amanda Estep1, Shane Caswell1, Jatin Ambegaonkar1, Kathryn Helwig1, Nelson Cortes1. 1Geoge Mason University, Manassas, VA. 2Old Dominion University, Norfolk, VA.

(No relevant relationships reported)

Falls are a major health problem for older adults with a reported 1/3 people over the age of 65 likely to suffer a fall in a given year. Exercise interventions have improved muscle strength and reaction time in older adults. Many interventions have occurred in a controlled setting. Further research is needed to evaluate the impact of fall prevention programs conducted in community settings to improve falls risk factors.

PURPOSE: To compare the effects of two interventions (INT), The Lebed Method (TLM) and Staying Active and Independent for Life (SAIL) on right and left leg strength (RLS & LLS), foot and hand reaction time (FRT & HRT), and timed up and go (TUG) in older adults in community venues.

METHODS: 74 and 103 older adults participated in TLM and SAIL (73±8 years, 1.61±.1 m, 82.1±21.7 kg; 71±7 years, 1.61±.1 m, 80±19 kg, respectively). TLM, a dance therapy program, was implemented for 8 weeks, 1x,2x/week. SAIL included aerobics, balance, strength, and stretching exercises and lasted 10 weeks, 1x, 3x/week. RLS & LLS (kg), FRT & HRT (ms), and TUG (s) were assessed pre & post INT (time). A 2-way factorial MANOVA was conducted to assess differences between time and INT.

RESULTS: A significant interaction was observed for LLS (p<0.05). LLS improved from pre to post for TLM (pre=14.3±7, post=20.2±8.1) and SAIL (pre=20.9±6.2, post=18.2±6.5). Only main effects were attained for remaining variables (p<0.05). All participants were faster (TUG, pre=9.1±4, post=8.2±3.1), improved FRT (pre=336±91, post=327±101) & HRT (pre=282±87, post=277±86). Faster HRT and FRT were seen for SAIL (319±96, 269±87) compared to TLM (356±90, 298±83). RLS & LLS increased from pre (16.4±7, 16.8±6.9) to post (20.7±7.5, 20.6±6.9). Leg strength was greater in SAIL (RLS=19.3±3.7, LLS=19.4±6.4) than TLM (RLS=16.1±6.2, LLS=16.9±8).

CONCLUSION: While both interventions were effective at improving leg strength and reaction time, SAIL had the greatest improvements. SAIL includes exercise and music like TLM but was developed for general population, yielding an attractive program while addressing specific modifiable risk factors. Future studies should investigate long-term retention of benefits following intervention, tracking changes in balance, activity level, and number of falls. Supported by grant from Potomac Health Foundation.

2498 Board #4 June 1 1:00 PM - 3:00 PM
Square-stepping Exercise For Older Adults With Chronic Disease To Improve Cognition and Mobility


(No relevant relationships reported)

Square-stepping exercise (SSE) is a visuospatial working memory task with a cued stepping response that improves mobility and cognition in older adults. Purpose: To determine if a SSE intervention improves cognitive and mobility in older adults with chronic disease (i.e., knee osteoarthritis [KOA], type 2 diabetes mellitus [T2DM] with self-reported cognitive complaints [SCC], and dementia), compared to control groups. Methods: We conducted three pilot randomized controlled trials, with 12- and 24- week intervention periods, compared to wait-list control groups. Assessments focused on: mobility (i.e., 30-second chair stand, and walking speed) for adults with KOA;
cognition [i.e., Cambridge Brain Sciences, antisaccade reaction time (RT)] for adults with T2DM with sCC; and mood and behaviours questionnaire (i.e., Neuropsychiatric Inventory Questionnaire; NPIQ) for adults with dementia. Results: KOA participants showed trends toward improved 30-second chair stand at 12-weeks (F=1.8, p=0.12, n²=0.16) and 24-weeks (F=3.4, p=0.09, n²=0.18), and walking speed at 24-weeks (F=2.4, p=0.14, n²=0.14), compared to controls after adjusting for baseline. T2DM with sCC improved on planned change scores from 12 to 24-weeks (F=5.8, p=0.02, n²=0.28) compared to controls, and a non-significant improvement in antisaccade RT of 38 ms (SD 16). Adults with dementia improved on NPIQ scores (i.e. symptoms) at 12-weeks: (total: F=7.3, p=0.01, n²=0.25; frequency: F=9.4, p=0.01, n²=0.30; and severity: F=7.0, p=0.02, n²=0.24), compared to controls. Conclusions: In our pilot trials, SSE showed promise for improving mobility and cognition in adults with chronic disease and demonstrates the potential for its use in adults with diverse medical and cognitive impairments.

Funding: Supported by the Department of Family Medicine, University of Western Ontario, Mitacs Accelerate, Ontario Graduate Scholarship, and Schlegel - University of Waterloo Research Institute for Aging.

RESULTS: The average age of the 402 subjects read 74.5±6.0 years old. The 50th percentile of each physical fitness assessment were listed as such body mass index 24.1 kg/m², 20% body fat, 4.2 grip test of dominant hand 33.3kg, 5-time sit and stand 11.2 sec, 3-chair stand test 14 time, open-eye stand on right foot 19.6 sec, chair sit-and-reach test -1.2 cm, and 8-feet walking test 8.0 sec. All physical fitness performance was observed to decrease with aging. CONCLUSIONS: Elderly males in different age groups demonstrate different levels of physical fitness, as indicated by the disparity in the normative physical fitness scores, and it seems sensible to adopt different normative physical fitness scores for elderly males living in rural and urban areas.

High-intensity interval training has been shown to improve health/fitness factors in adults. Evidence is limited in older adults with chronic disease and increased risk for exercise-related complications and for resistance training modes. PURPOSE: Assess the efficacy (aerobic and functional fitness) and safety of high-intensity resistance and sprint-cycle interval training in at-risk older adults. METHODS: Forty-eight participants (30 women; 69.6 years, 28.0±5.5 kg/m²; 60% with ≥2 chronic diseases) trained 3 days/week for 6 weeks. Participants were randomized to conditions: 1) high-intensity sprint interval cycle training (SIT; N=17); 2) high-intensity resistance training (HIRT; N=20); or 3) moderate-intensity continuous aerobic exercise (MICE; active control; N=11). Baseline and post-training measures included: maximal aerobic capacity (VO2 max), body composition, grip strength, flexibility and balance as indicated by the disparities in the normative physical fitness scores, and to explore the relationship between physical activity, physical fitness and quality of life. METHODS: To explore the relationship between physical activity, physical fitness and quality of life for the elderly population. Methods: We included in our study 105 older adults (≥60 years old) from three community in Beijing, China. Data of physical activity was collected by physical activity survey for the elderly (PASE). Items of physical fitness included grip strength, flexibility and balance, assessing according to the measurement manual of National Physical Fitness Surveillance in China. T score (ranging from 0-100) was calculated for each physical fitness item and added up to a total score. Quality of life was measured by the Medical Outcome Study 36-item short form health survey (SF-36). Subscales of SF-36 were summarized into two subdomains of physical component summary regarding physical health, and mental component summary for mental health. Multivariable linear regression was used to explore the relationship between physical activity, physical fitness and quality of life. Results: Among the study population physical activity and total score of all 3 items of physical fitness were the most important impact factors for physical component summary (standardized regression coefficients were 0.39 and 0.33, respectively). As regarded to mental component summary, total score of all 3 items of physical fitness, but not physical activity, was the major influencing factor (standardized regression coefficient was 0.24). No interactions were found between physical activity and physical fitness in relation to two subdomains of quality of life (P>0.05). Conclusion: Both physical activity and physical fitness had independent effects on quality of life for older adults in Beijing, China. Physical activity was the most important factor that associated with physical health, but not with mental health. The summary condition of grip strength, flexibility and balance was positively correlated with both physical and mental health.

Keywords: Physical activities, Physical fitness, Quality of life

PURPOSE: Endurance walk test performance is a powerful predictor of future mobility limitation and decline in older adults; whether other test parameters such as heart rate increase and post-test recovery provide useful metrics of resiliency has received limited attention. METHODS: Using data on 784 well-functioning (able to walk 400m without stopping, not taking beta blockers) men (47%) and women aged 60 to 94 years participating in the Baltimore Longitudinal Study of Aging, we examined heart rate increase (HR-I) from a resting state immediately after completing a fast-pace 400m walk and HR recovery (HR-R; HR decline 2-minutes post-test completion) in relation to 400m walk time, in terms of speed and reported ability to walk 400m to 1 mile at baseline and at follow-up an average of 2.1 years later. RESULTS: At baseline, independent of age, sex, race, height and reported exercise, HR-I (b=1.02; p<0.01) and HR-R (b=1.12; p<0.01) in separate models were negatively associated with 400m time; that is higher HR was associated with better performance; whereas, for a given 400m time, HR-R was associated with worse baseline reported walking ability (b=-0.207; p<0.011 and -0.240; p<0.002). Longitudinally, higher HR-I and HR-R predicted slower follow-up 400m time and poorer reported walking ability independent of baseline values (b=-0.19; p=0.039 and b=-0.24; p<0.037; b=0.007 and -0.11; p<0.011). No associations were observed between HR-I or HR-R and baseline or

Abstracts were prepared by the authors and printed as submitted.
follow-up usual gait speed. CONCLUSION: In well-functioning older adults, better heart rate response equates with better endurance walk performance, but for a given performance, higher heart rate response predicts worse concurrent reported walking ability and poorer future endurance walk performance and reported ability. Including heart rate response to endurance walk testing which is typically collected for safety monitoring may improve predictive models of future functional status.

### MEDICINE & SCIENCE IN SPORTS & EXERCISE®

**Position or policy of PepsiCo, Inc. Ownership Interest (Stocks, Bonds); This study was funded by the Gatorade Sports Science Institute. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc.**

Previously, we published sweating rate (SR) and sweat sodium concentration ([Na+]s) normative data in 506 athletes. PURPOSE: The purpose of this study was to expand the database and analyses to establish sport-specific normative data for SR and [Na+]s rate of sweat Na+ loss. METHODS: Data from 1303 athletes (1103 male, 200 female) were compiled from field and lab testing. SR was calculated from the difference in pre- to post-exercise body mass, correcting for food/fluid intake and urine/stool loss. A standardized absorbent sweat patch technique was used to determine local sweat [Na+]s and normalized to whole body sweat [Na+]s using published regression equations. Rate of sweat Na+ loss was determined from the product of whole body sweat [Na+]s and SR. The sport-specific analysis included sports with n>100; endurance (n=255), soccer (n=268), basketball (n=196), American football (n=271), and baseball (n=161). RESULTS: Data are mean ± SD. SR differed significantly between sports (ANOVA, Tukey’s post hoc; p<0.05); American football displayed the highest SR (1.5 ± 0.7 L/h), followed by endurance (1.3 ± 0.6 L/h), basketball (1.0 ± 0.4 L/h), soccer (0.9 ± 0.4 L/h) and baseball (0.8 ± 0.3 L/h). The rate of sweat Na+ loss was higher in American football (55.9 ± 36.8 mmol/h) and endurance (51.7 ± 27.8 mmol/h) compared with soccer (34.6 ± 19.2 mmol/h), basketball (34.5 ± 21.2 mmol/h), and baseball (27.2 ± 14.7 mmol/h). The rate of sweat Na+ loss was higher in soccer than baseball. After accounting for the impact of covariates (age, sex, body mass, temperature, humidity, season, and intensity), there were still significant differences (ANOVA, Tukey’s post hoc; p<0.05) in the adjusted means for SR and rate of sweat Na+ loss; endurance (1.2 L/h, 43.1 mmol/h), football (1.0 L/h, 38.2 mmol/h) and soccer (1.0 L/h, 35.4 mmol/h) were higher than baseball (0.8 L/h, 25.5 mmol/h), and endurance was higher than basketball (0.9 L/h, 32.0 mmol/h). CONCLUSION: This study suggests the potential for significant variation in the rate of sweat fluid and Na+ losses between sports, with highest values generally occurring in endurance and American football. There are already products targeted to meet the needs of endurance athletes to replace their higher sweat fluid and electrolyte losses; perhaps there is also a need for products and education specific to other sports.

### Thematic Poster - Thermoregulatory Sweating

**F-08**

<table>
<thead>
<tr>
<th>Board #1</th>
<th>June 1 1:00 PM - 3:00 PM</th>
<th>Room: CC-Lower level L100F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chair:</strong> J. M. Carter, FACS.M. Gatorade Sports Science Institute, Barrington, IL.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(No relevant relationships reported)

**POURPOSE:** To determine if exercise intensity has a significant effect on the relation between regional (REG) sweat [Na+]s and whole body (WB) [Na+]s. METHODS: Eleven recreational endurance athletes (7 men, 4 women; 71.5±8.4 kg; 28-40 yr) completed two randomized trials cycling for 90 min at 65% of HRmax (LOW, 109±20 Watts) or 85% of HRmax (HIGH, 169±27 Watts) in a plastic isolation chamber to determine WB sweat [Na+]s using the washout technique. REG sweat was collected from the dorsal and ventral forearm, dorsal and ventral wrists, triceps, upper chest, scapulas, lower back, ventral thighs, calves, and forehead using absorbent patches. REG and WB sweat [Na+]s were measured via ion chromatography. An 11-site aggregate of REG sweat [Na+]s was calculated from the surface area weighted mean of all sites. Room temperature (30.1±0.3°C vs. 30.1±0.2°C) and relative humidity (43.0±1.1% vs. 43.6±1.5%) were consistent between trials. Subjects consumed a consistent diet for 48-h and drank 500 mL of water 2 h before trials. Paired t-tests were used to compare measures at LOW and HIGH intensity. Linear regression and Pearson correlation were used to compare REG and WB [Na+]s.

**RESULTS:** WB sweat rate (0.516±0.077 g/min vs. 0.764±0.133 g/min; p<0.001) and WB sweat [Na+]s (32.6±14.3 mmol/L vs. 52.7±14.6 mmol/L; p<0.01) increased from LOW to HIGH. REG sweat [Na+]s increased (p<0.05) from LOW to HIGH at all sites except the thigh (p=0.13) and calf (p=0.18). The ratio between REG and WB sweat [Na+]s was greater at LOW vs. HIGH for the thigh (1.03±0.2 vs. 0.83±0.1; p=0.02) and lower back (1.29±0.25 vs. 1.08±0.19; p=0.04), but there were no differences between intensities at any other site, including the 11-site aggregate (1.28±0.20 vs. 1.22±0.16; p=0.45). There was a significant correlation between REG and WB sweat [Na+]s at each of the 11 sites for both LOW (r=0.70-0.92; p<0.005) and HIGH (r=0.68-0.93; p<0.05).

**CONCLUSIONS:** These findings suggest that for most sites REG and WB sweat [Na+]s increase proportionally with an increase in exercise intensity. Thus, in general the relation between REG and WB sweat [Na+]s is consistent across exercise intensities. While more research is needed, it seems that regression equations can be used to predict REG sweat [Na+]s from most REG sites irrespective of intensity when exercising between 65 and 85% HRmax.

**2504**

<table>
<thead>
<tr>
<th>Board #2</th>
<th>June 1 1:00 PM - 3:00 PM</th>
<th>Room: CC-Lower level L100F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chair:</strong> J. M. Carter, FACS.M. Gatorade Sports Science Institute, Barrington, IL.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(No relevant relationships reported)

Aerobic training increases gross and regional sweating rates (RSR) allowing improved evaporative heat loss. Variation in RSR are widely recognized, but limited RSR data and implications for thermoregulation are available in untrained individuals. PURPOSE: Our aim was to investigate RSR and distribution at 35 sites in young, untrained males (UT) versus endurance-trained male athletes (TR) during exercise-induced hyperthermia in a moderate environment. METHODS: Six young, healthy, untrained male athletes (UT; n=9; age, 22±2 yrs; VO2peak, 42.2±7.6 ml.kg⁻¹.min⁻¹) and aerobically trained male athletes (23 ±3 yrs, VO2peak 70.2±13 ml.kg⁻¹.min⁻¹) ran for 60 minutes in 25.6 ± 4.5°C, 48.5 ± 0.5 °C relative humidity, and a 1 m.s⁻¹ air velocity. RSR were measured at two exercise intensities (11%, 60% VO2peak; 12%, 75% VO2peak) using a modified absorbent technique. **RESULTS:** Core temperature was similar between groups at all stages (P>0.05). GSI was significantly higher in TR versus UT at I1 and I2 (I1: TR 36.5±4, UT 157 ± 66 g.m⁻².h⁻¹, P<0.001; I2 TR 657 ± 119, UT 311 ± 93 g.m⁻².h⁻¹, p<0.001), reflecting a significantly higher absolute work rate in TR versus UT (p=0.01). Absolute RSR were significantly higher in TR versus UT at 28 of 35 regions at I1 and 31 of 35 regions at I2. Highest RSR were observed on the central male back (50% of all sites). Both groups showed a medial to lateral decrease in RSR on the posterior torso, and proximal to distal increase on the arms. Normalized ratio values were significantly different between groups at 4 and 6 sites out of 35 at I1 and I2, respectively, none of which was significant following Bonferroni correction. No correlation was observed between RSR and local skin temperature in either group. **CONCLUSIONS:** These data provide the most detailed exercise-induced RSR for untrained males, showing large RSR variation. Despite significant differences in GSI and absolute RSR, normalized data suggest no significant differences in distribution of sweat between groups. Male athletes demonstrated superior thermoregulation, with similar Tcore and Tsk values despite a higher absolute workload. Funded by the Adidas Innovation Team.
Previous research has measured the amount of sweat absorbed in basketball uniforms during exercise, but data are limited in other sports. **Purpose:** To determine the amount of trapped sweat (TS) in various sports uniforms during sport-specific, laboratory-based exercise. **Methods:** Eleven male (30 ± 5 years, 75.7 ± 5.2 kg) and 6 female (29 ± 4 years, 59.9 ± 9.9 kg) moderately-trained athletes completed three trials consisting of 120 min intermittent sport-specific exercise in standard uniforms for various sports, including football (n=9 men), basketball (n=4 men, 5 women), soccer (n=4 men, 5 women), baseball/softball (n=4 men, 4 women), and endurance (n=5 men, 4 women) in a temperature-controlled laboratory (basketball: 25°C, 55% rh; all other sports: 30°C, 55% rh). Protocols were designed to simulate the demands of each sport (endurance: 82 ± 5% HRmax, RPE 13 ± 2; basketball: 75 ± 10% HRmax, RPE 13 ± 1; soccer: 77 ± 10% HRmax, RPE 12 ± 1; basketball: 66 ± 12% HRmax, RPE 10 ± 2; and baseball/softball: 59 ± 3% HRmax, RPE 9 ± 2). Sweat loss (SL) was determined from change in rude body mass corrected for fluid intake, urine loss, respiratory water loss, and metabolic mass loss. Nude and clothed body mass were measured pre- and post-exercise to determine TS. Analysis of variance followed by Tukey’s post hoc test was used to compare sports. Data are mean ± SD. **Results:** There were significant differences in SL between sports (football: 2.61 ± 0.36 kg; endurance: 2.18 ± 0.53 kg and soccer (1.99 ± 0.81 kg) > basketball (1.24 ± 0.37 kg) and baseball/softball (1.19 ± 0.38 kg). There were also significant differences in TS (p<0.0001): football (0.58 ± 0.14 kg) > endurance (0.28 ± 0.16 kg) and soccer (0.24 ± 0.18 kg) > basketball (0.11 ± 0.08 kg) and baseball/softball (0.15 ± 0.12 kg). TS as a percentage of SL was greater in football (22.5 ± 3.8%) than endurance (12.2 ± 4.7%), soccer (10.9 ± 3.4%), basketball (9.2 ± 4.4%), and baseball/softball (10.8 ± 6.2%). **Conclusion:** Sports with higher SL were associated with higher volumes of TS in uniforms. The football uniform (including full pads) led to the most TS and greatest underestimations in SL. Such high volumes of TS are also likely to have ramifications for evaporative heat loss capacity and therefore warrant future research investigating the effects of TS on thermoregulation.

Performing prolonged, arduous occupational work in the heat is associated with considerable heat strain, which may be exacerbated on the next work day. Recently, we showed that whole-body heat loss was not modified by prolonged work in the heat on the preceding day in young habitually active men. However, it is unclear whether prolonged heat strain may reduce heat loss on the next day in older workers, who display impaired thermoregulatory function and who recover more slowly from exercise-induced stress compared to young adults. **Purpose:** To determine whether prolonged work in the heat impairs whole-body heat loss and exacerbates heat storage on the next day in older men. **Methods:** Changes in whole-body heat exchange and heat storage were assessed in six older (SD 5) men during heat stress tests performed on the same day prior to (Day 1), and on the following day (Day 2), a prolonged work simulation. Each heat stress test involved three 30-min bouts of cycling performed at increasing, fixed rates of metabolic heat production of 150 (Ex1), 200 (Ex2) and 250 W/m² (Ex3), each separated by 15-min recovery, in hot-dry conditions (40°C, 20% relative humidity (RH)). The work simulation (7 h) involved three moderate-intensity intermittent work bouts (2 h) each separated by 30-min rest breaks in hot-dry conditions (38°C, 34% RH). Total heat loss (evaporative ± dry heat exchange) and metabolic heat production were measured using direct and indirect calorimetry, respectively. Body heat storage was quantified as the temporal summation of heat production and loss. **Results:** Total heat loss (mean±95% CI) during Ex1 did not differ between Day 1 (149.8 ± 24 W/m²) and Day 2 (143.6 ± 20 W/m²; P=0.29), but decreased on Day 2 during Ex2 (138.5 ± 26 W/m²) vs. Ex3 (219 ± 10 W/m²) relative to Day 1 (191 ± 176 and 230 ± 14 W/m², respectively; both P<0.01). As a result, body heat storage across all exercise bouts was 19% greater on Day 2 (364 ± 74 kJ) than on Day 1 (295 ± 50 kJ; P<0.02). **Conclusions:** Prolonged work in the heat impairs whole-body heat loss and exacerbates body heat storage during moderate-to-high intensity work on the next day in older men. These outcomes indicate that older workers may be more vulnerable to heat-related illness when performing consecutive, arduous work shifts.

**Supported by the Natural Sciences and Engineering Research Council of Canada.**
Multiple Sclerosis (MS) is a demyelinating disease of the central nervous system (CNS). There are two major sub-types of MS: non-progressive (NP) and progressive (P). NP is characterized by intermittent exacerbations of symptoms, followed by a return to near baseline. P is characterized by a steadily worsening of symptoms. Many people who are diagnosed as NP will transition to P. Both NP and P result in sensorimotor impairments that can lead to poor mobility and decreased quality of life.

PURPOSE: A sensitive, non-ambulatory measure of sensorimotor function that can predict the transition from NP to P could be useful in the clinical management of MS.

METHODS: Sensorimotor function of 19 control (CON; 14 women, 55±13.9 yrs), 31 NP (28 women, 52±9.9), and 29 P (20 women, 59±9.1) participants was assessed. Vibration threshold was measured with a Bioheliometer at three locations on the plantar surface of the non-dominant (CON) or most-affected (NP, P) foot. Proprioception was measured at the ankle with a manipulandum, using a position-matching task. Mobility measures included the 25-foot-walk (25FWT) and the Timed-Up-and-Go (TUG). Data were analyzed across and between groups using a one-factor ANOVA and post-hoc pairwise t-tests, respectively, with significance established as p < 0.05.

RESULTS: There was a main effect of group for all outcome variables. Vibration threshold distinguished NP from P in that these differed across those groups. Neither mobility measure nor proprioception at the ankle distinguished the 2 MS sub-types.

<table>
<thead>
<tr>
<th></th>
<th>CON (n=19)</th>
<th>NP (n=31)</th>
<th>P (n=29)</th>
<th>ANOVA p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big Toe (v)²ᵃᶜ</td>
<td>12.7±10.97</td>
<td>15.6±13.79</td>
<td>26.1±15.52</td>
<td>0.004</td>
</tr>
<tr>
<td>5ᵗʰ Metatarsal (v²)ᵃ</td>
<td>9.47±7.97</td>
<td>13.97±13.34</td>
<td>27.19±16.92</td>
<td>0.001</td>
</tr>
<tr>
<td>Heel (v)¹ˢ</td>
<td>12.1±11.85</td>
<td>15.45±12.70</td>
<td>28.07±16.39</td>
<td>0.001</td>
</tr>
<tr>
<td>Proprioception (°)ᵃᵇ</td>
<td>1.85±1.20</td>
<td>4.53±4.48</td>
<td>5.11±3.76</td>
<td>0.001</td>
</tr>
<tr>
<td>25FWT (s)ᵃᵇ</td>
<td>5.12±0.50</td>
<td>8.44±4.88</td>
<td>10.07±4.56</td>
<td>0.001</td>
</tr>
<tr>
<td>TUG (s)ᵇ</td>
<td>6.89±1.17</td>
<td>11.90±7.10</td>
<td>13.95±5.84</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Table 1. Data are mean±SD. Significant differences: ᵃCON vs. NP; ᵇCON vs. P; ᶜNP vs. P

CONCLUSION: Vibration threshold may be a promising outcome variable for discriminating among individuals with NP and P MS sub-types. This could be useful in a clinical setting for cross-sectional comparisons of NP and P, as well as to detect transitions from NP to P in longitudinal studies.

Supported by Department of Defense Grant W81XWH-16-1-0351

Hamstring injuries (HI) are the most common muscle injuries in both professional and amateur soccer. With the introduction of the effective Nordic hamstring exercise (NHE), a decrease of hamstring injuries was expected. Nevertheless, an annual increase of HI is seen in the last decade. This might be due to poor compliance. Arguments for non-compliance are among others, that the NHE is not soccer-specific enough. Therefore, we developed the Bounding Exercise Programme (BEP) as an alternative. It is a sport-specific exercise programme which includes concentric, eccentric and plyometric exercises.

PURPOSE: To determine the preventive effect of the Bounding Exercise Programme on hamstring injury occurrence in adult amateur male soccer players.

METHODS: Soccer teams (N=32) competing on first class amateur level, were cluster-randomized to the intervention or control group. Both groups were instructed to perform their regular training programme, and the intervention group was also instructed to perform the BEP during the whole competition. At baseline, player characteristics were gathered from all participants. During the competition 2016-2017 all players weekly registered exposure (minutes) and HI occurrence. Compliance (route of BEP) was reported by all players in the intervention group.

RESULTS: 588 male soccer players (24.7 ±4.5 yrs old) participated in this study. A total of 65 HI were reported within one competition. The overall HI incidence was 1.39 per 1000 soccer hours for the control group and 1.12 per 1000 soccer hours for the intervention group.

Analysis of intention to treat showed no statistical significant difference between both groups in occurrence of HI (OR =0.89, 95% CI 0.459-1.747) and no significant difference in time to first HI (HR =0.90, CI = 0.478-1.695). There was also no effect found of adherence to BEP for the occurrence of HI and time to first HI.

CONCLUSIONS: Our study showed no benefit of BEP over regular soccer on preventing HI in adult amateur soccer players. Compliance for BEP was moderate (on average 71%).

This study was supported by a grant from the Netherlands Organization for Health Research and Development and the Royal Netherlands Football Association, was approved by the Medical Ethics Committee of UMC Utrecht (16-352/C) and is registered in the Dutch Trial Registry (NTR6129).

Restrictive Anorexia Nervosa (ANR) is a clinical mental disorder defined as abnormal eating behavior and is often associated with physical hyperactivity. There is no consistent cut-off use to define what is considered excessive physical activity in term of duration, frequency and intensity in contrast with healthy physical activity (1). On the other hand, ANR is marked by bone loss and with low Body Mineral Density (BMD)(2). Few data are available in daily patterns of Physical Activity and in the relationship between time spent in moderate to vigorous physical activity (MVPA) and BMD in females with anorexia nervosa.

METHODS: 17 females with anorexia nervosa (22±2yrs) were included in this study. Body composition was assessed by DXA measurements (Hologic QDR-4500W, Waltham, MA). 24h Physical activity levels and sleep time were monitored by using actigraphy (ActiSleep and ActiGraph GT3X, Pensacola, USA).

RESULTS: Females with diurnal higher VPA levels demonstrated an increased in integral Femoral Neck Bone Mineral Density (FNBMDD) (0.678 g/cm² vs. 0.623 g/cm²) compared to those with lower diurnal VPA levels (p=0.05). Time spent in light physical activity (LPA) is associated with a significantly lower total hip BMD (g/cm²) (0.788 ± 0.11 vs 0.873 ± 0.15 ; p<0.001). CONCLUSION: This investigation shows that ANR females accumulating more total Vigorous Physical Activity presented increased BMDs when compared to their less active peers. These data highlight the importance of VPA in females with AN to counteract their low bone mass and to improve their bone health. High time spent in LPA may be considered to be deleterious for BMD.(1) Achanam N, Coëffier M, Dèchelote P. Physical activity in patients with anorexia nervosa. Nutr Rev.
BACKGROUND: Following anterior cruciate ligament reconstruction (ACLR) surgery, lower extremity recovery of the uninjured limb >90% is commonly recommended for clearance to return to play (RTP). However, evidence regarding the timing of achieving such recovery is lacking, especially in skeletally immature populations. PURPOSE: To examine the proportion of pediatric ACLR patients (<15 years) who achieve >90% of lower extremity recovery at 6-9 months following ACLR surgery. METHODS: Bilateral strength (quadriceps, hamstrings, hip abductor, and hip extensor), Y-balance (anterior, postero-medial, and postero-lateral reach), and hop (single, triple, cross-over, and 6 meter timed) tests were assessed. Descriptive statistics (%) were employed. Additionally, sub-groups were analyzed according to sex and technique/autograft type: males with transphyseal quadriceps hamstrings (Male-HS), females with transphyseal quadriceps hamstrings (Female-HS), and males with extra- compartmental physio-sparing iliotibial band (Male-ITB) using chi-square (x²) test with p<0.05. RESULTS: A total of 93 pediatric ACLR patients (Male-HS: N=21, age=13.6±1.0, Female-HS: N=33, age=13.4±0.7, Male-ITB: N=39, age=12.5±1.3) were enrolled. Time from ACLR to RTP testing was 6.9±3.4 months. The proportion of pediatric ACLR patients, overall, achieving >90% of strength was: 76.3% in quadriceps, 39.1% in hamstrings, 79.6% in hip abductors, and 82.8% in hip extensors. Y-balance test resulted 82.6% in anterior reach, 83.9% in postero-medial reach, and 89.1% in posterolateral reach. Hop test indicated 62.5% in single hop, 72.9% in triple hops, 56.5% in cross-over hops, and 71.4% in 6 meter timed hops. x² analysis identified a difference in hamstrings strength, which showed a lower proportion of >90% recovery in Male-HS (23.8%) and Female-HS (15.6%) compared to Male-ITB (66.7%, p<0.001). CONCLUSIONS: Approximately 7 months following ACLR, more than 3/4 of the patients achieved >90% of quadriceps, hip abductor, and hip extensor strength, but not hamstrings strength. While over 4/5 of the patients performed >90% in Y-balance, less than 3/4 achieve >90% on hop tests. graft type markedly influences hamstrings strength. Less than 1/5 (18.9%) of Male-HS and Female-HS reached >90% compared to 2/3 (66.7%) in Male-ITB patients.

INTRODUCTION: Degenerative hip osteoarthritis (OA) is a common progressive disorder causing disability. The injection of exogenous hyaluronic acid (HA), or viscosupplementation (VS), can potentially help restore the properties of synovial fluid. There is limited literature available evaluating the long-term efficacy and associated functional impact of VS in hip OA. PURPOSE: To determine if a single intra-articular injection of a high-molecular weight (HMW) VS would improve function and decrease pain in persons suffering from hip OA. METHODS: A double-blinded randomized control trial was conducted at a University Hospital Center in Canada. Patients were randomly allocated to either the treatment group, an ultrasound guided single intra-articular injection of a HMW HA, or the placebo group, a single extra-articular injection of local anesthetic. Participants underwent evaluations at 2 weeks prior to the injection (T0), and at 1 month (T1), 3 months (T2) and 6 months (T3) post injection. Patients completed two questionnaires; the Hip Disability and Osteoarthritis Outcome Score (HOOS) and the Short Form Survey (SF-36). Gait biomechanics were evaluated in a lab. RESULTS: Between May 2014 and September 2017, 38 participants were evaluated in this study over the course of 6 months. In the treatment group, N = 19 and in the placebo group, N = 18. The mean age at the time of injection was 55. On the HOOS symptom subscale, the placebo group worsened from T0 to T3 by 6.29% compared to the treatment group. The VS group improved their pain subscore from T0 to T3 by 7.82%. The control group worsened by 1.22% during that same time period and continued to deteriorate by 6.09% at T3. There were also improvements in the activities of daily living subscale from T0 to T3, with the treatment group improving by 5.29% while the placebo group worsened by 5.15%. The most important change occurred in the sports and recreational subscale of the HOOS. Between T0 and T3, the placebo group worsened by 17.82%. The treatment group improved by 6.67%. CONCLUSION: Our preliminary results suggest that a HMW VS hip injection for degenerative OA, when compared to true placebo, may lead to long-term improvements in pain relief, increase in function and in activity participation. NIH Clinical Trials Registry: NCT02068674

The Prevalence Of Obstructive Sleep Apnea Within A Professional Rugby League Team: An Exploratory Study
Johnpaul Caia1, Andrew Scotti, Shona L. Halson1, Vincent G. Kelly1, 1University of Queensland, Brisbane, Australia. 2Weledy Hospital, Brisbane, Australia. 3Australian Institute of Sport, Canberra, Australia. 

Cardiovascular Risks For Participation In Marathon Among The Adolescent Athletes In Sri Lanka - A Pilot Study
Sanka Thebuwanaarachchi. Teaching Hospital Karapitiya, Galle, Sri Lanka.

Undetected cardiovascular abnormalities are one of the major causes of sudden death in young athletes. Currently we lack data on this field in Sri Lanka. PURPOSE: To determine the prevalence, the associated factors of cardiovascular disease among the adolescent players and the cardiovascular risks for participating in marathon. METHODS: Research was conducted in three sports medicine clinics selected from the hospitals of three main provinces in the country including Western, Southern and Central provinces where sports medical officers’ conducted pre participation medical screening of players and documented in Pre participation Examination (PPE) forms. Study population consisted of adolescent players aged between 10 to 19y who attended previously mentioned clinics for medical clearance prior to the marathon run. Physically challenged players were excluded. Sample was selected from January 2015 to August 2015. The sample size was 900. Convenient cluster sampling method was incorporated. Pretesting was done which led to the amendments in the Data extraction sheet. Secondary data were collected from the PPE forms from the clinics. A cross-sectional analytical study was conducted to determine the prevalence and the associated factors of cardiovascular disease: RESULTS : Prevalence of cardiovascular diseases among adolescent players in Sri Lanka according to our study was 2.9%. Most common cardiac abnormality was Mitral Valve Prolapase. Mitral Stenosis, Ventricular Septal Defect and Aortic Stenosis were the other cardiac abnormalities detected. Important incidental finding of our study was a higher prevalence (6%) of bronchial asthma among adolescent players which was more than the cardiovascular disease. CONCLUSION : Properly conducted Pre Participation screening reveals underlying cardiovascular disease and it may be used as a tool to identify cardiovascular risks for participation in marathon among adolescent players and hence reduce sudden cardiac death incidents.
Immune and Hormones Levels Responses Before and After Specific Maximal Protocol of Brazilian Olympic Athletes
Hugo Tadashi Kano, Layene Peixoto Barros, Franz H. Burini, Roberto C. Burini. UNESP Medical School, Botucatu, Brazil. (Sponsor: Roberto C Burini, FACSM)  

(Athletes are overexposed to stress factors such as training routine, sleep and dietary pattern, which may influence immune function and hormones patterns modulating health and performance. Immune suppression after sport metabolic overload is an issue for elite athletes and should be considered during training log. Purpose: The purpose of this study was to evaluate Leukocytes, Testosterone and Cortisol responses to specific maximal protocol of elite brazilian athletes, and their relations dynamically. Methods: We evaluated 55 elite athletes (16 judo, 10 boxing and 29 rowing Olympic national athletes, 38 males and 17 females; 24.2±6.9yrs) for leukocytes (Leak) and hormones levels such as Testosterone (T) and Cortisol (C) taken blood samples before and after specific maximum effort protocol. Results: Leukocytes values before and after test were 7.4±2.13 and 10.02±1.7x10^3/mm^3 (pre vs post 2.6±10^3/mm^3); Cortisol levels were 15.3±3.72 and 16.21±1.9ng/mL (pre vs post 0.9ng/mL) and Testosterone 371.5±57.2 and 362.1±73.1ng/mL. Analyzing genders separately, post vs pre difference of Leukocytes, Testosterone and Cortisol levels for males and females were 2.4±10^3/mm^3, -18.8mg/dL, 0.5±mg/dL; 3.1±10^3/mm^3, 2.2mg/dL and 1.7mg/dL respectively. Conclusions: Leukocytes elevation after maximum effort were observed on males and females athletes despite sport modality, and these elevations were not associated with Testosterone or Cortisol variations during this protocol. Leukocytes response may be a primary indicator of immune response integrity compared with Testosterone declines or Cortisol elevations in response to sport induced stress protocol. Health issues, specially upper respiratory tract infections, has been associated with immune suppression after metabolic overload and should be focused besides sports adaptation to training log and competition.)

Oral BPA consumption of 50 μg/kg BW significantly increased glucose AUC, but not insulin or estrogen. These data provide the first direct evidence that endocrine disruptors like bisphenol A (BPA) may alter glucose and estrogen metabolism. The oral ingestion of BPA on glucose, insulin, and estrogen responses. Previous observational studies have shown a correlation between urinary bisphenol A (BPA) and type 2 diabetes, however the direct effects of BPA on risk markers in the pathogenesis of diabetes are unknown. Purpose: To determine the effects of oral ingestion of BPA on glucose, insulin, and estrogen responses. Methods: After an overnight fast, ten healthy college students (7M, 3F; 40 Hispanic, 210±0.8 yrs; 24.2±3.9 kg/m²) were block randomized, in a double-blinded fashion, to oral BPA-High (BPA: 100 μg/kg BW) and BPA-Low (BPA: 50 μg/kg BW) groups. Blood glucose, insulin, and estrogen concentrations and calculated AUC were measured during 0, 30 and 60-min of the OGTT to assess incretin effects. Results: Plasma glucose, insulin, and estrogen concentrations and area under the curve (AUC) were measured at baseline, minutes 15, 30, 45, 60, and then every 30 minutes for the next 2 hours in response to a 75g oral glucose tolerance test using a repeated measures ANOVA. Results: Compared to PL, BPA-Low AUC was significantly higher (p = 0.05) in BPA-Low and BPA-High (295 ± 139, 2239 ± 1255, 14030 ± 4550 mg/mL/min). Compared to PL, glucose AUC tended to be higher (p = 0.08) in BPA-Low and was significantly (p = 0.04) higher in BPA-High (1150 ± 23, 1233 ± 24, 1245 ± 30 mmol/L/min). Insulin AUC (6360 ± 382, 6527 ± 400, 5683 ± 462 μU/mL/min) and estrogen AUC (12154 ± 2752, 12611 ± 3236, 11145 ± 2263 μg/mL/min) were not significantly different between conditions (p = 0.05). Conclusion: Oral BPA consumption of 50 μg/kg BW significantly increased glucose AUC, but not insulin or estrogen. These data provide the first direct evidence in humans that consumption of BPA alters a risk marker in the pathogenesis of type 2 diabetes.

The Influence of Metabolic Syndrome on Cardiot Intima Media Thickness in Children
Robert E. Downing, Rebecca Place, Paul Visich. University of New England, Biddeford, ME.  

(No relevant relationships reported)}
Conclusions: Independent of insulin sensitivity and GLP-1, INT combined with LCD improved early-phase pancreatic function in obese adults when compared to an energy matched diet. Additional work is required to elucidate the mechanism(s) by which INT improves insulin secretion during weight loss to optimize diabetes prevention.

Several studies have reported improved glycemic control the day after a session of exercise, but it is unclear if this is a direct effect of exercise or an indirect effect of the exercise-induced energy deficit. The purpose of this study was to determine the effect of exercise deficit after acute exercise on free-living glycemic control the next day. Methods: 12 healthy subjects (male=4, female=8, age=28.6±8 yrs, BMI=24.6±3.2 kg/m², VO2max=36.1±10 mL/kg·min−1) completed two experimental trials, which were identical other than the energy content of the meals consumed after exercise. Before each trial, continuous glucose monitoring (CGM) probes were inserted in the abdominal region. On day 2, subjects were provided a standardized breakfast and lunch, then they exercised in the afternoon at 65% VO2max until 350 kcal were expended (~50 min). After exercise on one occasion, subjects consumed meals (~5% CHO, ~30% Fat, ~15% PRO) supplemented with calories to replenish the energy expended during exercise, thereby achieving energy balance (EB). On the other occasion, the meals after exercise were not supplemented with extra calories, inducing a 350 kcal energy deficit (ED). Throughout the next day, subjects ate identical meals in both the EB and ED trials, and free-living glycemic control was compared between trials starting at 0800h. Results: 3-hour post-prandial area under curve (AUC) was significantly lower after breakfast in EB compared with ED (27.5±3.0 vs. 29.4±3.1 mEq·h, p=0.03), but not different after lunch (28.8±4.2 vs. 27.9±3.3 mEq·h, p=0.38), dinner (28.7±3.3 vs. 27.3±3.3 mEq·h, p=0.50), or evening snack (27.8±3.5 vs. 26.8±2.1 mEq·h, p=0.45). Similarly, average postprandial glucose (3-hour) was lower after breakfast in ED vs. EB (5.6±0.7 vs. 6.0±0.8 mM, p=0.02), and not different between trials after the other meals. Despite differences in the glycemic response to breakfast, average 24-hour glycemic response did not differ between EB and ED (24-hour AUC: 27.2±2.5 vs. 26.5±2.1 mEq·h, respectively; p=0.2). Conclusion: Comparing with eating meals that replenish the energy expended during exercise, an exercise-induced energy deficit lowered the glycemic response to breakfast the next day - but this energy deficit did not impact total 24-hour glycemia the day after exercise. Supported by NIH Grant# R01 DK077966

Conclusions: by higher fasting and meal-induced suppression of FATox. Postprandial VL blood flow was also stimulated to a greater degree 1h post-exercise when compared to BL post-prandial measures. The impact of acute HIIE demonstrates MF can be improved acutely, prior to chronic adaptations. Supported By NIH Grant T32 AT 004904

Funded in part by a College of Human Sciences and Education Dean’s Circle Grant

2526 June 2 1:25 PM - 2:30 PM

Relationship between Cardiorespiratory Fitness and Relative Gut Microbiota Composition in Healthy Adults

Ryan P. Durk1, Esperanza Castillo1, Leticia Márquez-Magaña1, Gregory J. Grosicki2, Nicole Bolter3, C. Matthew Lee4, James R. Bagley1, 1San Francisco State University, San Francisco, CA; 2Tufts University, Boston, MA.

Purposes: Bacteria residing in the human gastrointestinal tract has a symbiotic relationship with its host. Animal models have demonstrated a relationship between exercise and gut microbiota composition. The purpose of this study was to explore the relationship between cardiorespiratory fitness and relative gut microbiota composition, measured by the ratio of Firmicutes to Bacteroidetes (F/B ratio) in healthy adults. Methods: Twenty-one males and 19 females (Age=26.1±2.8 y, BMI=24.0±4.2 kg/m²), who did not take antibiotics in the last 6 months, volunteered for this study. Participants completed a 3-month exercise trial, tracked their nutritional intake for 7 days (via MyFitnessPal3), and collected their stool sample with an OMNIGENE Gut® home stool collection kit. Body composition and maximal cardiorespiratory fitness (VO2max) were measured by air displacement plethysmography using the Bod Pod® and a symptom-limited graded treadmill test, respectively. Relative microbiota composition was determined by analyzing DNA extracted from stool samples using a Quantitative Polymerase Chain Reaction (qPCR) approach that specifically measured the amount of a target gene (16s RNA) found in Firmicutes and Bacteroidetes. Relationships between F/B ratio and potentially related dietary, anthropometric, and fitness variables were assessed using correlation analyses with appropriate Bonferroni adjustment (p=0.004). Results: Average F/B ratio in all participants was 0.94 and average VO2max was 45.8±8.8 mL/kg/min. F/B ratio was significantly correlated to VO2max (r=−0.45, p=0.004), but no other fitness, nutritional intake, or anthropometric variables (p>0.004). Conclusions: VO2max was responsible for ~20% of the variance of an individual’s relative gut bacteria as determined by F/B ratio. These data support animal findings by demonstrating a relationship between relative human gut microbiota composition and cardiorespiratory fitness in healthy adults. Future investigations should confirm this relationship in heterogeneous populations and investigate the utility of exercise training as medium to promote beneficial changes in gut microbiota.

Introduction: Maternal high fat diets (HFD) result in excess fat accumulation in the liver of offspring, known as hepatic steatosis. Maternal exercise during this crucial period of fetal development can be protective against hepatic steatosis in older offspring. However, it is unknown whether these protective effects can be seen in younger offspring. Here we sought to determine whether maternal exercise would attenuate maternal HFD-induced steatosis in young adult rats. Methods: Female Wistar rats (7-8 weeks of age) were randomized into one of four groups: HFD (42% fat, 10% sucrose) or ND (ND) with either exercise (RUN) or sedentary (SED) for 18 weeks. Results: Male offspring had increased body mass compared with females (p<0.05). Maternal HFD-induced increases in male offspring body mass was attenuated in the HFD/RUN offspring (p<0.05). Maternal HFD feeding significantly increased hepatic steatosis in male (but not female offspring), which was not attenuated by maternal RUN. Male offspring had increased (p<0.05) hepatic markers of mitochondrial biogenesis and mitophagy (TFAM, PPARγ, NRF2) in all offspring and the mitophagy marker BNIP3 in HFD/RUN offspring. Interestingly, hepatic markers of de novo lipogenesis (FAS, ACC), mitophagy (ATG12:5, BNIP3, P62, LC3 II), and mitochondria biogenesis/content (TFAM, OXPHOS-Complex II) were significantly increased in female offspring, but not maternal RUN. Conclusion: Although maternal exercise did not attenuate maternal HFD-induced hepatic steatosis as has been previously reported in older adult offspring, it did significantly increase hepatic markers of mitochondrial biogenesis and autophagy/mitophagy. Furthermore, female offspring had elevated hepatic markers of mitochondrial health which may possibly explain why female

Abstracts were prepared by the authors and printed as submitted.
Exercise is an effective therapy for numerous pathological conditions that are associated with elevated metabolites and inflammatory factors. These chemicals can activate receptors on peripheral sensory neurons, such as Acid Sensing Ion Channels (ASICs) and Transient Receptor Potential Vanilloid 1 (TRPV1). High-intensity exercise can induce release of protons, metabolites, and inflammatory factors, which are known to activate ASICs and TRPV1 and elicit reflex-mediated changes in hemodynamics and respiration, as well as pain perception and fatigue. Diminishment of these sensory pathways might contribute to the benefits of exercise in disease conditions by reducing deleterious sympathoexcitation and associated inflammation. Supported by Department of Veteran Affairs.

Amnestic mild cognitive impairment (aMCI) is the typical prodromal stage of Alzheimer’s disease (AD). To date, pharmacological treatments in aMCI are of modest efficacy. Evidence suggest that physical exercise may promote structural and functional brain changes in healthy adults and clinical settings. However, the extent to which comparable effects can be observed in aMCI remains unclear. PURPOSE: Identify brain mechanisms underlying neurocognitive effects of aerobic training in aMCI. METHODS: 23 subjects with aMCI (age 70.9±5.6) were assigned to aerobic (AT, n=11) or balance and coordination (BAC, n=12) groups. Intervention lasted 16 weeks, 3 sessions/week. AT intensity gradually increased to 70-80% of heart rate reserve (HRR), while BAC was kept below 30%. HRR and peak oxygen consumption (Vo2peak) were determined using cardiopulmonary exercise test. Subjects underwent fMRI sessions, evaluating neural pattern during tasks, known to be sensitive in aMCI (i.e. face-name associative memory and processing of complex auditory information). Neuroradiological assessments were performed to evaluate changes in cognitive domains including verbal and spatial memory, and executive functions. RESULTS: Increased activity in bilateral hippocampi was found in the AT group post intervention (p<0.007), while increased activity in left fusiform gyrus was shown in the BAC group (p<0.008), during memory encoding. During information processing, both groups demonstrated increased responses in high-order cognitive and language areas (e.g. temporo-parietal junction and inferior frontal gyrus), representing greater resemblance to normal aging patterns, compared to pre-training [q(FDR)<0.05]. Changes in Vo2peak were correlated with changes in executive functions in the AT group, including semantic verbal fluency (r=0.819, p<0.002) and phonemic verbal fluency (r=0.611, p<0.03). Improvements in immediate recall (normalized Z-score change 0.74±0.38 vs 0.015) and delayed recall (0.71±0.71, p<0.005) of verbal information (1st & 8th repetitions of the Rey auditory verbal learning test) were demonstrated in the BAC group. CONCLUSION: Both aerobic and non-aerobic (low-intensity balance and coordination) training modalities may promote neuroplastic changes in older individuals with aMCI and high risk of AD.
Aerobic Exercise and Cerebral White Matter Integrity in MCI Patients: A 1-Year Randomized Controlled Trial

Takashi Tarumi, Binu P. Thomas, Rong Zhang, J. Carson Smith, FACSMD, 'Johns Hopkins University, Baltimore, MD. 'University of Maryland, College Park, MD. (Sponsor: Dr. J. Carson Smith, FACSMD) (No relevant relationships reported)

Cerebral white matter (WM) represents the structural substrate of neuronal communications and is damaged in dementia patients. Aerobic exercise training (AET) may improve cerebral WM integrity in healthy older adults, but its effect in populations at risk for dementia remains unclear. PURPOSE: To determine the effect of AET on cerebral WM integrity in patients with amnestic mild cognitive impairment (MCI).

METHODS: We conducted a 1-year, single-blinded, parallel randomized controlled trial of AET and stretching intervention programs in patients with MCI. At baseline and post intervention, diffusion tensor images (DTI) were acquired to measure the volumes of cerebral WM and WM hypointensities. Maximal oxygen consumption (VO2max) was measured at pre and post intervention. RESULTS: Thirty-six MCI patients completed AET (n=16) or stretching (n=20) program with the baseline and post-intervention cerebral WM and WM hypointensities. Maximal oxygen consumption (VO2 max) was 19.1% (SE=±2.42) of Mmax in the STIM trials and 17.4% (SE=±2.06) in the SHAM trials, showing a significant increase of 1.73% with STIM (p = 0.0016). CONCLUSIONS: Subjects showed an increase in spinal excitability while undergoing STIM. The results demonstrate that the spinal flexors play a role in the motor adaptation response to imperceptible vibration. This increase in spinal excitability suggests that the performance benefits of imperceptible noise stimulation may have a rapid onset, on the order of 10-20 milliseconds, in contrast to cortical mechanisms which are greater than 100 milliseconds. Determining which motor centers mediate the behavioral response to noise stimulation, and to what degree, will help define the optimal parameters for the application of noise stimulation.

Aerobic Exercise Regulates Synaptic Transmission by Attenuating Oxidative Stress in the Paraventricular Nucleus of Spontaneously Hypertensive Rats

Li ZHAO, Yan LI, Boya GU, Yuanyuan LV. Beijing Sport University, Beijing, China. (No relevant relationships reported)

Synaptic transmission in the hypothalamic paraventricular nucleus (PVN) plays a key role in the control of sympathetic outflow. Whether exercise training associated with reduced sympathetic activity and oxidative stress in hypertension is implicated in changes in sympathetic drive in the PVN remains unclear. METHODS: In the present study, spontaneously hypertensive rats (SHRs) were subjected to exercise training for 8 weeks, five times per week, and Westar Kyoto (WKY) rats as control cohort. Miniature excitatory and inhibitory postsynaptic currents (mEPSCs and mIPSCs) were recorded from PVN in vivo hypothalamic slice preparations obtained after the last training, and biomarkers of oxidative stress and physical indexes were observed. RESULTS: The mean frequency and amplitude, as well as the rise time and the decay time constant of mIPSCs, were significantly decreased in 20-wk-old SHRs compared with WKY 20-wk-old controls. In contrast to mEPSCs, only the mean mEPSCs frequency was higher, and there were no other changes in mEPSCs in comparison to the control group. SHRs exhibited higher ROS, 8-OHdG, and MDA, and lower SOD1, SOD2, CAT, Ogg1, and SOD activity, CAT activity in the PVN. These SHRs also had a significant increase in heart rate, blood pressure and sympathetic nerve activity, and higher levels of norepinephrine (NE). Exercise training ameliorated all these changes, resulting in an increase in the mean frequency, amplitude and the kinetics of mIPSCs, accompanied by a decrease in the mean frequency of mEPSCs in the PVN. CONCLUSIONS: This study demonstrates that moderate intensity, high frequency exercise training induces antioxidant-related adaptations in the PVNs of SHRs, which in studies results in a selective enhancement of inhibitory synaptic transmission partly to recue autonomic nerves and reduce blood pressure in hypertension.
Background: Traumatic anterior cruciate ligament (ACL) rupture can lead to bilateral deficits in balance, skilled movement, and force production. Such deficits persist for years independent of knee musclecaul or joint translation. Recently, others have demonstrated reduced cortical sensorimotor excitability and hemodynamic activity in conjunction with increased cortical inhibition and normalized spinal inhibition. The consequences of traumatic musculoskeletal injury (MSI) appear to extend to the brain, with maladaptive neuroplasticity contributing to disability. Non-invasive brain stimulation (NIBS) represents a promising strategy to modulate corticospinal activity after traumatic MSI, but therapeutic efficacy is untested. Objective: To examine the influence of NIBS on behavioral and neurophysiological activity after ACL rupture.

Methods: Twenty participants were randomized, sham-controlled, double-blind, cross-over study. Nine experienced traumatic ACL rupture and reconstruction within five years of the study (ACL: 1~9, age 20.6±2.3, height 166.1±18.0 cm, weight 68.1±9.1 kg). Eleven matched participants with no history of lower body injury served as controls (CON: N=11, 20.3±1.4yr, 165.0±5.3 cm, 65.7±8.4 kg). Participants completed a familiarization visit followed by two treatment visits with active or sham intermittent theta-burst stimulation (iTBS) applied to the injured (or non-dominant) motor cortex (M1) leg representation. Voluntary activation, force production, and corticospinal dynamics were examined. Results: The protocol was well tolerated. Active stimulation increased voluntary activation (4.2±1.4%, p < 0.01), relative force (44.22±14.21%, p < 0.01), and MEP amplitude (10.9±3.1%, p < 0.00) in the injured leg. Stimulation normalized superimposed twitch force (208.3±0.22N, p < 0.00) and contralateral silent period duration (10.91±5.13ms, p < 0.05). Conclusions: One bout of NIBS was sufficient to normalize behavioral and corticospinal dysfunction 3.2±1.1 yr after ACL, with distinct effects on the interhemispheric motor system network. Future work on the effects of repeated treatments, injury characteristics, and timing is needed. Nevertheless, traumatic MSI may be added to the list of conditions with neurological aspects responsive to NIBS.

2537

June 1 2:45 PM - 3:00 PM
Are Exercise Effects on Valence-Modulation of the Acoustic Startle Eyeblink Response Trait Dependent?
Kathryn Elizabeth Wilson1, Jianchun Yin2, Rodney King Dishman, FACSM1. 1University of Nebraska Medical Center, Omaha, NE. 2Shanghai Normal University, Shanghai, China. 1University of Georgia, Athens, GA. (Sponsor: Rodney K. Dishman, FACSM) (No relevant relationships reported)

Purpose: This laboratory experiment tested the hypotheses that 1) changes in sensitivity to emotional stimuli would manifest for those stimuli to which one is sensitive to affective cues and have been primarily restricted to prescribed (rather than self-selected) exercise intensities. It is possible that effects of exercise on affective processing of appetitive and aversive stimuli are moderated by motivational dispositions (approach/avoidance) reflective of individual differences in functioning of neural systems responsible for behavioral inhibition and behavioral activation (BIS/BAS traits). It is also possible that effects are influenced by perceived control of the exercise intensity.

Methods: We examined affective modulation of the acoustic startle eyeblink response during affective picture viewing before and after moderate intensity exercise with and without the opportunity to adjust intensity, or quiet rest among 58 undergraduates scoring high or low for BIS/BAS traits.

Results: A 4-way mixed-model ANOVA indicated a main effect for valence [F(2, 108) = 16.21, p < 0.01; η² = 0.28], with consistent expected effects of picture content. There were no effects of personality group (p > 0.18; η² ≤ 0.08). Helmer’s contrasts revealed a 3-way qualitative interaction between valence, condition and time [F(1, 54) = 6.2, p < 0.02, η² = 0.10]. Follow-up RM-ANOVA’s revealed a quadratic valence X time interaction during the prescribed exercise condition [F(1, 57) = 7.38, p < 0.01; η² = 0.12]; the reduction in ASER magnitude in response to neutral stimuli was greater than expected in the exercise condition. These effects were not observed in the adjustable exercise or control conditions.

Conclusions: Results confirm that cycling exercise does not alter emotional response to affective pictures, regardless of motivational disposition, and extend the evidence to conditions in which participants can alter the exercise intensity.

F-12

Free Communication/Slide - Gait and Biomechanics

2538

June 1 1:00 PM - 1:15 PM
Effect of Forefoot Type on Self-reported Pain in Minimalist and Traditionally Shod Runners
Jean L. McCrory, FACSM1, Lauren K. Cline2, Erica Casto3, Kyla M. Galfreath4. 1West Virginia University, Morgantown, WV. 2University of Massachusetts, Amherst, MA. (Sponsor: Derek M. Galbreath, FACSM) (No relevant relationships reported)

Distance running is a popular recreational activity despite high rates of overuse injury. The efficacy of wearing minimalist shoes to prevent injury has been debated. We previously reported that minimalist runners are more likely to experience site-specific lower extremity pain; however, no clear relationship has been established between shoe type, forefoot (FF) shape (Egyptian, Morton’s, or square), and pain. Therefore, the purpose of this study is to examine self-reported pain in the lower limbs in minimalist and traditionally shod runners with various forefoot types.

Methods: Following consent, 48 experienced runners (age: 27.5±9.3 yrs, height: 172.2±10.2 cm, mass: 70.7±16.6 kg; gender: 20M/28F) running at least 10 miles a week for the past three months, completed a visual analog scale (VAS) about pain they experience in five common sites of injury: knee, ankle, calf, shin, and foot. A score of 3-5 on the VAS was considered pain. Shoes were categorized as either minimalist (n=40 feet, midsole drop <4mm) or traditional (n=56 feet, midsole drop >4mm). Superior view photographs were taken of the FF and were categorized as type shoe (minimalist, traditional) and forefoot type (EF, MF, SQ) related to pain (yes, no). (p<0.05). Results: More minimalist runners reported EF reported pain (61.8%; p=0.004) when compared to MF (50%) or SQ (20%). More minimalist runners with EF reported calf pain (77.8%; p=0.028) than those with MF (0%) or SQ (20%). FF type did not relate to pain at any other site.

Conclusion: Runners with EF are more likely to report pain at least one location, and specifically in the calf, than runners with other FF shapes when wearing minimalist vs traditional shoes. Minimalist shoes encourage the runner to strike the ground with the forefoot; however, this may result in more eccentric loading of the calf musculature and Achilles tendon. Our minimalist runners reported no pain with other FF types. Other FF types may be better able to absorb the foot contact and muscle forces better than a more typical foot when wearing minimalist shoes.

2540

June 1 1:15 PM - 1:30 PM
Sagittal Plane Gait Mechanics are Associated with Femoral Cartilage Thickness After ACL Reconstruction

Derek N. Pamukot1, Tyler J. Moffit2, Michael N. Vakula1, Skylar C. Holmes3, Steven A. Garcia1, Melissa M. Montgomery1. 1California State University, Fullerton, Fullerton, CA. 2Utah State University, Logan, UT. (Sponsor: Daniela Rubin, FACSM) (No relevant relationships reported)

Individuals with ACL reconstruction (ACLR) are at greater risk for knee osteoarthritis (OA) due to aberrant walking biomechanics. Cartilage morphology is typically imaged using magnetic resonance imaging, but ultrasonography may provide a cost-effective alternative method. PURPOSE: To evaluate the association between sagittal plane mechanics and femoral cartilage thickness in individuals with ACLR. METHODS: 33 individuals with primary unilateral ACLR (age=22.2±2.9 years; body mass index=24.2±4.5 kg/m²; time since ACLR=55.8±31.6 months; 73% Female; IKDC=85.7±9.5; 16 patellar tendon; 8 hamstring tendon; 9 allograft) participated in this study. Femoral cartilage thickness was assessed at the medial (MC) and lateral (LC) femoral condyle, and in the proximal medial (PM), central (CM), and distal (DM) areas using ultrasonography on 140° of knee flexion. Participants completed 5 walking trials at a self-selected speed while striking consecutive force plates, and data were extracted from the first 50% of stance phase. Kinematic variables included the peak knee flexion angle (KFA), knee flexion angle at heel contact (KFAH), and knee flexion excursion (KFE). Kinetic variables included the peak external knee flexion moment (KFM) and angular impulse (KFI). Partial correlation adjusted for gait speed and time since ACLR was used to analyze the relationship between ultrasound and gait variables (p<0.05). RESULTS: After adjusting for gait speed and time since ACLR, greater KFI was associated with thicker MC cartilage (r=0.46, p=0.006). Trends were observed between greater KFI and
Kinematics And Muscle Activity While Running In Minimalist, Neutral, And Ultra-cushioning Shoes

James Becker1, Brianne Borgia2. 1Montana State University, Bozeman, MT. 2University of Nevada, Las Vegas, Las Vegas, NV.

Abstracts were prepared by the authors and printed as submitted.
Frontal plane mechanics, such as hip adduction angle and base of gait (BOG), have been implicated as causes for running-related injuries such as iliotibial band syndrome and patellofemoral pain. While modification of frontal plane variables may be a way to alter injury risk, the effect of speed and sex on frontal plane mechanics has not been investigated. Describing these effects may facilitate more appropriate prescription of gait retraining to reduce injury risk. **PURPOSE:** To determine the influence of sex and speed on frontal plane kinematics during running. **METHODS:** Whole body kinematics and ground reaction forces were collected for 99 NCAA Division I collegiate athletes (52 males) during treadmill running at 2.68, 3.35, and 4.47 m/s. Athletes were healthy at time of testing and had no history of lower extremity surgery. BOG at midstance (cm), hip adduction at initial contact (ADDIC, deg), peak hip adduction (ADDPK, deg), and peak contralateral pelvic drop (PELPK, deg) for the right limb were compared between sex and speed using 2-way repeated measures ANOVAs. **RESULTS:** A significant sex by speed interaction (p < 0.01) for BOG was observed. BOG decreased significantly (p < 0.01) with speed for both sexes. Females exhibited larger BOG than males at 3.35 and 4.47 m/s (females: 6.6 ± 1.5 cm and -0.1 ± 1.5 cm, males: 0.2 ± 2.4 cm and -0.9 ± 2.5 cm for 3.35 and 4.47 m/s, respectively). No significant interactions (p > 0.40) were observed for ADDIC, ADDPK, or PELPK. There was a significant speed main effect for ADDIC, ADDPK, and PELPK. ADDIC, ADDPK increased significantly with speed (p < 0.01). PELPK at 2.68m/s was significantly less than 3.35 and 4.47m/s (p < 0.01, mean difference = 0.5 deg). Females demonstrated greater ADDIC and ADDPK than males (p < 0.01, mean difference = 2.0 deg for both ADDIC and ADDPK). **CONCLUSIONS:** Females demonstrate a wider BOG than men at faster running speeds. Females also demonstrate greater hip adduction than men at the same running speed. As a result, both sex and speed must be considered when assessing frontal plane kinematic variables, particularly with regard to identifying excessive motion which may be related to injury.

**BACKGROUND:** To date limited studies incorporating prolonged runs in healthy runners have produced conflicting results. Furthermore, kinematic variability of the ankle, knee and hip have not been assessed, nor has hip strength been measured simultaneously. Rather previous studies have focused on foot contact angle variability and stride time variability. **PURPOSE:** To compare changes in lower limb strength & kinematic variability after a prolonged run in healthy runners. **METHODS:** 7 healthy subjects (25±2.5 years, 1.77±0.12 m, 65.2±19.9 kg) volunteered for this study. Subjects ran on a motorized treadmill for an average of 44.3±1.9 minutes at a self-selected training pace. 3D kinematic data were collected after 5 minutes of running and again at the end of the run at 200Hz using reflective markers placed on the lower body with 6 infrared cameras. Variables of interest included ankle, knee and hip sagittal, frontal and transverse planes of motion before and after the run using a handheld dynamometer. Each subject performed 3 maximum voluntary isometric contractions (MVCs) for each motion. The highest number for each motion was recorded.
RESULTS: The mean number of accumulated years of health care expenditures was 6.2 years, and the average annual total health care cost was $7,813/person/year. After adjustment, average annual expenditures were lower for adults who were consistently active (i.e., 7 hrs/week MVPA throughout adulthood), aggressive improvers (i.e., very little activity during adolescent but consistent 7 hrs/week during adulthood), and with a lull in 20-30s (i.e., very active during adolescent, moderately active in 20-30s, very active in mid-life) when compared to those who did no MVPA in any life-period (i.e., consistently inactive) (See Table). Detailed sensitivity analyses did not reveal evidence of confounding or effect modification.

CONCLUSION: Adults that are consistently active or show substantial MVPA improvement throughout adulthood have lower health care expenditures after age 65. Strategies that promote physical activity throughout adulthood may help reduce Medicare expenditures.

<table>
<thead>
<tr>
<th>Trajectory (N)</th>
<th>Average marginal decrease (per person/year)</th>
<th>Average marginal decrease (per person/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age-adjusted</td>
<td>Multivariable</td>
</tr>
<tr>
<td>Consistently inactive (743)</td>
<td>$-1,116 (-$1,185, $1,047)</td>
<td>$-818 (-$2,061, $425)</td>
</tr>
<tr>
<td>Moderate improver (1,988)</td>
<td>$-1,540 (-$2,382, $-2,327)</td>
<td>$-48 ($1,249, $1,154)</td>
</tr>
<tr>
<td>Consistent lull (3,273)</td>
<td>$-1,165 (-$2,299, $-31)</td>
<td>$-37 ($-144, +$39)</td>
</tr>
<tr>
<td>Aggressive improver (1,168)</td>
<td>$-1,116 (-$1,185, $1,047)</td>
<td>$-818 (-$2,061, $425)</td>
</tr>
<tr>
<td>Early improver &amp; late decliner (1,128)</td>
<td>$-1,044 (-$1,122, $-983)</td>
<td>$-101 (-$1,357, $1,155)</td>
</tr>
<tr>
<td>Moderate decliner (2,028)</td>
<td>$-2,110 (-$2,382, $-2,327)</td>
<td>$-48 ($1,249, $1,154)</td>
</tr>
<tr>
<td>Fast decliner (1,676)</td>
<td>$-319 (-$393, -$247)</td>
<td>$-250 (-$1,518, $1,018)</td>
</tr>
<tr>
<td>Consistently active (5,220)</td>
<td>$-1,421 (-$1,488, $-1,154)</td>
<td>$-1,165 (-$2,299, $-31)</td>
</tr>
<tr>
<td>Steady decliner (1,802)</td>
<td>$-37 (-$144, -$39)</td>
<td>$-115 (-$1,389, $1,160)</td>
</tr>
<tr>
<td>Lull in 20-30s (2,724)</td>
<td>$-1,607 (-$1,675, $-1,540)</td>
<td>$-1,423 (-$2,602, $-244)</td>
</tr>
</tbody>
</table>

PURPOSE: The purpose of this study was to investigate the associations of changes in occupational sitting time and self-rated quality of life (QOL) in adult sedentary office workers undergoing a sedentary behavior intervention. METHODS: Data were derived from the ongoing study ‘Stand & Move at Work’, a group randomized trial aimed at reducing employee sedentary time through individual, environmental, and policy level changes. Physical functioning and mental health QOL scores were assessed with the SF-12 questionnaire. Sitting time (min/day) throughout the work day was assessed by the activPAL accelerometer/inclinometer with seven days of continuous wear. Work logs were used to isolate sitting minutes at work. These measures were assessed at baseline and at the three month time-point during the intervention. Change over time was computed for all variables by subtracting the individual 3-month value assessed at baseline and at the three month time-point during the intervention. Change over time was computed for all variables by subtracting the individual 3-month value assessed at baseline and at the three month time-point during the intervention. Change over time was computed for all variables by subtracting the individual 3-month value assessed at baseline and at the three month time-point during the intervention.

CONCLUSIONS: Decreases in sitting time were associated with improvement in self-reported physical functioning quality of life but not in mental health quality of life. Longer term results over 12 months of intervention and comparisons between the two different intervention arms may shed more light on the robustness and interpretation of the possible link between sitting time and quality of life domains.
30 min) with an equal amount of time in a given type of activity (short sedentary bouts, LIPA, or MVPA) on all-cause mortality risk. **RESULTS:** Over a median follow-up of 5.5 years, there were 647 deaths. There was no association for replacing prolonged, uninterrupted sedentary bout time with both LIPA (per 30-minute HR: 0.85; 95% CI: 0.80-0.90) and MVPA (per 30-minute HR: 0.69; 95% CI: 0.52-0.90) on all-cause mortality risk, but no association for replacement with shorter sedentary bouts (per 30-minute HR: 0.99; 95% CI: 0.96-1.03). **CONCLUSIONS:** In this national cohort study of middle-aged and older adults, replacing prolonged, uninterrupted sedentary bouts with shorter sedentary bouts was not associated with a reduction in all-cause mortality risk. Instead the all-cause mortality risk incurred by prolonged, uninterrupted sedentary bouts was only reduced by LIPA or MVPA.

**Background:** Insufficient physical activity is a well-established risk factor for chronic disease and early mortality. More recent evidence suggests that excess sitting time may be an additional risk factor, independent of physical inactivity. This may be due, at least in part, to the displacement of physical activities with sedentary behaviors.

**Purpose:** To examine the mortality risk reductions associated with replacing thirty minutes of daily sitting time for an equivalent duration of physical activity.

**Methods:** Participants included 40,866 men and 60,891 women in the Cancer Prevention Study-II Nutrition Cohort. An isotemporal substitution approach to Cox proportional hazards regression models were used to estimate adjusted hazard ratios (HR) and 95% confidence intervals (HR, 95% CI) for all-cause mortality associated with the substitution of thirty minutes of daily sitting time with an equal duration of light or moderate-to-vigorous intensity physical activity (LIPA, MVPA).

**Results:** During 14 years (1999-2013) of follow-up, 16,163 men and 15,638 women died. Overall, reallocation of 30 min/day of sitting to LIPA (HR=0.94, 0.92-0.97) or MVPA (HR=0.91, 0.88-0.93) was associated with significant reductions in mortality risk. Among the least active participants, the replacement of 30 min/day of sitting time with 30 min/day of LIPA was associated with a 14% mortality risk reduction (HR=0.86, 0.83-0.89) and replacement with MVPA was associated with a 50% mortality risk reduction (HR=0.50, 0.44-0.58). Similar associations were seen among the moderately active group (HR=0.91, 0.89-0.93 for LIPA replacement, HR=0.65, 0.56-0.79 for MVPA replacement). However, among the most active participants, substitution of sitting time with LIPA or MVPA was not associated with a significant reduction in mortality risk (HR=1.00, 0.97-1.02, HR=0.97, 0.95-1.01, respectively).

**Conclusions:** Among the least active and moderately active, the replacement of modest amounts of sitting time with either LIPA or MVPA was associated with longevity, although the associations were strongest when sitting time was replaced with MVPA.

**Purpose:** Identification of physiological changes that predict functional decline and reflect the onset of cognitive change may identify mechanisms common to mobility and cognition; potentially leading to earlier diagnoses and intervention efforts. Although greater peak VO₂ and walking efficiency have been linked to better preservation of physical functioning with aging, it is unclear how changes in energy reserve affect cognitive performance. The objective of this study was to assess the association between longitudinal changes in energy reserve and cognitive performance in a cohort of well-functioning adults.

**Methods:** Peak VO₂ (mL/kg/min), the energetic cost of a 5-min 1.5 mph treadmill walk (mL/kg/min), and cognitive performance were assessed in over 1000 participants (mean baseline age 67.5 y, range 24-96, 49% male) of the Baltimore Longitudinal Study of Aging. The primary outcomes were changes in the domains of attention, memory, and executive function over an average of 4-years (range 1-7 yrs), measured through a neuropsychological battery at each visit. The primary predictor was energy reserves (mean walking VO₂, peak VO₂). The association between change in energy reserve and change in cognitive performance was modeled using linear regression models with generalized estimating equations for repeated measures, adjusted for age, sex, body mass index (kg/m²), race, education, number of chronic conditions, and an interaction between energy reserves and age.

**Results:** In fully adjusted population average models, a significant interaction between energy reserves and age was observed for memory (β = -0.42, p<0.001), executive function (β = 1.63, p<0.001), and attention (β = -0.19, p=0.04), indicating that declining energy reserves contributed to poorer cognitive performance in all domains over time. Z-scores indicate these effects were greatest for memory, followed by executive function and attention.

**Conclusions:** Among well-functioning, community-dwelling adults, declining energy reserves are linked to poorer cognitive performance over time. This evidence indicates that combining measures of energy capacity and energy cost to assess physiologic reserve may serve as an early indicator of cognitive decline and convey evidence of those at risk of poorer cognitive outcomes over time.

**Purpose:** To examine the mortality risk reductions associated with replacing thirty minutes of daily sitting time for an equivalent duration of physical activity.

**Methods:** Participants included 40,866 men and 60,891 women in the Cancer Prevention Study-II Nutrition Cohort. An isotemporal substitution approach to Cox proportional hazards regression models were used to estimate adjusted hazard ratios (HR) and 95% confidence intervals (HR, 95% CI) for all-cause mortality associated with the substitution of thirty minutes of daily sitting time with an equal duration of light or moderate-to-vigorous intensity physical activity (LIPA, MVPA).

**Results:** During 14 years (1999-2013) of follow-up, 16,163 men and 15,638 women died. Overall, reallocation of 30 min/day of sitting to LIPA (HR=0.94, 0.92-0.97) or MVPA (HR=0.91, 0.88-0.93) was associated with significant reductions in mortality risk. Among the least active participants, the replacement of 30 min/day of sitting time with 30 min/day of LIPA was associated with a 14% mortality risk reduction (HR=0.86, 0.83-0.89) and replacement with MVPA was associated with a 50% mortality risk reduction (HR=0.50, 0.44-0.58). Similar associations were seen among the moderately active group (HR=0.91, 0.89-0.93 for LIPA replacement, HR=0.65, 0.56-0.79 for MVPA replacement). However, among the most active participants, substitution of sitting time with LIPA or MVPA was not associated with a significant reduction in mortality risk (HR=1.00, 0.97-1.02, HR=0.97, 0.95-1.01, respectively).

**Conclusions:** Among the least active and moderately active, the replacement of modest amounts of sitting time with either LIPA or MVPA was associated with longevity, although the associations were strongest when sitting time was replaced with MVPA.

**Purpose:** The U.S. Department of Health and Human Services (HHS) charged an external federal advisory committee to review the scientific literature and provide independent recommendations to the government to inform the development of the second edition of the Physical Activity Guidelines for Americans.

**Methods** The Committee asked 38 questions on relationships between physical activity and health outcomes in systematic literature reviews. A grading rubric was used to evaluate the strength of evidence - Strong, Moderate, Limited, or Grade Not Assignable (insufficient evidence). A grade of ‘strong’ indicated that evidence from the literature directly applied to the systematic review question; was free from serious doubts about generalizability; limited the risk of bias; showed consistency in the direction and approximate size of the effect across studies; and provided considerable confidence in the accuracy of the findings. The Committee presented its conclusions and recommendations.

**Results** The Committee concluded there was strong evidence that physical activity has a beneficial effect on many health outcomes, including improvements in weight and bone health in children under age six, physical function in older adults, and incidence of seven types of cancer. Examples are provided in Table 1.

**Conclusion** The Committee’s systematic reviews will be compiled into a Scientific Report and submitted to the HHS Secretary. The Department will use the Committee’s evidence-based recommendations, as well as public and federal agency comments, to develop the second edition of the Physical Activity Guidelines for Americans. The Committee’s work firmly grounds the second edition of the Physical Activity Guidelines for Americans in the current science on physical activity and health.
Conclusion Statement

For the general population, strong evidence demonstrates that attenuated exercise, and PV expansion were measured using echocardiography (rest and during exercise). Hypervolemia augmented supine SV further in Y (68±4 ml/beat, compared to O women, who exhibited very small increases in SV during hypervolemic exercise (i.e., <5 ml/beat). CONCLUSIONS: Healthy older women appear to have a reduced ability (relative to younger women) to utilize acute increases in preload to raise left ventricular stroke volume, including during large muscle exercise. These findings likely reflect the combined effects of exceptional lusitropic function in younger women, and a less compliant ventricle in the aged female heart.

Cardiac Physiology

HF reduced FS by 50% (HF: 24 ± 2%, CON: 48 ± 3%; p < 0.001; indicative of moderate severity HF. CS was reduced by ~15% in HF rats compared to CON (38 ± 1 vs 45 ± 1 m/m; p = 0.001). D′ was not different (HF: 79 ± 13 m; p = 0.34). CS was positively correlated with FS (r = 0.9, p < 0.001). For the general population, strong evidence demonstrates a relationship between greater amounts of physical activity and risk of gestational diabetes mellitus. That FS was correlated with CS has important mechanistic and clinical implications. D′ can be resolved in an animal model of moderate HF where CS is reduced but D′ is not different (HF: 79 ± 13 m; p = 0.34). CS was positively correlated with FS (r = 0.9, p < 0.002); D′ was not (r = -0.33, p = 0.42). CS was positively correlated across species in health and disease. The parameters of this relationship, critical speed (CS) and D′ represent the aerobic and ‘anaerobic’ capacities of the animal and in combination accurately predict exhaustion. Elucidating the determining mechanisms of CS and D′ in HF will allow for development of more efficacious therapies. PURPOSE: To establish the power-duration relationship in a validated model of HF and elucidate the mechanism(s) that determine CS and D′. Specifically, we tested the hypotheses that: 1) CS (but not D′) would be reduced in HF; and 2) measurements of heart function would correlate with CS. METHODS: Nine adult female Sprague-Dawley rats were randomized to control (CON; n = 4) or HF (n = 5) groups. HF was induced via surgical myocardial infarction and the rats were given ≥ 21 days to recover. Multiple constant speed treadmill runs to exhaustion were used to determine CS and D′ in both groups. HF was induced via surgical myocardial infarction and the rats were given ≥ 21 days to recover. Multiple constant speed treadmill runs to exhaustion were used to determine CS and D′ in both groups. Doppler echocardiography was used to evaluate heart function (i.e., fractional shortening (FS) which approximates ejection fraction) following CS and D′ determination. RESULTS: HF reduced FS by 50% (HF: 24 ± 2%, CON: 48 ± 3%; p < 0.001); indicative of moderate severity HF. CS was reduced by ~15% in HF rats compared to CON (38 ± 1 vs 45 ± 1 m/m; p = 0.001). D′ was not different (HF: 79 ± 13 m; CON: 61 ± 13 m; p = 0.34). CS was positively correlated with FS (r = 0.9, p < 0.001), D′ was not (r = -0.33, p = 0.42). CONCLUSION: CS and D′ can be resolved in an animal model of moderate HF where CS is reduced but D′ is not. Crucially, this HF model is free from the prescription therapeutics that confound interpretation of the mechanistic relationship between HF and CS or D′ in humans. That FS was correlated with CS has important mechanistic and clinical implications.

Structural and Functional Determinants of Critical Speed in Heart Failure

Fractional Shortening (%)

Healthy Left Ventricle

Infarcted Left Ventricle

Filling pressures (E/E′). E/A ratio during peak resting preload conditions (i.e., supine hypervolemia), moreover, was positively associated with VO2peak in Y, but not in O women. During upright exercise, hypervolemia increased SV an average of 15 ml/beat across all 4 work intensities in Y women (p=0.05 vs. normovolemia). This was in contrast to O women, who exhibited very small increases in SV during hypervolemic exercise (i.e., <5 ml/beat).

2612 Board #2

June 1 3:15 PM - 5:15 PM Critical Speed in Heart Failure Rats: The Central Determinant of Performance

Jesse C. Craig, Joseph H. Merino, Daniel M. Hirai, Trenton D. Colburn, Ayaka Tabuchi, Jacob T. Caldwell, Carl J. Ade, Timothy I. Musch, FACSM, David C. Poole, FACSM. FACS

Official Journal of the American College of Sports Medicine

Vol. 49 No. 5 Supplement S529

Abstracts were prepared by the authors and printed as submitted.
Gravity changes along the z-axis (posGz) influence right and left ventricular cardiac output (CO_RV, CO_LV). This is of importance in many sports after changes in posture or in phases of accelerations. PURPOSE: This study aimed to compare estimates of cardiac output by gas exchange and continuous blood pressure (cBP) measurements to assess transient differences in CO_RV and CO_LV. METHODS: Nine healthy male subjects (age: 31 ± 3 y, BMI: 24 ± 2 kg·m⁻²) participated in experiments on a long-arm human centrifuge (HiHC; base line: 1.7 g), in parabolic flights (PF) and on a tilt seat (TS; initial position 65°). Three consecutive posGz changes for ~2 s intervals (I₁, I₂, I₃) were performed (HiHC: 2.1 g - 1.2 g - 2.1 g; PF: 1.8 g - 0 g - 1.8 g; TS: 90° -6° - 90°). Breath-by-breath V̇O₂, heart rate and cBP were measured. Left ventricular stroke volume was determined from cBP allowing to estimate CO_LV. Arterio-venous O₂ concentration difference was calculated as average for 30 s before the first posGz change (I₁). This allows calculating CO_LV for the following periods (I₁, I₂, I₃) according to Fick’s principle. RESULTS: Differences between CO_RV, CO_LV are shown in Fig. 1. The highest difference (9.26 L·min⁻¹) was found in TS after the change from the 90° to -6° position. CONCLUSION: The combination of V̇O₂ and cBP measurements allows to assess differences in CO_RV and CO_LV. The differences in I₁ after a reduction in posGz indicate a blood volume shift into the pulmonary veins which has an impact on CO_LV, which increases during the following posGz increase (I₁). Further influences from breathing must be studied.

Fig. 1: Difference of CORV and COLV
Acknowledgement: This study was funded by German Ministry of Education and Research (05WB1426)

The mechanisms of the diving reflex involve the simultaneous activation of the sympathetic and parasympathetic nervous systems (PNS). The enhanced PNS capabilities as achieved through aerobic training has been hypothesized in the diving reflex, specifically vagally-mediated bradycardia, and the research remains controversial. PURPOSE: The current study was conducted to evaluate heart rate responses associated with the diving reflex in aerobically trained and untrained men. METHODS: Using 2 x 3 mixed factorial ANOVA, lowest heart rate achieved, percent heart rate reduction, and time course of heart rate reduction were compared between aerobically untrained (n = 7) and trained (n = 9) men while breath holding in air, water at 15 °C, and water at 0 °C. RESULTS: Results showed that trained men did not differ in percent heart rate reduction or lowest heart rate achieved, although there was a tendency for lower heart rate achieved in the trained group (p = .06). A significant interaction was found for time course (p = .01), where trained men took significantly longer to reach a plateau in heart rate in the air compared to untrained men. No differences in training status were found for time course in the two water conditions. However, a linear increase in time course for untrained men in the water conditions indicated a potentially delayed response by the PNS with the diving reflex. CONCLUSION: No additional clarification on the impact of training status on the diving reflex has been made except that an effect may lie in the timing of the response of the PNS.
CONCLUSION: Short-term high-intensity aerobic interval training improves peak aerobic capacity in middle-aged post-menopausal women, and reduces the extent of menopause-related differences in LV function. Amanda Nio is the beneficiary of a doctoral grant from the AXA Research Fund.

PURPOSE: Optimizing exercise as therapy for pulmonary arterial hypertension (PAH) requires an understanding of which approaches maximize benefit and minimize detriment, particularly in more advanced disease. Therefore, in rats with severe, angioproliferative PAH we examined cardiopulmonary effects of three distinct training approaches: 1) high-intensity interval training (HIIT), 2) low-intensity continuous exercise training (CET), or 3) voluntary wheel running (VWR).

METHODS: SD rats (~200g, male) with Sugen-Hypoxia-induced PAH (SuHx) underwent 6 wk of training as either HIIT (2 min at ~85% VO2max, VO2 reserve [VO2R] at 3 min at 30%VO2R, for 4-5 cycles, n=12) or CET (45-60 min at 30%VO2R, n=11) performed 5 days/wk on a treadmill, or were housed with computer-monitored wheels (n=14). Additional SuHx rats were untreated (SED, n=15). Healthy, exercising animals were controls (CON, n=14). Echocardiography was performed at pre- and post-training; all other measurements were post-training.

RESULTS: Mortality in SuHx was highest for SED (5 deaths at days 65, 66 (2), 77, and 81) and HIIT (4 deaths at days 56, 60, 68, and 71), and lowest for CET (2 deaths at days 60 and 73) and VWR (2 deaths at days 59, 68). While all animals exhibited similar baseline RV function, SuHx rats that died prematurely (n=13) had worse (p<0.05) cardiac output (CO, 148±12mL/min) and stroke volume (SV, 466±39mL/min) at pre-training compared to surviving SuHx (n=39, 216±19mL/min, 593±30mL/min). SuHx-induced elevation in RV systolic pressure (RVSP) and RV hypertrophy were not ameliorated by training with any approach (p>0.05 vs. SuHx-SED). However, final RV function in surviving SuHx was higher for all 3 training approaches (p<0.05 vs. SuHx-SED). HIIT resulted in the highest RV function and RV hypertrophy (p<0.05 vs. SuHx-SED), with a trend towards a higher RV mass (p=0.11; Pmin<0.05; Model A), or fat-free mass (FMI, p=0.08; Pmin<0.05; Model B) was the factors that most highly predicted energy expenditures. Predictive equations coupled PAH with body mass (Model A) and FFM (Model B), were correlated (r=0.74 and r=0.76, respectively) and did not differ (mean ± SEM: Model A, 4463 ± 65 Kcal·d^{-1}; Model B, 4462 ± 61 Kcal·d^{-1}) from DLW measured energy expenditures.

Conclusion: By quantifying and grouping SOF training exercises into activity factors, SOF energy requirements can be predicted with reasonable accuracy and these equations can be used by dietetic/logistical personnel to plan appropriate feeding regimens to meet SOF nutritional requirements across their various mission profiles.

Disclaimer: The views expressed in this abstract are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government.

PURPOSE: The metabolic cost of load carriage (LC) is frequently predicted using the Pandolf et al. (1977) equation. Recent laboratory investigations have identified that the Pandolf equation under-predicts the metabolic cost of LC in untrained personnel during treadmill walking (Drain et al., 2017). However, the relationship between the actual and Pandolf predicted metabolic cost of outdoor LC in UK Armed Forces personnel has not been established.

METHODS: Twenty-two UK Armed Forces personnel (Royal Marine Commandos and Parachute Regiment, mean ± SD: age 23 ± 3 years; stature 180.9 ± 4.9 cm; body mass 83.1 ± 6.6 kg; predicted VO_{2max} 540 ± 3.1 ml·kg^{-1}·min^{-1}) completed 15, 20 minutes of outdoor LC, with external load masses ranging from 25 to 70 kg. The stages were completed at a patrol, forced, and insertion marching speed (2.5, 4.8, and 5.5 km·h^{-1}, respectively). During the final 2-4 minutes of each LC stage, oxygen uptake (VO_{2}) was measured using the Douglas bag technique. Predicted VO_{2} for each speed-load mass combination was calculated using the Pandolf equation and compared to the measured VO_{2} using paired t-tests and 95% Limits of Agreement (LoA).

RESULTS: The Pandolf equation systematically under-predicted the metabolic cost of LC for all speeds and load masses combined [mean difference 3.2 ± 2.9 ml·kg^{-1}·min^{-1} (p<0.001), 95% LoA -2.5-8.9 ml·kg^{-1}·min^{-1} ] resulting in a VO_{2} predictive error of 17.9 %. Mean difference and 95% LoA at the different speeds were: (a) 2.5 km·h^{-1} [4.8 ± 1.9 ml·kg^{-1}·min^{-1} (p<0.001), 95% LoA 1.0-8.6 ml·kg^{-1}·min^{-1}], (b) 4.8 km·h^{-1} [1.5 ± 2.7 ml·kg^{-1}·min^{-1} (p<0.001), 95% LoA -3.9-6.9 ml·kg^{-1}·min^{-1}], and (c) 5.5 km·h^{-1} [4.2 ± 3.3 ml·kg^{-1}·min^{-1} (p<0.001), 95% LoA 2.1-10.7 ml·kg^{-1}·min^{-1}], with prediction errors of 30 %, 6 % and 14 %, respectively.

CONCLUSIONS: The current study demonstrates a systematic under-prediction of VO_{2} for British Army personnel during outdoor LC when applying the Pandolf equation, supporting the findings of previous laboratory studies. Furthermore, the error appears to be of greater magnitude when LC speeds are lower, i.e. at a representative patrolling pace. This in part could be attributed to the load mass distribution of the modern soldier, which differs from the back mounted load carried data used to develop and refine the Pandolf equation.
MEDICINE & SCIENCE IN SPORTS & EXERCISE®
FRIDAY, JUNE 1, 2018

2621 Board #3 June 1 3:15 PM - 5:15 PM
Pandolf Equation Efficacy In Predicting Gender-Specific Energy Expenditure Differences While Carrying Light To Heavy Loads
Victoria A. Gregory, Charles S. Fulco, Peter N. Frykman, Rebecca E. Fellin, Nathaniel I. Smith, Joseph F. Seay. U.S. Army Institute of Environmental Medicine, Natick, MA.
(No relevant relationships reported)

With the recent decision permitting women to enter Combat Arms roles in the military, knowledge of gender-based differences in energy expenditure (EE) during load carriage has become more operationally relevant. However, one of the most common equations for predicting the energy cost of load carriage has not been systematically compared between male and female Soldiers.

PURPOSE: To examine the efficacy of the Pandolf equation [1] to predict EE of male and female Soldiers while carrying light to heavy loads.

METHODS: Twenty-nine (12 Female, 17 Male, mean ± SD: age 24 ± 2 y, 1.76 ± 0.10 m, body mass 79.4 ± 11.0 kg) OCs volunteered. Energy expenditure was assessed using a combination of structured activities such as physical training, foot drill, and classroom training on base and 5 days on a field exercise in Officer Cadets (OCs). METHODS: Twenty-nine (12 Female, 17 Male, mean ± SD: age 24 ± 2 y, 1.76 ± 0.10 m, body mass 79.4 ± 11.0 kg) OCs volunteered. Energy expenditure was assessed using a combination of structured activities such as physical training, foot drill, and classroom training on base and 5 days on a field exercise in Officer Cadets (OCs).

RESULTS: Total average energy (M; 16 ± 5, F; 13 ± 3 MJ·day⁻¹) and fat (M; 149 ± 46, F; 122 ± 34 g·day⁻¹) intake. Energy, PRO and fat intake, but not CHO intake, was in line with UK Military Dietary Reference Values for both sexes. Average PRO and CHO intake was greater (p<0.05) at mealtimes (M) than snacks (S) irrespective of sex. PRO 112 ± 48 (M) vs 28 ± 28 (S); CHO 306 ± 137 (M) vs 167 ± 134(S) g). However, unlike PRO (breakfast (B) 32 ± 14; mid-morning (S1) 10 ± 10; lunch (L) 38 ± 15; mid-afternoon (S2) 11 ± 11; dinner (D) 42 ± 18; evening (S3) 8 ± 7 g), CHO intake was more evenly spread throughout the day (B 91 ± 43; S1 52 ± 43; L 101 ± 42; S2 66 ± 53; D 114 ± 52; S3 43 ± 38 g).

Conclusion: The present study indicates that OC energy, energy expenditure estimation methods during 10 days of military training

2622 Board #4 June 1 3:15 PM - 5:15 PM
Comparison of Training Intensity, Energy Balance, and Sleep Duration in British Army Officer Cadets between Base and Field Exercise
Sarah C. Needham-Beck, Andrew G. Siddall, Jane E.S. Thompson, Steven D. Powell, Victoria C. Edwards, Sam D. Blacker, Sarah Jackson, Julie P. Greeses, Sophie L. Wardle, Sam D. Blacker. 1University of Chichester, Chichester, United Kingdom. 2Army HQ, Andover, United Kingdom.
(No relevant relationships reported)

PURPOSE: Initial military training typically prepares personnel for service through a combination of structured activities such as physical training, foot drill, and classroom and practical lessons conducted on base and during field exercises. This study compared the training intensity, energy balance, and sleep duration between 5 days of training on base and 5 days on a field exercise in Officer Cadets (OCs).

METHODS: Twenty-nine (12 Female, 17 Male, mean ± SD: age 24 ± 2 y, 1.76 ± 0.10 m, body mass 79.4 ± 11.0 kg) OCs volunteered. Energy expenditure was assessed using a wrist-mounted research grade accelerometer, worn during weeks 9 (base) and 22 (field exercise) of the 42-week British Army Regular Commissioning Course. Energy intake was quantified from researcher-led dietary weighing and food diaries for a sub-set of OCs (n=16), which was compared to daily energy expenditure to calculate energy balance. On base and field exercise data were compared using paired and independent sample t-tests, with statistical significance set at p<0.05.

RESULTS: Time spent in the sedentary, light, and moderate exercise intensity zones was similar while training on base and on field-exercise (p>0.05). However, more time was spent in the vigorous exercise intensity zone on base compared to the field exercise (mean difference ± SD: 28 ± 22 min, p<0.001). Daily sleep time was higher on base compared to the field exercise (333 ± 91 vs. 126 ± 79 min, p<0.001) and the OCs were in negative energy balance both on base (-3.17 ± 2.00 MJ), and during the field exercise (-7.18 ± 5.33 MJ), with a greater energy deficit experienced on exercise (p<0.05). CONCLUSIONS: Time spent in physical activity zones were similar during training on base and on field exercise, although less time was spent in the vigorous intensity zone during the latter. However, OCs had less sleep and a greater energy deficit during field exercise, which has potential implications for their ability to sustain the level of activity required; therefore, impacting physical performance and potentially increasing fatigue-related injury risk.

2623 Board #5 June 1 3:15 PM - 5:15 PM
Time of Day and Macronutrient Intake of British Army Officer Cadets during Military Training
Victoria C. Edwards, Jane E.S. Thompson, Steven D. Powell, Sarah Jackson, Julie P. Greeses, Sophie L. Wardle, Sam D. Blacker. 1University of Chichester, Chichester, United Kingdom. 2Army HQ, Andover, United Kingdom.
(No relevant relationships reported)

PURPOSE: In athletic populations, the amount and timing of macronutrient intake can influence the restoration of muscle glycogen, attenuation of muscle damage and affect training recovery and adaptations. Despite similarities in the physically demanding, long-term nature of training for both athletes and military personnel, the composition and timing of dietary intake by military personnel is often more limited than athletes, particularly in initial military training establishments. This study quantified the total energy intake and timing of energy and macronutrient intake for Officer Cadets (OC) during training.

METHODS: Twenty (10 male and 10 female) OCs (mean ± SD: age 22 ± 1 y, 1.73 ± 0.08 m, body mass 77.0 ± 9.3 kg) underwent the British Army Officer Commissioning Course at the Royal Military Academy Sandhurst completed food diaries for 10 days, alongside researcher-led dietary weighing of main meals. Daily energy intake and carbohydrate (CHO), protein (PRO) and fat proportions were analysed using nutritional analysis software (Nutritics). Paired and independent samples t-tests were used to compare dietary intake between meals and sex, respectively. RESULTS: Total average energy (M; 16 ± 5, F; 13 ± 3 MJ·day⁻¹) and PRO (M; 144 ± 42, F; 114 ± 25 g·day⁻¹) intake over 10 days was greater for men than women (p<0.05). However, CHO intake was found to be different between sexes for CHO (M; 453 ± 148, F; 377 ± 80 g·day⁻¹) and fat (M; 149 ± 46, F; 122 ± 34 g·day⁻¹) intake. Energy, PRO and fat intake, but not CHO intake, was in line with UK Military Dietary Reference Values for both sexes. Average PRO and CHO intake was greater (p<0.05) at mealtimes (M) than snacks (S) irrespective of sex. PRO 112 ± 48 (M) vs 28 ± 28 (S); CHO 306 ± 137 (M) vs 167 ± 134(S) g). However, unlike PRO (breakfast (B) 32 ± 14; mid-morning (S1) 10 ± 10; lunch (L) 38 ± 15; mid-afternoon (S2) 11 ± 11; dinner (D) 42 ± 18; evening (S3) 8 ± 7 g), CHO intake was more evenly spread throughout the day (B 91 ± 43; S1 52 ± 43; L 101 ± 42; S2 66 ± 53; D 114 ± 52; S3 43 ± 38 g).

Conclusion: The present study indicates that OC energy, energy expenditure estimation methods during 10 days of military training

2624 Board #6 June 1 3:15 PM - 5:15 PM
Comparison of Research- and Consumer-grade Energy Expenditure Estimation Methods during 10 Days of Military Training
Andrew G. Siddall, Jane E.S. Thompson, Steven D. Powell, Victoria C. Edwards, Sarah S. Kefayawi, Priya A. Singh, Elise R. Orford, Michelle C. Venables, Sarah Jackson, Julie P. Greeses, Sam D. Blacker and Steve D. Myers. 1University of Chichester, Chichester, United Kingdom. 2Medical Research Council, Cambridge, United Kingdom. 3Army HQ, Andover, United Kingdom.
(No relevant relationships reported)

PURPOSE: Wearable physical activity monitoring devices have improved the ability to estimate free-living total energy expenditure (TEE) but their application during arduous military training alongside more well-established techniques has not been widely documented. This study aimed to assess the validity of the two wrist-worn activity monitors to estimate TEE by evaluating performance against doubly labelled water (DLW) during British Army Officer Cadet (OC) training.

METHODS: Twenty (10 male and 10 female) OCs (mean ± SD: age 22 ± 1 y, height 1.73 ± 0.08 m, body mass 77.0 ± 9.3 kg) wore one research-grade accelerometer (GENEActiv, Cambridge, UK, “RES”) on the dominant wrist and one commercially available activity monitor (“RES”) on the non-dominant wrist. Assessment of the research-grade accelerometer and commercially available activity monitor was a crossover design, with participants completing 10-day blocks of training in a randomised order. Each day within the block was composed of a 5-day training block and 5-day rest block. Measurements of energy expenditure were performed using doubly labelled water (DLW) during British Army Officer Cadet (OC) training. Two research-grade accelerometers (GENEActiv, Cambridge, UK, “RES”) were placed on the non-dominant wrist and one commercially available activity monitor (“RES”) was placed on the dominant wrist. Measurements of energy expenditure were performed using doubly labelled water (DLW) during British Army Officer Cadet (OC) training.
available (FITBIT SURGE, USA; “COM”) monitor on the non-dominant wrist for 10 days of training. Immediately prior to this 10-day period, participants consumed a bolus of DLW and provided daily urine samples, which were analysed by mass spectrometry to determine TEE. Bivariate correlations and limits of agreement were calculated to compare the 10-day mean TEE from DLW with both activity monitors to evaluate device performance.

RESULTS: TEE (mean ± SD) from DLW, RES and COM were 17.2 ± 2.7 MJ day−1 (4112 ± 652 kcal day−1), 17.3 ± 2.8 MJ day−1 (4129 ± 677 kcal day−1) and 15.1 ± 3.7 MJ day−1 (3607 ± 888 kcal day−1), respectively. TEE from DLW was linearly correlated with both RES (r=0.876, p<0.001) and COM (r=0.888, p<0.001). Despite a stronger association with DLW however, COM tended to underestimate TEE (mean bias [95% CI]) by -2.1 [-5.6-1.4] MJ day−1 [-505 [-1348-339] kcal day−1; p<0.05]. In contrast, mean TEE from RES was similar to DLW (-0.05 [-3.6-3.5] MJ day−1; [11 [-867-845] kcal day−1; p<0.05].

CONCLUSION: Wearable physical activity monitors provide a cheaper and more practical method for estimating free-living TEE than DLW, and could be useful for military populations. However, this study suggests a consumer monitor may underperform, by underestimating TEE, during physically demanding training in comparison to a research-grade device.

PURPOSE: Wearable physical activity monitors provide the capability to estimate the physical demands of military training and to potentially inform training practices. This study aimed to compare both the daily energy expenditure (EE) and weekly physical activity (PA) measured from two wrist-worn activity monitors (Fitbit Surge, USA; “COM”) during initial military training.

METHODS: Forty (26 male, 14 female) OC’s (mean ± SD: age 24 ± 2, height 1.76 ± 0.08 m, body mass 72.1 ± 9.7 kg) wore a consumer (“CN”); Fitbit Surge, San Francisco, USA) and a research-grade (“RG”; GENEA) during the second 14-week term of British Army OC training. A filtering process was implemented to exclude training days that did not fulfil wear-time criteria. Bivariate Pearson’s correlations and limits of agreement (LoA) were used to compare EE measurement and duration of sedentary, light, moderate and vigorous PA between devices.

RESULTS: Mean daily estimated EE from the CN and RG were 13.9 ± 2.5 and 15.7 ± 1.8 MJ day−1, respectively. Estimated daily EE ranged from 8.6 ± 2.8 (day 35) to 22.4 ± 6.7 MJ day−1 (day 49) in CN and from 10.7 ± 4.5 (day 55) to 21.3 ± 8.1 MJ day−1 (day 49) in RG. There was a strong correlation between EE in CN and RG over 14 weeks (r = 0.761, p<0.001). However, the LoA indicated that CN underestimated EE (mean bias [95% CI]) by -1.4 [-16.3-3.2] MJ day−1 (p<0.001) compared to the RG. Mean daily estimates from CN were 1089 ± 86 sedentary minutes, 221 ± 44 light minutes, 40 ± 14 moderate minutes and 56 ± 16 vigorous minutes. RG estimated 543 ± 53 sedentary minutes, 90 ± 16 light minutes, 249 ± 52 moderate minutes and 33 ± 14 vigorous minutes. All intensities were significantly different between CN and RG (p<0.05). The LoA on estimated sedentary minutes (526 mins day−1 [319-734 mins day−1], light minutes (131 [39-224 mins day−1] and vigorous minutes (24 [15-62] mins day−1), but underestimated moderate minutes -208 [-295 -122] mins day−1).

CONCLUSION: Consumer grade physical activity monitors provide an easily accessible tool for monitoring military training but more research is required to improve their accuracy before they can be used to inform training practices.

Physiological data are often used to develop work/rest cycles and thermal exposure guidance. A large component of the U.S. Navy’s shipboard heat exposure guidance, known as Physiological Heat Exposure Limit (PHEL) curves, relies on metabolic rate. Shipboard work spaces present an extremely challenging work environment with respect to the impact of high heat and humidity on the integrity of obtaining digital data. Data collections conducted on an aircraft carrier have an increased potential for signal disruption due the potential for electromagnetic interference and previous attempts have been unsuccessful. With the availability and technological advancement of more robust commercial, wireless physiological data devices, it is now possible to evaluate if existing exposure guidance accurately reflects the work rate performed within the shipboard environment. PURPOSE: To obtain actual shipboard metabolic rates of various personnel aboard an aircraft carrier deployed in the Persian Gulf. METHODS: Twenty-nine personnel (age: 23 ± 3 yrs, height: 169 ± 10 cm, weight: 79.4 ± 14.3 kg) had their VO2, HR, and Tm measured while performing actual shipboard duties for approximately three hours on two separate days (T1 and T2). Personnel were from the following work spaces: Flight Deck, Hangar Bay, Scullery, Galley, Waste Management, Captain, and Reactor Room. RESULTS: From a possible total collection time of 12,771 min, there were 9,248 min (72%) of usable data for VO2, 12,120 min (95%) for HR, and 10,711 min (84%) for Tm. Mean results were consistent across all personnel for both trials (mean trial duration = 194 ± 33 min). VO2 was 0.67 ± 0.14 L/min and 0.67 ± 0.11 L/min, p=.22; HR was 102 ± 11 bpm and 96 ± 11 bpm, p=.06; and Tm was 37.6 ± 0.2°C and 37.4 ± 0.2°C, p<0.04 for T1 and T2, respectively. CONCLUSION: Findings from this pilot study indicate that physiological data, including actual work setting VO2, HR, and Tm data, can be obtained using current technology in extreme work place i.e., field) environments. This sophisticated technology can have a significant impact on developing new work/rest guidance, in addition to heat exposure guidance, in military and civilian work place environments. Results from this pilot evaluation will lead to an effort to revise the U.S. Navy’s shipboard PHEL curve guidance.
Table 1. Summary of means, p-values and effect sizes for variables of interest

<table>
<thead>
<tr>
<th>Variable</th>
<th>HW (Mean±SD)</th>
<th>OWOB (Mean±SD)</th>
<th>ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leg Strength (Nm/BW)</td>
<td>223.8(41.0)</td>
<td>221.3(57.7)</td>
<td>0.87(0.05)</td>
</tr>
<tr>
<td>Max vertical jump (cm)</td>
<td>33.67(3.4)</td>
<td>30.87(4.4)</td>
<td>0.22(0.38)</td>
</tr>
<tr>
<td>Max landing force (BW)</td>
<td>2.02(0.38)</td>
<td>1.96(0.47)</td>
<td>0.64(0.14)</td>
</tr>
<tr>
<td>Average load rate (BW/s)</td>
<td>34.1(12.6)</td>
<td>26.5(10.0)</td>
<td>0.04(0.67)*</td>
</tr>
<tr>
<td>Instantaneous Load rate (BW/s)</td>
<td>110.424.1</td>
<td>82.9(20.3)</td>
<td>0.003(1.25)*</td>
</tr>
<tr>
<td>Dorsiflexion excursion (degrees)</td>
<td>48.65(0.7)</td>
<td>42.6(7.92)</td>
<td>0.009(0.90)*</td>
</tr>
<tr>
<td>Knee flexion excursion (degrees)</td>
<td>43.40(3.26)</td>
<td>35.38(20.0)</td>
<td>0.07(0.92)*</td>
</tr>
<tr>
<td>Hip flexion excursion (degrees)</td>
<td>21.39(8.3)</td>
<td>14.8(6.10)</td>
<td>0.026(0.79)*</td>
</tr>
</tbody>
</table>

* indicates p<0.05

Persons with Chronic Obstructive Pulmonary Disease (COPD) experience a greater fall risk than healthy individuals of the same age. Obesity has been associated to an even greater fall risk in persons with COPD. Gait abnormalities such as an increasing step width has also been associated with severity of COPD. Recent research has shown that a high intensity intervention decreases step width in persons with COPD. However, no research has been done to investigate possible difference in gait pattern between persons with COPD who have obesity and those who have a healthy body mass index (BMI). PURPOSE: To investigate differences in gait pattern between people with COPD who have obesity and those who have a healthy BMI. METHODS: 9 persons with COPD who have a BMI in the Obese category (OBMI) and 5 persons with COPD who have a BMI in the Healthy category (HBMI) participated. Participants completed 5 trials of walking forward at a comfortable pace on pressure-sensor walkway. Velocity, stride, step length, stride width, and step width were measured as average of 5 trials and compared between groups using a 2-tailed independent samples t-tests or a Mann-Whitney U test depending on normality. Hedges’ effect size was also calculated. RESULTS: OBMI group walked with wider steps showing a trend towards statistical significance (OBMI: 15.7±4.9cm; HBMI: 9.9±2.5cm; p=0.033). No other variables were significantly different between the groups. Effect sizes ranged from trivial (0.05 for cadence) to large (1.08 for step width). CONCLUSION: A wider step gait in OBMI may be related to increased fear of falling. Research with greater sample size must be done to further investigate the how obesity affects gait patterns in persons with COPD.

Kinetic features of running mechanics have been implicated in the development of bony and soft tissue injuries. Progressively heavier runners may be at increased risk for lower extremity injuries due to kinetic factors, but this has yet to be examined. The relationships between running kinetics and recent lower extremity injury among runners of different body sizes are not clear. PURPOSE: To determine the key kinetic characteristics of running gait among runners across the spectrum of body mass index (BMI in kg/m^2) values with and without recent history of lower extremity injuries. METHODS: Recreational competitive runners (N=278; 46.6% women; 34.8±14.9 yr) were stratified into three BMI groups in kg/m^2: healthy weight BMI=24.9, overweight BMI 25.0-29.9, obese BMI≥30. A 3D motion tracking system and instrumented treadmill captured ground reaction forces (GRF) and loading rates at preferred running speed. BMI group comparisons were made using univariate analyses of variance of covaried for running speed. Recent history of lower extremity bony and soft tissue injuries related to running was self-reported. Key variables included peak GRF and vertical instantaneous loading rate (VILR). Linear regressions were used to determine the relationship between BMI and VILR after accounting for running speed; models included age, sex, running speed, GRF and VILR. RESULTS: Injury prevalence (stress fractures, tendinitis, plantar fasciitis, patellofemoral pain) was not different among the three BMI strata (28%-38%). Peak GRFs were highest in the overweight group compared to the healthy weight and obese runners, respectively (47.9±11.9 kN vs 40.7±14.1 kN and 39.9±13.3 kN; p<.0001). Regression results indicated that after accounting for running speed (R2=0.123), BMI accounted for an additional 6% of the variance to the model for VILR (B coefficient 0.251). CONCLUSIONS: The effect of BMI on loading rates during running at a preferred speed is relatively small. Our findings indicate that progressively heavier runners were not at a higher risk for lower extremity injury, and this may be due to internal motion adjustments that are made to control VILR and peak GRF at preferred speeds.

Obesity decreases relative skeletal muscle strength and alters biomechanics during daily activities such as rising from a chair. To date, the role of this decreased muscle strength in obesity-induced biomechanical alterations is unknown. Purpose: To determine the relationship between lower extremity skeletal muscle strength and biomechanics during sit-to-stand. Methods: Nine obese (BMI 32.5 ± 2.5 kg/m^2) young adults (age: 28.4 ± 5.7 y) completed sit-to-stand task three times from a chair (seat height: 52 cm). Ten high speed cameras were used to track retroreflective coordinate data through 3D motion analysis at a rate of 200Hz. Specific outcomes of interest included: peak trunk flexion velocity (deg/s), peak trunk flexion angle (deg), and task duration (s). Maximal voluntary isometric contractions (MVCs) of the knee extensors and flexors were measured via a previously validated handheld dynamometer (Hoggan MicroFET2) and normalized to body mass. Linear regression was used to determine relationships between body mass and relative muscle strength with independent variables. Results: Body mass index was positively associated with peak trunk flexion velocity (y = 4.458x - 5.208, r² = 0.506, p = 0.032), but not peak trunk flexion angle (p = 0.127) or task duration (p = 0.924). Conversely, relative knee extensor and flexor strength were inversely related to peak trunk flexion velocity and angle (r² = 0.541 - 0.786, p < 0.05). The ratio of relative knee extensor to knee flexor strength was inversely related to task duration (y = -0.347x + 2.43, r² = 0.49, p = 0.022). Conclusions: Excess body mass induces greater trunk flexion velocity, likely to generate sufficient momentum to stand. High levels of knee extensor and flexor strength may decrease peak trunk flexion angle and velocity reduce sit-to-stand time in obesity.

Kinetic features and recent history of lower extremity injury in overweight and obese runners

Knee flexion excursion (degrees)
Dorsiflexion excursion (degrees)
Instantaneous Load rate (BW/s)
Average load rate (BW/s)

Conclusions:
Excess body mass induces greater trunk flexion velocity, likely to generate sufficient momentum to stand. High levels of knee extensor and flexor strength may decrease peak trunk flexion angle and velocity reduce sit-to-stand time in obesity.

Fatigability of the dorsiflexor muscles in people with type 2 diabetes and controls

People with type 2 diabetes (T2D) and diabetic polyneuropathy are more fatigable for the dorsiflexor muscles during isometric fatiguing contractions; however, it is unknown if the greater fatigability is observed in people with T2D and no signs of neuropathy. PURPOSE: To determine the neural and muscular mechanisms of dorsiflexor muscle fatigability for an intermittent isometric contraction task in people with T2D and healthy controls. METHODS: 8 people with T2D (65±6 yrs; 26±2 kg·m^2; 9,400±828 daily steps; 2 women) with no signs of diabetic polyneuropathy were matched based on age, BMI, and physical activity with 5 healthy controls (64±6 yrs; 26±2 kg·m^2; 9,400±828 daily steps; 2 women). Fatigability was assessed with an intermittent isometric protocol using 6-s contractions at 50% of maximal voluntary contraction (MVC), followed by a 4-s rest until task failure. MVCs were performed every 60s. Task failure was defined as MVC ≤ 50% baseline MVC. Electrically-evoked twitch contractions were elicited during and after each MVC to estimate voluntary activation and contractile properties of the dorsiflexor muscles. RESULTS: Time to task failure of the fatiguing task was 42% briefer in people with T2D compared with controls (6.6±4.17 vs. 11.40±6.58 min, respectively; p<0.05). Voluntary activation was similar between T2D and control group at baseline (96.8±6.3±7. vs 98.2±1.4%, p=0.43) and declined similarly during the fatiguing task (task end; 94.9±6.4 vs. 92.6±4.8%, p=0.39). The electrically-evoked twitch amplitude was inversely related to VILR with people with T2D and controls before the fatiguing task (5.3±3.8 vs. 5.4±2.3 mm, p=0.96) and declined similarly during the fatiguing task (5.1±2.80 vs. 55.0±43.3% reduction, p=0.13). CONCLUSIONS: Both muscular and neural mechanisms contributed to fatigability of the dorsiflexor muscles for an intermittent isometric fatiguing task in people with T2D and age- and BMI-matched controls, although 77%±4.7% decrease in activity muscle played a greater role than the reduction in neural drive. These findings that suggest people with T2D whom have no signs of diabetic polyneuropathy are more...
Obesity is a preventable risk factor for osteoarthritis (OA), a leading cause of pain and physical disability. Prior studies have linked altered gait biomechanics and quadriceps strength deficits to OA development in clinical populations, but data are lacking in young obese individuals without OA.

**PURPOSE:** To compare quadriceps strength and gait biomechanics between obese (OB) and normal weight (NW) young adults. A secondary purpose was to examine the relationship between quadriceps function and gait biomechanics.

**METHODS:** 47 participants were recruited and classified by body mass index (BMI), 24 NW (BMI = 21.9±1.7; 54% female) and 23 OB (BMI = 33.7±2.4; 48% female). Fat and fat-free mass (FFM) were obtained via air displacement plethysmography. Quadriceps strength was assessed using a maximal voluntary isometric knee extension at 60° of knee flexion. Gait biomechanics were collected at a standardized (ST) 1 m/s and self-selected (SS) gait speed. A 2 group by 2 condition ANOVA was used to evaluate peak knee flexion angle (PKF), knee flexion excursion (PKE), peak internal knee extension moment (KEM), peak vertical ground reaction force (vGRF), vertical landing rate (vLR), isometric peak torque (PT), and rate of torque development (RTD). Pearson correlations were calculated between quadriceps strength and gait biomechanics at ST and SS speed.

**RESULTS:** OB had lower PT (5.32 [95%CI: 3.11, 3.93] vs. 4.11 [95% CI: 3.67, 4.55] Nm/FMF, p < 0.001), and late RTD (7.6 [95% CI: 6.1, 9.1] vs. 10.0 [95% CI: 8.8, 11.2] Nm/FMF/sec, p = 0.02) compared to NW. NO differences between groups were found at ST gait speeds. Partial correlation adjusted for SS walking speed revealed a moderate relationship between PT and KEM (r = 0.48, p < 0.05). No differences between groups were found at ST gait speeds. Partial correlation adjusted for SS walking speed revealed a moderate relationship between early RTD and KEM (r = 0.42, p < 0.05).

**CONCLUSIONS:** OB have deficits in quadriceps strength relative to FFM, and walk slower compared to NW. RTD was moderately associated with KEM, and KEM was lesser in OB compared to NW. Smaller KEM suggests that OB walk with a quadriceps avoidance gait, which may contribute to knee OA development. Exercise interventions targeting RTD may be useful for improving walking mechanics in OB.

**F-34 Thematic Poster - Muscle Physiology in Muscular Dystrophy and Cancer**

**Friday, June 1, 2018, 3:15 PM - 5:15 PM**
Room: CC-Lower level L100H

**Chair:** Dawn Lowe, FACSM. University of Minnesota, Minneapolis, MN.

(No relevant relationships reported)

**Board #6 June 1 3:15 PM - 5:15 PM**

**Quadriiceps Impairment Associated With Knee Mechanics During Gait In Obese Young Adults**
Michael N. Vakula1, Koren L. Fisher2, Pablo B. Costa3, Derek N. Pamukoff4, 1University State University, Logan, UT; 2Utah State University, Fullerton, Fullerton, CA. (Sponsor: Daniela Rubin, PhD, FACSM) (No relevant relationships reported)

Fatigable than controls independent of physical activity levels, although, statistical power analysis indicates 11 people in each group are needed to clarify the findings of this preliminary data set.
compared to pre-injury (p < 0.001). By day 2, the low M-wave RMS recovered to
pre-injury (1.37 vs. 1.18 mV, p = 0.34) and coincided with a large improvement in
isometric torque (1.10 to 1.85 mN, p = 0.001), which fully recovered by day 9 (2.87 vs. 2.90 mN, p = 0.82). CONCLUSIONS: These data substantiate that a major
contributor to ECC contraction-induced strength loss in dystrophic muscle is mem-
brane excitability. Moreover, acute recovery of strength in the days after the
ECC protocol occurred in conjunction with the restoration of membrane excitability.
Our results provide a mechanistic explanation for why dystrophic muscle is more
prone to ECC contractions and gives insight into how the muscle recovers post-injury.
Importantly, these findings may aid in the development of therapeutic treatments for
patients with DMD, particularly in regards to establishing safe and effective exercise
programs.

2639 Board #5 June 1 3:15 PM - 5:15 PM

The Effect of Creatine and Creatineine on Myocellular Injury in Doxorubicin-Treated Skeletal Muscle Myoblasts
Eric Bredahl1, Wisam Najdawi1, Sarah Hook1, Joan Eckerson, FACSFM, Jake Siedlik1, Kristen Drescher1. Creighton University, Omaha, NE. (No relevant relationships reported)

Doxorubicin (DOX) is a powerful chemotherapy agent that is associated with a number of deleterious side effects including skeletal muscle dysfunction and atrophy. Although the exact mechanisms behind the observed myotoxicity are not fully understood, DOX treatment has been shown to result in the generation of reactive oxygen species and changes in short-term energy metabolism. Conversely, creatine (Cr) supplementation has been shown to have a therapeutic role in several disease states characterized by muscle atrophy, which is a hallmark of DOX treatment. PURPOSE: To examine the ability of Cr and Cn to attenuate the decline in Cr metabolism and minimize DOX-induced apoptosis and necrosis in skeletal muscle myoblasts. METHODS: Rat skeletal muscle myoblasts were cultured until they reached 85–90% confluence using rat skeletal muscle growth media (GM). Cells were subcultured and treated with one of the following for 12 hours: normal GM (control); Cr (10mM Cr+GM); Cn (10mM Cr+GM); DOX (25mM DOX+GM); DOX+Cr+GM; and DOX+Cn+GM. After incubation, protein synthesis, ATP, and lactate levels were measured. Apoptosis and necrosis were assessed using Annexin V apoptosis detection kit and high contrast staining. A one-way ANOVA with Tukey’s post-hoc testing was used to detect significance. RESULTS: There was a significant change relative to GAPDH in creatine kinase (CK) expression between the control and DOX-treated cells (15±8.2% vs. 90±8.7%, p=0.03). In addition, 13.2±7.5% of DOX-treated cells were undergoing apoptosis, which was significantly higher than the 3.2±6.5% in the control cells (p=0.04). No significant differences in rates of apoptosis were found between control samples and cells treated with DOX+Cr or DOX+Cn. Conclusion: These findings suggest that CK expression is significantly altered in skeletal muscle myoblasts treated with DOX relative to control cells and that DOX treatment results in higher rates of necrosis and apoptosis. Treatment with Cr or Cn minimized the DOX-induced change in CK expression, as well as the rate of apoptosis and necrosis. These findings suggest that Cr and Cn may attenuate the degree of skeletal muscle dysfunction and atrophy during chemotherapy with DOX.

2640 Board #6 June 1 3:15 PM - 5:15 PM

Effect of Resistance Training on Contractile Force Production during Doxorubicin-Treatment
Mikayla Kauffman1, Allison Tigner1, Sarah Hook1, MacKenzie Twaddell1, Meghan Wagner2, Eric Bredahl1, Jake Siedlik1, Joan Eckerson, FACSFM, Kristen Drescher1. Creighton University, Omaha, NE. (No relevant relationships reported)

Doxorubicin (DOX) is a powerful chemotherapy agent with several harmful side effects including cardiovascular and skeletal muscle dysfunction. The observed muscle dysfunction can have a significant impact on the capacity of the DOX-treated patient to perform activities of daily living. Although it has been shown that aerobic and anaerobic exercise before treatment can minimize the degree of DOX-induced muscle dysfunction, few studies have examined the effect of resistance training (RT) on muscle dysfunction during chemotherapy treatment with DOX. PURPOSE: To examine the ability of RT on skeletal muscle dysfunction during DOX treatment using a rat model. METHODS: Male Sprague-Dawley rats (N=39) were randomly assigned to one of four groups: Sedentary + Saline (SS, n=9), Sedentary + DOX (SDOX, n=10), RT + Saline (RTS, n=12), and RT + DOX (RTOX, n=9). Animals in the RT groups were housed in specialized cages where the food and water height was progressively elevated so that they achieved an erect bipedal stance to access their food and water for a total of 15 wk. Animals in the sedentary groups remained in standard animal housing for the duration of the study. Starting week 10, animals received weekly intraperitoneal injections of DOX (3 mg/kg) for 4 wk. One week after their last injection, animals underwent ex vivo muscle analysis of the soleus (SOL) and extensor digitorum longus (EDL) muscles. A one-way ANOVA with Tukey’s post-hoc testing was used to detect significance. RESULTS: Maximal twitch forces for the EDL were significantly lower in the SDOX (0.45 ± 1.85 g) vs. SS (1.37 ± 1.48 g, p=0.05) and a significantly lower twitch force compared to RTS (9.37± 3.01 vs. 15.42 ± 4.38 g, p=0.05) for the EDL. No significant differences were found among the groups for maximal twitch force in the SOL. CONCLUSION: These findings suggest that DOX-induced muscle dysfunction is more pronounced in the EDL than the SOL. However, it appears that RT during treatment is effective in mitigating some of the effects of DOX-induced muscle dysfunction in the EDL.

2641 Board #7 June 1 3:15 PM - 5:15 PM

Cancer Environments Effect on Skeletal Muscle mTORC1 Regulation by Physical Activity and Feeding in Mice
Brittany Counts1, Brandon VanderVeen1, Justin Hardee1, Dennis Fox1, Ryan Montalvo1, James Carson, FACSFM. University of South Carolina, Columbia, SC. (No relevant relationships reported)

Physical activity and feeding behaviors exert continuous regulation on daily skeletal muscle anabolic signaling. Mice exhibit diurnal variation in physical activity levels and food intake, which are significantly elevated during the dark cycle and negligible during the light cycle. The mechanistic target of rapamycin complex 1 (mTORC1) signaling axis serves to integrate feeding and physical activity with daily anabolic and catabolic processes. The mTORC1 activation status in muscle is a contributor to overall systemic anabolism. The energy status (EFS) model is an established preclinical model of cancer cachexia. While cachexia suppresses basal mTORC1 signaling, there are significant gaps in our understanding of how the cancer environment effects diurnal mTORC1 fluctuations to feeding and activity. PURPOSE: We examined the cancer environment’s effect on diurnal mTORC1 flux in skeletal muscle. METHODS: Body weight, food consumption, physical activity, and plasma glucose were monitored for 4 consecutive days at the end of the light (SEDENTARY [SED]) and dark (ACTIVE [ACT]) cycles in male C57BL6 (B6, N=16) and MIN (N=14) mice. Mice had free access to food and water, and were sacrificed at the end of either the SED or ACT state. Gastrocnemius muscle was analyzed using standard anatomic and histologic techniques. RESULTS: Mice in the B6 group exhibited significant differences in physical activity, food consumption and plasma glucose between SEDARY and ACT states; the cancer environment disrupted this response. The rate of mTORC1 phosphorylation was significantly higher in the SED group compared to SS. Rats in the RTOX had a significantly higher maximal twitch force compared to SDOX (9.37± 3.01 vs. 6.01 ± 1.85 g/s, p=0.05) and a significantly lower twitch force compared to RTS (9.37± 3.01 vs. 15.42 ± 4.38 g, p=0.05) for the EDL. No significant differences were found among the groups for maximal twitch force in the SOL. CONCLUSION: These findings suggest that DOX-induced muscle dysfunction is more pronounced in the EDL than the SOL. However, it appears that RT during treatment is effective in mitigating some of the effects of DOX-induced muscle dysfunction in the EDL.
is disrupted in MIN mice. Moreover, this suppressed anabolism, which may be driven by decreased feeding and reduced physical activity behaviors. Future studies should examine if targeting these behaviors can improve skeletal muscle anabolic flux in the presence of the cancer environment. Supported by NCI R01-CA121249

2642 Board #8  
June 1 3:15 PM - 5:15 PM  
Effect Of Aerobic Physical Training On The Expression Of Muscular Myomircs In Experimental Models Of Cancer.  
João LP Gomes, Gabriel C. Tobias, Tiago Fernandes, André C. Silveira, Patricia C. Brum, Roger Chamamas, Edimar M. Oliveira. University of Sao Paulo, Sao Paulo, Brazil.  
(No relevant relationships reported)

PURPOSE: There are several comorbidities associated with cancer as muscle cachexia. MicroRNAs (miR) in skeletal muscle (myomiRs) has been highly investigated for being related to several physiological and pathological factors. Aerobic physical exercise plays an important role in the regulation of the expression of several microRNAs.METHODS: We analyzed the expression of myomiRs using two mice models MMTV-PyMT (breast cancer, non-cachectic) and CT26 (colon cancer, cachectic). Animals were running trained and divided into 4 groups: SH; Sedentary Trained; CS; Cancer Sedentary; CT; Cancer Trained. Body and skeletal muscles were weights. Skeletal muscle function was analyzed by grip strength. We analyzed microRNAs expression by RT-PCR and proteins levels by Western blot. The tumor volume was determined by macroscopic caliper measures.RESULTS: Exercise training prevented the tumor progression. MMTV non-cachectic animals showed no loss of muscle mass and function. MiR-206 expression increased CS and miR-486 was decreased and it was not present in CT group. We also evaluated the same parameters in the CT26 model. The body mass, gastrocnemius and anterior tibial weight were decreased in CS and it was not prevented in CT group. Cancer increased the expression of miR-206 in skeletal muscle and aerobic training does not prevent these effects. The expression of miR-486 was decreased in CS group and PTEN levels was increased (p<0.05), decreasing PI3K-AKT-mTOR pathway and decreased muscle mass and function. However aerobic trained does not prevent these effects. CONCLUSIONS: MiR-486 expression was decreased in skeletal muscle and circulation due to cancer and can be regulating cachexia by decreasing protein synthesis pathway. While miR-206, that is a skeletal muscle specific, was increased and the target genes tested were not modified. Thus, these two microRNAs can be markers of the skeletal muscle damage in cancer cachexia, regulating the protein synthesis pathways.

F-35 Thematic Poster - Protein Metabolism  
Friday, June 1, 2018, 3:15 PM - 5:15 PM  
Room: CC-Mezzanine M100C

2643 Chair: Nancy R. Rodriguez, FACSM. University of Connecticut, Storrs, CT.  
(No relevant relationships reported)

During traditional (TRD) resistance exercise, there is a decrease in the velocity and power output achieved over the course of a set consisting of multiple repetitions. Reconfiguration of an exercise set into a cluster set (CLU), which includes a brief intra-set rest period, has been shown to counteract this performance decline. However, the effect of intra-set rest manipulations during resistance exercise on changes in protein synthesis rates in healthy young men has not been studied.

2644 Board #1  
June 1 3:15 PM - 5:15 PM  
Evaluation Of Lean Body Mass As A Predictor Of Dietary Protein Intake  
Joseph R. Stanziene, Joseph I. Boullata, Michael Bruneau, Jr., Stella L. Volpe, FACSM. Drexel University, Philadelphia, PA.  
(Sponsor: Stella L. Volpe, FACSM)  
(No relevant relationships reported)

Protein intake bivariately ($R^2$=0.088, p<0.001), but was lost in the multivariate model when PBF and sex were controlled (p=0.05). PBF alone predicted protein intake in this model (r=0.112, sr=-0.215, p<0.01). CONCLUSION: Our results support a significant relationship between protein intake and LBM in Masters athletes using a bivariate model; however, it is unclear whether a definitive relationship exists due to lack of significant results in the multivariate model. An additional finding revealed that PBF demonstrated a significant negative relationship with protein intake. Longitudinal research should be conducted to better elucidate these relationships. This study was not funded
However, the temporal pattern of change in MPS tended to be greater in the TRD conditions versus CLU condition (P<0.10). **CONCLUSION:** These data showed that both TRD and CLU configurations of barbell back squat augment postexercise MPS throughout 0-5 h of recovery in trained young men and women. These data indicate that the intra-set rest manipulations present in CLU do not induce differences in muscle anabolism from TRD-style of resistance exercise trained in young men and women.

#### 2647: June 1 3:15 PM - 5:15 PM

**Board #4**

**Dose Effect of Whey Protein on Gut Hormone Responses in Pre-Diabetes and Type 2 Diabetics**

Chris Irvine¹, Todd Castleberry¹, Michael Oldham¹, Matthew Brisebois¹, Sarah Deemer², Ryan Gordon¹, Aubri Henderson¹, Vic Ben-Ezra¹, °Texas Woman’s University, Denton, TX. °The University of Alabama Birmingham, Birmingham, AL. (Sponsor: Dr. David Nichols, FACSVM) (No relevant relationships reported)

**BACKGROUND:** GLP-1 and GIP have been shown to increase following a 50 g dose of whey protein prior to a high glycemic load in type 2 diabetics. However, this increase is reduced in diabetics compared to healthy individuals. Pancreatic polypeptide (PP) and peptide tyrosine tyro sine (PYY) also increase, while whey increases decreases after the consumption of whey protein; however, it is not known if a similar hormone response occurs with a lower dose of whey protein consumption prior to a glycemic load or if there is a dose effect. Our hypothesis was that 20 g and 30 g of whey protein would elicit an increase in GLP-1, GIP, PP, and PYY and decrease ghrelin in a dose dependent manner.

**PURPOSE:** The purpose of this study was to examine the effect of two different doses of whey protein ingested 30 min prior to a 50 g OGTT on gut hormone and incretin response.

**METHODS:** Nine diabetic and pre-diabetic participants (n=9, mean ± SD; age: 64.3 ± 8.1 yrs; BMI: 29.4 ± 6.0 kg/m²; HbA1c: 6.4 ± 0.6%; Na+ 140 ± 14 mEq/L; K+ 4.3 ± 1.2 mEq/L; Creatinine: 1.3 ± 0.8 mg/dL) completed three trials. The randomly assigned trials consisted of: ingestion of 250ml of water (CON); 250 ml of water + 20 g whey (20g); 250ml of water + 30 g whey (30g), prior to completing a 50 g OGTT. Blood was collected at -30, 0, 15, 30, 60, 90, 120, and 150 min for the measurement of GIP, GLP-1, ghrelin, PP, and PYY. The whey protein mixture was administered immediately following the -30 min and the 50 g OGTT began immediately after the 0 min blood draw. Metabolites were measured using multiplex fluorescent detection. One-way repeated measure ANOVA was used for statistical analysis for each dependent variable (P<0.05).

**RESULTS:** 20g and 30g of whey protein significantly increased integrated area under the curve (AUC) of GIP 32% and 38% compared to CON. 30g significantly decreased ghrelin AUC -13.9% and -20% compared to 20g and CON. 30g significantly increased the curve (AUC) of GIP 32% and 38% compared to CON. 30g significantly decreased ghrelin AUC -13.9% and -20% compared to 20g and CON. There were no significant differences for GLP-1 and GIP AUC between 20g and CON. There were no significant differences for GLP-1 and GIP between all trials.

**CONCLUSION:** 30 g of whey protein prior to a 50 g OGTT increased the secretion of GIP and PP and decreased ghrelin in type 2 and pre-diabetics. There seems to be a dose affect relationship between whey, ghrelin, and PP. 30 g of whey preload may induce insulinosensitive and satiety effects stemming from GIP, PP, and ghrelin responses in type 2 and pre-diabetics.

---

**S538 Vol. 49 No. 5 Supplement**

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

**FRIDAY, JUNE 1, 2018**

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

---

**2649: June 1 3:15 PM - 5:15 PM**

**Board #6**

**Blunted Muscle Synthetic Response To Feeding And Resistance Exercise In Obese Young Adults**


**Abstract**

Obesity induces anabolic resistance of myofibrillar protein synthesis rates (MPS) to the ingestion of a protein-dense food in young adults. However, the effectiveness of acute resistance exercise before food ingestion to enhance the amino acid sensitivity of MPS with obesity has not been examined. **PURPOSE:** To compare the impact of resistance exercise on MPS responses to protein-dense food ingestion in normal-weight (NW) and obese (OB) young adults. **METHODS:** 7 NW (21.1±1 y, BMI 21.9±0.5 kg/m²) and 7 OB (22.1±1 y, BMI 35.7±2.3 kg/m²) men and women underwent primed continuous L-[ring-13C]phenylalanine infusions coupled with blood and muscle biopsy collections to measure MPS at basal and fed-state of the exercise (EX) and non-exercise (CON) legs. Participants performed unilateral resistance exercise (4 sets × 10-12 repetitions) followed by the ingestion of 6 oz of lean pork loin (36 g protein; 4 g fat; 180 kcal).

**RESULTS:** Total work performed during exercise was similar among groups (NW: 1610±164 kg·m; OB: 1888±154 kg·m; P=0.24). Plasma essential amino acid concentrations increased similarly after pork ingestion in both groups (time effect: P<0.05) with peak values at 2 hours of the postprandial period. Basal MPS was similar between NW and OB groups (P=0.05). MPS was stimulated in the EX and CON legs after pork ingestion in both the NW (absolute change from basal: CON 0.027±0.008 %/h; EX 0.035±0.011 %/h) and OB groups (CON 0.027±0.006 %/h; EX 0.033±0.011 %/h; P=0.05). MPS was stimulated to a greater extent in the EX vs. CON legs in NW (P<0.02) but not OB group (P=0.26). **CONCLUSION:** Our results suggest that increased adiposity may attenuate the effectiveness of resistance exercise to augment the postprandial MPS response.

**Funding provided by the ACSM Foundation Doctoral Student Research Grant**

---

**2650: June 1 3:15 PM - 5:15 PM**

**Board #7**

**The Effect of Pre Sleep Casein Protein Consumption on Next Morning Resting Metabolic Rate in Resistance Trained Women**

Brittany R. Allman, Margaret C. Morrissey, Michael J. Ormsbee FACSM. Florida State University, Tallahassee, FL. (No relevant relationships reported)

**The Effect of Pre-Sleep Casein Protein Consumption on Next-Morning Resting Metabolic Rate in Resistance-Trained Women**

Brittany R. Allman, Margaret C. Morrissey, Michael J. Ormsbee FACSM

Institute of Sports Sciences & Medicine, Florida State University

Nighttime eating has been discouraged by the media due to its purported negative implications on metabolism. However, recent studies have shown that nighttime casein protein (PR9) either increases or has no effect on next morning resting metabolic rate (RMR). However, the effects of eating PRO at night on RMR in resistance-trained women is unclear. **PURPOSE:** To examine the effect of consuming nighttime PRO on next-morning RMR in resistance-trained women. **METHODS:** Thirty healthy, resistance-trained (squat 100% body weight, bench press 70% body weight), normal weight and fatness (BMI, 19.9±2.3 kg/m²; body fat 28.7±4.9%), eumenorrheic females (age, 22±3 years) volunteered for this study. Participants reported to the lab on four different occasions: pre-testing and maximal testing familiarization (1a), maximal testing (1b), and two experimental trials (2 and 3). Thirty minutes before bed participants consumed micellar casein protein (PRO; 30 g protein, 120kcal) or a non-caloric, isocaloric (PLA; 30 g protein, 120kcal) placebo. RMR and respiratory exchange ratio (RER) were measured using open-circuit indirect calorimetry at baseline (BL) and immediately upon waking (AM) the following morning. **RESULTS:** There was no significant change in next-morning RMR when
Dietary amino acids are important for both the repair and rebuilding of body proteins and the replenishment of exercise-induced oxidative losses. Current athlete recommendations are based primarily on the protein intake required to maintain nitrogen (i.e., protein) balance rather than one that optimizes whole body protein metabolism and maintains exercise performance. **Purpose:** To determine how a range of protein intakes, including a new tracer-derived safe intake, altered protein metabolism and exercise performance during a period of controlled training. **Methods:** Using a double blind randomized crossover design, 10 male endurance-trained runners (~32y; ~65 ml O2/kg/min; ~62 km/wk) completed 3 trials, each consisting of 4 days of controlled training (20, 5, 10, 20 km days 1–4, respectively). Controlled diets provided 6–9 g/kg/d of carbohydrate and 0.80 g protein/kg/d from whole foods that was supplemented with 0.12 (LOW), 0.40 (MOD), and 1.03 (HIGH) g of crystalline amino acids/kg modelled after egg protein. Oral [15N] glycine was ingested on the 1st and 4th day to determine whole body protein synthesis (S), breakdown (B), and net balance (NB). Maximum voluntary isometric contraction (MVC), 5-km Time Trial (5kmTT) and peak force (Jump) were tested 2 days before and immediately after the controlled diet and training. **Results:** S and B were not altered by training or protein intake. NB was negative in LOW and positive in HIGH with a dose-response between conditions (HIGH > MOD > LOW, p<0.05). Inconsistent statistical revealed that for MVC, HIGH likely (probability 87%) had a moderate benefit over LOW (ES=0.57) and likely (probability 77%) a small benefit over MOD (ES=0.42). For the 5kmTT, HIGH likely (probability 79%) had a moderate benefit over LOW (ES=0.57) and a possible (probability 69%) small benefit over MOD (ES=0.26). No differences were found for Jump performance. **Conclusion:** Endurance trained males consuming adequate carbohydrate maintained exercise performance and enhanced whole body protein metabolism when consuming >1.2g/kg/d of dietary protein. Our data suggest that training quality and post-exercise recovery would be optimized in endurance-trained runners who consume dietary protein towards at the higher end of current ACSM recommendations (i.e., 1.2–2.9g/kg).

**June 1 3:15 PM - 5:15 PM** **High Protein Intakes Enhance Whole Body Protein Metabolism and Exercise Performance in Endurance-Trained Males**

(No relevant relationships reported)

**June 1 3:30 PM - 4:30 PM** **Incentivizing Physical Activity in American Indian Adolescents At Risk For Metabolic Disorders**

Kevin R. Short, Jennifer Q. Chadwick, Kenneth C. Copeland, Dannielle J. Dumas, Lisa Wolbert, Tamela K. Cannadt, Mary A. Tullier, Melicia C. Whitt-Glover, Michelle Segar. 1University of Alabama at Birmingham, BIRMINGHAM, AL. 2Gramercy Research Group, Winston-Salem, NC. 3University of Michigan, Ann Arbor, MI. 4University of Oklahoma Health Sciences Center, Oklahoma City, OK. 5Choctaw Nation of Oklahoma, Talihina, OK. 6Choctaw Nation of Oklahoma, Hugo, OK. 7Choctaw Nation of Oklahoma, Durant, OK. 
(No relevant relationships reported)

**June 1 3:45 PM - 4:00 PM** **African American Women and Outdoor Physical Activity: Understanding Patterns and Group Engagement**

Oliveia Affuso, FACSM1, Amber W. Kinsey1, Melissa C. Whitt-Glover, FACSM2, Michelle Segar1. 1University of Alabama at Birmingham, BIRMINGHAM, AL. 2Gramercy Research Group, Winston-Salem, NC. 3University of Michigan, Ann Arbor, MI. 
(No relevant relationships reported)

**June 1 3:15 PM - 4:45 PM** **Promotion and Intervention Strategies**

**FREE COMMUNICATION**

F-36 **Free Communication/Send - Physical Activity Promotion and Intervention Strategies**

Friday, June 1, 2018, 3:15 PM - 5:15 PM
Room: CC-Mezzanine M100D

**Chair:** Catrine Tudor-Locke, FACSM. University of Massachusetts Amherst, Amherst, MA. 
(No relevant relationships reported)

**June 1 3:15 PM - 3:30 PM** **Physical Activity Maintenance Among African American Women: Factors Associated with Lapses and Recovery**

Amber W. Kinsey1, Melissa C. Whitt-Glover, FACSM2, Michelle Segar1, Olivia Affuso, FACSM1. 1University of Alabama at Birmingham, Birmingham, AL. 2Gramercy Research Group, Winston-Salem, NC. 3University of Michigan, Ann Arbor, MI. 
(Sponsor: Olivia Affuso, FACSM) 
(No relevant relationships reported)

**Purpose:** Studies have demonstrated that lapse-recovery cycles, or the brief periods of little to no physical activity (PA) that may persist for days or weeks (lapses) followed by a return to normal PA levels (recovery), are integral to long-term PA maintenance in African American (AA) women. Given the low PA levels and high rates of chronic disease among AA women, understanding factors associated with lapse-recovery cycles in AA women who successfully maintain PA may improve interventions for promoting and sustaining PA in high-risk populations. **Methods:** AA women (≥ 18 years) who self-reported PA maintenance (≥ 6 months) were recruited via email, word-of-mouth, and social media to complete an online survey. Questions included whether respondents experienced a lapse in the previous year, and if so, the number and causes of lapses, the longest lapse experienced, and factors that helped to resume PA. Respondents were asked to recall the metabolic cycles separately, using a priori codes; discrepancies were discussed to reach consensus. **Results:** Of the 206 respondents, 139 (67.5%; age 38.4 ± 11.6 years) experienced a lapse in PA in the past year. Most women (58.3%, n=81) experienced 1–2 lapses, with most lasting <1 month (43.9%). The top five predictors of lapses included work demands (33.1%), an injury or surgery (24.5%), travel/vacations (22.3%), lack of time (19.4%; e.g. scheduling conflicts) and family factors (16.5%; e.g. caretaking, relationship issues). The factors associated with resuming PA included becoming motivated again (18.0%; e.g. goal-setting, self-talk), social support (15.1%; e.g. encouragement from friends/family, joining PA groups), weight (14.4%; e.g. gaining weight as motivation), feeling better (14.4%; e.g. physically and mentally, body craving PA), and recovering from an injury or surgery (14.4%). **Conclusions:** Understanding correlates of PA lapse-recovery cycles in AA women who maintain PA can aid in developing strategic interventions to foster long-term PA behaviors among this important population. Our findings suggest that motivation, social support, weight and positive affect might be ideal intervention targets. Future studies should explore the impact of targeted strategies to address lapse-recovery cycles.

**June 1 3:45 PM - 4:00 PM** **Studies have demonstrated that lapse-recovery cycles, or the brief periods of little to no physical activity (PA) that may persist for days or weeks (lapses) followed by a return to normal PA levels (recovery), are integral to long-term PA maintenance in African American (AA) women. Given the low PA levels and high rates of chronic disease among AA women, understanding factors associated with lapse-recovery cycles in AA women who successfully maintain PA may improve interventions for promoting and sustaining PA in high-risk populations. **Methods:** AA women (≥ 18 years) who self-reported PA maintenance (≥ 6 months) were recruited via email, word-of-mouth, and social media to complete an online survey. Questions included whether respondents experienced a lapse in the previous year, and if so, the number and causes of lapses, the longest lapse experienced, and factors that helped to resume PA. Respondents were asked to recall the metabolic cycles separately, using a priori codes; discrepancies were discussed to reach consensus. **Results:** Of the 206 respondents, 139 (67.5%; age 38.4 ± 11.6 years) experienced a lapse in PA in the past year. Most women (58.3%, n=81) experienced 1–2 lapses, with most lasting <1 month (43.9%). The top five predictors of lapses included work demands (33.1%), an injury or surgery (24.5%), travel/vacations (22.3%), lack of time (19.4%; e.g. scheduling conflicts) and family factors (16.5%; e.g. caretaking, relationship issues). The factors associated with resuming PA included becoming motivated again (18.0%; e.g. goal-setting, self-talk), social support (15.1%; e.g. encouragement from friends/family, joining PA groups), weight (14.4%; e.g. gaining weight as motivation), feeling better (14.4%; e.g. physically and mentally, body craving PA), and recovering from an injury or surgery (14.4%). **Conclusions:** Understanding correlates of PA lapse-recovery cycles in AA women who maintain PA can aid in developing strategic interventions to foster long-term PA behaviors among this important population. Our findings suggest that motivation, social support, weight and positive affect might be ideal intervention targets. Future studies should explore the impact of targeted strategies to address lapse-recovery cycles.
develop diabetes. METHODS: We enrolled overweight or obese, non-diabetic AI boys and girls, 11-20 years old with low physical activity. Participants were instructed to exercise 3 days/week for 48 weeks at a Choctaw Wellness Center, earning payments for 20-60 minute sessions of moderate-to-vigorous physical activity. The program was subdivided into three, 16-week-long phases to test different incentive strategies. RESULTS: Mean ± sem age of the 43 girls and 34 boys who completed baseline and started exercise was 14.0 ± 2.2 years. Seven risks for future diabetes were present, including obesity at baseline (43 ± 8%), low physical activity (6.800 ± 2.399 steps per day) and low aerobic fitness (VO2max; 19.4 ± 5.7 ml/kg/min). In Phase 1, the financial incentive to exercise more frequently was not effective; the incentivized subgroup had a similar number of exercise sessions (28 ± 2) as the control payment group (26 ± 3, p > 0.05). However, in Phase 2, the financial incentive to increase exercise duration was successful, exercise duration for the incentivized and control subgroups were 38.2 ± 2.2 versus 19.1 ± 1 minutes per session (p = 0.002, Effect size ~0.9), respectively. In Phase 3, the effect of reducing the incentives was inconclusive due to high participant withdrawal. CONCLUSIONS: Our goal to get habitually sedentary, obese adolescents to increase their exercise behavior was at least partly successful, since the participants collectively completed 3,229 exercise sessions. The use of incentives was also helpful to promote the program and to extend the duration of exercise sessions in Phase 2. However, a remaining challenge is to help adolescents overcome barriers that prevent them from exercising more frequently and sustaining a daily exercise program. Funding: NIH/ NIMHD P20 MD000528, Choctaw Nation of Oklahoma.

Prostate cancer (PC) treatments can result in long-term side effects that impact physical function and quality of life. Exercise has been shown to be a safe and effective strategy to reduce and manage treatment side effects; however, very few PC survivors are sufficiently active and provided supervised exercise programming is not feasible in many clinical settings. To address this need, the Prostate Cancer Supportive Care (PCSC) Program implemented an exercise counseling clinic led by a certified exercise physiologist who focused on facilitating exercise behaviour change. Purpose: To evaluate if an exercise counselling clinic can improve the aerobic and resistance exercise levels in men with PC, to align with the exercise oncology guidelines. Methods: Participants of the PCSC Program were invited to attend an exercise counselling clinic as part of their regular PC clinical care, namely 4 x 45-minute one-on-one sessions over 12-months (baseline, 6- and 12-months). At each session, the total amount of aerobic and resistance exercise current PC treatments, physical symptoms and readiness for change were recorded using self-report questionnaires and a guided interview. A retrospective chart review was performed from data collected between July 2015 (clinic inception) and September 2017. Results: 128 men (age = 67.6±7.0) attended the clinic at baseline. 93 of these men attended 2 or more visits and were analyzed further. 55% were currently receiving treatment or had received it in the past 6-months. Attendance was 73% at the 6-month follow-up and dropped to 36% at 12-months. Compared to baseline, there was an 18% increase in men meeting aerobic exercise guidelines (62%, p<0.01), 26% increase for resistance training guidelines (47%, p<0.01) and 22% increase for both aerobic and resistance training guidelines (39%, p<0.01). At baseline, the vast majority of men were in the preparation, action or maintenance stage of change (41%, 13% and 40% respectively). Conclusion: An exercise counselling clinic can significantly improve aerobic and resistance exercise levels in men with PC and improve adoption of the exercise oncology guidelines. Future work will focus on duration and intensity of support required to increase long-term behaviour change and target men with PC who are not meeting exercise oncology guidelines.

Funding: NIH/NIMHD P20 MD000528, Choctaw Nation of Oklahoma.

There are approximately 13 million cancer survivors in the U.S.; fewer than 10% meet the exercise recommendations outlined by the American College of Sports Medicine. Poor adherence is likely explained by a variety of factors. If we can identify these factors, we may be able to tailor the prescription, monitoring, and encouragement of exercise more effectively. PURPOSE: To determine variables that influence retention in an exercise trial for cancer survivors. METHODS: We enrolled 157 cancer survivors in an exercise program lasting 10 weeks and consisting of biweekly cardiovascular, strengthening, and flexibility components. At baseline and following the intervention, we assessed anthropometric and cardiovascular profiles, health and cancer history, and physical functioning. Chi-square and logistic regression analyses tested variables associated with program completion. RESULTS: We retained 37.7% of patients through follow-up. Women were more likely to complete the trial (43.2%) than men (19.4%; p = 0.010). Differences between cancer type were minimal. Adherence was better among breast cancer patients (p = 0.016) but this was attributable to sex; there was no difference among patients with multiple cancers (p = 0.583) or patients who had a previous heart attack (p = 0.681) or stroke (p = 0.528), had diagnosed hypertension (p = 0.513) or pulmonary disease (p = 0.199), were obese (p = 0.893), or smoked (p = 0.335). Fatigue (p = 0.696) and mode of treatment (surgery, chemotherapy, radiation; p = 0.225) did not affect completion. There was a difference among patients with hypertension (0.50% retained) compared to patients without hypertension (22.4%; p = 0.040). Patients with poor sit-and-reach scores were also more likely to drop out: 53.3% of patients who could reach their toes completed the program compared to 26.5% who could not reach their toes (p = 0.016). CONCLUSION: Exercise adherence is low among cancer survivors; in our sample, fewer than 40% of patients were retained through follow-up. Several factors predicted retention, but sex had the strongest association. Further efforts must be made to identify risk factors for attrition in this population. The differences observed in retention by sex suggest other cohorts may need to be stratified by sex to verify our findings.

Purpose: To examine the effectiveness of a three-stage physical training program on ADL-related functional fitness and daily physical activity for community-dwelling old-old Japanese women. METHODS: After giving written informed consent, the subjects, unable to stand on one leg for more than 20 seconds with eyes open, were divided into a 3 times/week group (HFG; 13 females, 81 ±2±7.9 yrs, BMI 22.8±1.6) and a 1 time/week group (LFG; 10 females, 81.7±3.2 yrs, BMI 21.9±1.3). The program was composed of three stages for 16 weeks. First, participants learned about management skill for their physical soreness and asked to stand on one leg with eyes open for one minute, 3 times a day for each leg at class and at home. Second, they learned to strengthen their core and lower leg muscle using an elastic band. The last stage was to learn a three-minute arm and leg combined exercise program with music: ADL-related functional fitness(sitting & standing time, zigzag walking time), one-leg standing time with eyes open, and knee extension strength were obtained. Balance ability was measured by the area covering and total length of the center of gravity sway (COP). Each measurement item was assessed before and after the intervention period. Daily physical activity was measured by pedometer in the first and last 7 days during the intervention period. Student’s t-test and two-way repeated measures ANOVA were used to test the effectiveness. RESULTS: The class participation were 82.4% and 81.8% respectively. Sitting & standing time (HFG: 18.4±5.6 to 16.3±5.1 sec., LFG: 17.4±3.9 to 17.7±3.6 sec, F=3.573, P=0.073), zigzag walking time (HFG: 19.2±2.9 to 17.2±4.2 sec., LFG: 16.6±3.1 to 16.8±2.9 sec, F=11.88, P=0.002), one-leg standing time with eyes open (HFG: 6.1±3.1 to 13.7±4.2 sec, LFG: 5.9±2.3 to 6.1±1.8 sec, F=30.69, P=0.000), knee extension strength (P=0.040), and balance ability (area covering of COP, F=13.58, P=0.001, total length of COP, F=21.00, P=0.022) daily steps (HFG: 3864±747 to 4454±632 steps, LFG: 3831±832 to 4001±860 steps, F=5.52, P=0.032) also improved significantly in HFG. CONCLUSIONS: Three-stage physical training program was effective for functional fitness and daily physical activity by old-old Japanese females.
13-month data (N=93) indicate that mean PFS scores continue to decline to 15.6±8.2 fatigability after the 5 month intervention also declined to 53% (N=61). Preliminary points (13.4%) to 16.1±9.0 (p=0.001); the number of participants classified with higher months, participants lost 10.7 lbs (5.2% of body weight) and increased total physical scores= less fatigability); self-reported PA using the Community Healthy Activities Model Program for Seniors Survey (CHAMPS) questionnaire; and weight.

However, the effects of weight loss and PA interventions on improving physical differences were found in PA levels at baseline or 24 months based on behavioral skills had higher baseline PA compared to those who did not (6779 vs. 5752; p=0.03). No steps; p=0.02) than those who did not. Within self-monitoring strategies, participants recording PA (53% baseline; 57% 24 months) and calories (52% baseline; 43% 24 months) were the most common self-monitoring strategies. There were no differences in strategies between CC and TO groups at either baseline or 24 months. Participants who used self-monitoring strategies at 24 months had higher PA levels at baseline (6473 vs. 4730 steps; p =0.045) and 24 months (6103 vs. 5251 steps; p=0.04, respectively). Participants with group support at 24 months also had higher baseline PA compared to those who did not (6779 vs. 5752; p=0.03). No differences were found in PA levels at baseline or 24 months based on behavioral skills or professional support.

CONCLUSIONS: Participants reported frequent use of a variety of lifestyle strategies at baseline and 24 months. Self-monitoring, especially recording daily steps, may be particularly important in sustaining PA levels after intentional weight loss.

Lifestyle Strategies to Support Sustained Physical Activity after Intentional Weight Loss: Results from MAINTAIN-pc Trial

Molly B. Conroy, FACSMD, Bethany B. Gibbs, Margaret P. Lott, Rachel Hess, Cindy Bryce, Gary S. Fischer, Dana Tudorascu, Diane Comer, Laurey Simkin-Silverman, Kimberly Huber, Kathleen M. McGigue, University of Utah, Salt Lake City, UT; University of Pittsburgh, Pittsburgh, PA; University of Miami, Miami, FL.

(Please note relationships reported)

PURPOSE: Weight maintenance after intentional loss is challenging, and sustained physical activity (PA) levels can help. Less is known about lifestyle strategies that may promote sustained PA levels after intentional weight loss.

METHODS: We analyzed baseline and 24-month data from the Maintaining Activity and Nutrition through Technology-Assisted Innovation in Primary Care (MAINTAIN-pc) trial. MAINTAIN-pc recruited adults who had intentionally lost >= 5% body weight in past 2 years and were randomized to tracking tools with tailored coaching (CC) or tracking tools alone (TO). At assessments, participants reported lifestyle strategies used in the past 6 months, including self-monitoring, group support, behavioral skills, and professional support. PA levels were assessed with Omron pedometer HJ-720T with blinded feedback screen. Wilcoxon rank sum or t tests compared PA levels between strategy use vs. no use.

RESULTS: At baseline, 194 participants were 53.5±12.2 years old, 74% female, and 88% White. Median baseline PA level was 5988 steps/day. At baseline, 69% used self-monitoring, 73% support group, 100% behavioral skills, and 68% professional support in past 6 months; at 24 months these rates were 75%, 60%, 98%, and 61%, respectively. Recording PA (53% baseline; 57% 24 months) and calories (52% baseline; 43% 24 months) were the most common self-monitoring strategies. There were no differences in strategies between CC and TO groups at either baseline or 24 months. Participants who used self-monitoring strategies at 24 months had higher PA levels at baseline (6473 vs. 4730 steps; p=0.045) and 24 months (6103 vs. 5251 steps; p=0.04, respectively). Participants with group support at 24 months also had higher baseline PA compared to those who did not (6779 vs. 5752; p=0.03). No differences were found in PA levels at baseline or 24 months based on behavioral skills or professional support.

CONCLUSIONS: Participants reported frequent use of a variety of lifestyle strategies at baseline and 24 months. Self-monitoring, especially recording daily steps, may be particularly important in sustaining PA levels after intentional weight loss.
cardiorespiratory endurance (1.5 mile run) on day 3. Participants completed the same standardized warm-up before each measurement day. Paired-independent samples t-tests were conducted using SPSS 24.

**RESULTS:** Females significantly improved flexibility (31.1 ± 9.2 cm to 34.1 ± 8.1 cm, t = 3.8, p < .001), power (long jump = 1.75 ± 0.33 m to 1.81 ± 0.31 m, t = 3.0, p = .006), muscular endurance (push-ups = [n=13] = 25.2 ± 7.0 to 29.8 ± 7.8 reps, t = 2.4, p = .035), and strength (back squat = 58.2 ± 12.4 kg to 64.3 ± 13.9 kg, t = 4.6, p < .001; press = 32.3 ± 5.9 kg to 34.7 ± 4.3 kg, t = 3.7, p = .002; and deadlift = 80.0 ± 18.9 kg to 87.7 ± 22.0 kg, t = 3.2, p = .005). Males significantly improved flexibility (29.5 ± 6.6 cm to 31.6 ± 7.4 cm, t = 2.1, p = .043), muscular endurance (pull-ups = [n=16] = 3.6 ± 0.9 to 4.2 ± 1.0 reps, t = 2.7, p = .018) and strength (back squat = 101.8 ± 27.0 kg to 110.6 ± 30.0 kg, t = 5.0, p < .001; deadlift = 130.4 ± 31.6 kg to 139.5 ± 31.2 kg, t = 4.2, p = .001). Females improved significantly more than males only for power (long jump, t = 3.1, p = .006).

**CONCLUSIONS:** The GPP-focused HIIT training significantly improved multiple fitness domains for females and males after 6 months of training, with no significant fitness decreases. Improvements were found even among experienced HIIT participants, which may help facilitate continued participation.

---

**2664 June 1 3:45 PM - 4:00 PM**  
**Effect of Heavy Resistance and Plyometric Training on Running Economy and 5km Performance in Well-trained Male Athletes**  
Li Fei, Ding Haiyong, Zhang Xiaohui, Han Guangqiang, Chen LinShan, Huang Chunyan. SHANGHAI UNIVERSITY OF SPORT, SHANGHAI, China.

(No relevant relationships reported)

**Purpose** The present study was to investigate the effect of 8-week heavy strength training plus plyometric training on well-trained male athletes' running economy and 5km performance.

**Methods** Twenty-three male long-distance runners (25.2±3.8 years; 79.5 ± 9.9 yrs.; 79.5 ± 9.9 mean ± SD) were recruited from California State University, East Bay (CSUEB) campus, and local independent-living senior populations. Sit-to-stand (STS) was done for four sets for five repetitions at 70% of 1RM, on the fifth set the subject's one-repetition maximum (1RM) for squat and bench press. A cross over design was used to determine the order of the final three trials in which the subject would drink eight ounces of a caffeinated pre-workout out (CA), a caffeine-free pre-workout (NC), or water (C). 20 minutes post consumption of fluid, the subjects did a standard warm-up, then completed four sets of back squat for five repetitions at 70% of 1RM, and on the fifth set the subject would complete repetitions until fatigue. Bench press was done for four sets for five repetitions at 70% of 1RM, on the fifth set the subject would complete repetitions until fatigue. The number of repetitions completed on the last set of both squat and bench press were recorded.

**RESULTS** An ANOVA was utilized to determine if significant differences occurred in repetitions to failure in the control trial, with caffeinated pre-workout, and with non-caffeinated pre-workout. There was a statistically significant difference in squat (F(1,304, 7.823)= 5.543, p=.041) and bench press (F(1,857, 11.141)= 5.484, p=.024) repetitions to failure. Post hoc analysis revealed that squat repetitions to failure were significantly greater in CA and NC when compared to C (p=.028; p=.044). There was no significant difference between repetitions to failure when comparing CA and NC (p=.99). Post hoc analysis also revealed that bench press repetitions to failure were significantly greater in CA when compared to C and NC (p=.05; p=.234).

**CONCLUSIONS** The use of CA significantly increased repetitions to failure for both squat and bench press when compared to a control trial. The use of NC resulted in a significant increase in repetitions to failure for squats, but no significant improvement in repetitions to failure in the bench press. The use of CA and NC have an ergogenic effect on resistance training performance.

---

**2665 June 1 4:00 PM - 4:15 PM**  
**Exercise Time and Intensity: The Ideal Ratio to Prevent Overtraining and Maximize Fitness**  
Heather J. Porter1, Joshua J. Davis2, Jinger S. Gottschall1. 1The Pennsylvania State University, University Park, PA. 2Penn State Hershey Medical Center, Hershey, PA. (Sponsor: W. Larry Kenney, FACSM)

(No relevant relationships reported)

The American College of Sports Medicine recommends that adults achieve at least 30-50 minutes of moderate-intensity cardiorespiratory exercise 5 days per week or 20-60 minutes of vigorous-intensity exercise 3 days per week. While these minimum guidelines are clearly described, there are currently no maximum guidelines, particularly with respect to high-intensity time and frequency, for the prevention of overtraining. **PURPOSE:** To evaluate the correlation between salivary hormones, time in varying heart rate zones, and psychosocial stress variables in order to prevent overtraining and improve fitness. Our hypothesis is that chronic exercise durations greater than 1 hour per week in the high intensity (greater than 90% maximum heart rate) zone will lead to decreased variation in the production of stress hormones, decreased ability to reach the heart rate and increased reporting of tension as well as fatigue. **METHODS:** Twelve healthy adults between 25-50 years who regularly exercised more than 8 hours per week recorded their heart rate during every training session and answered daily surveys regarding their mood for 3 weeks. Next, they completed an experimental day composed of 2, 30-minute high-intensity interval sessions separated by 4-hours of non-active recovery. We collected saliva samples prior to each exercise session, immediately following, and 30-minutes post to assess changes in cortisol and testosterone concentrations. Heart rate was monitored throughout the experimental day to determine exercise and recovery values. **RESULTS:** There was a correlation between weekly time training at an intensity greater than 90% maximum heart rate and the variables associated with overtraining. Cortisol and testosterone saliva concentration fluctuated less in the participants who exercised in this extreme zone for more than 50 minutes per week. To add, these participants were not able to reach the same intensity during the second-high intensity session on the experimental day and reported greater tension as well as fatigue on the surveys in the weeks prior to testing. **CONCLUSIONS:** Our data demonstrate that 50 minutes of high-intensity training per week is a suggested maximum, cumulative time in order to prevent symptoms related to overtraining.

---

**2666 June 1 4:15 PM - 4:30 PM**  
**The Effect of Pre-Workout on Resistance Training Repetitions to Failure**  
Jacob Prete, Eloane Biechler, Adam Brogle, Matthew Greene, Emma Corkill, Hunter Dunlap, Loras College, Dubuque, IA. (Sponsor: Vincent Paolone, FACSM)

(No relevant relationships reported)

The usage of pre-workout supplementation has increased substantially in recent years, as research has shown pre-workout supplements can significantly enhance performance in all populations.

**PURPOSE:** To compare and determine the effectiveness of a caffeine-free pre-workout and a caffeinated pre-workout on repetitions to failure in bench press and squat.

**METHODS:** Subjects completed a total of four trials. The first trial was done to find the subject’s one-repetition maximum (1RM) for squat and bench press. A cross over design was used to determine the order of the final three trials in which the subject would drink eight ounces of a caffeinated pre-workout out (CA), a caffeine-free pre-workout (NC), or water (C). 20 minutes post consumption of fluid, the subjects did a standard warm-up, then completed four sets of back squat for five repetitions at 70% of 1RM, and on the fifth set the subject would complete repetitions until fatigue. Bench press was done for four sets for five repetitions at 70% of 1RM, on the fifth set the subject would complete repetitions until fatigue. The number of repetitions completed on the last set of both squat and bench press were recorded.

**RESULTS:** An ANOVA was utilized to determine if significant differences occurred in repetitions to failure in the control trial, with caffeinated pre-workout, and with non-caffeinated pre-workout. There was a statistically significant difference in squat (F(1,304, 7.823)= 5.543, p=.041) and bench press (F(1,857, 11.141)= 5.484, p=.024) repetitions to failure. Post hoc analysis revealed that squat repetitions to failure were significantly greater in CA and NC when compared to C (p=.028; p=.044). There was no significant difference between repetitions to failure when comparing CA and NC (p=.99). Post hoc analysis also revealed that bench press repetitions to failure were significantly greater in CA when compared to C and NC (p=.05; p=.234).

**CONCLUSIONS:** The use of CA significantly increased repetitions to failure for both squat and bench press when compared to a control trial. The use of NC resulted in a significant increase in repetitions to failure for squats, but no significant improvement in repetitions to failure in the bench press. The use of CA and NC have an ergogenic effect on resistance training performance.

---

**2667 June 1 4:30 PM - 4:45 PM**  
**Developing And Validating The Sit-to-stand As A Muscular Power Measure In Older Adults**  
Jennifer J. Sherwood, Cathy Inouye, Shannon L. Webb, Pavel V. Romanovski, Trenton Ashizawa, Tori Coleman, John W. Adams, Michel Mintza Osseen. California State University, East Bay, Hayward, CA.

(No relevant relationships reported)

**Purpose:** Here, we tested the validity and reliability of velocity and power measurements performed with a GYMaware linear position transducer (LPT) during a sit-to-stand (STS).

**Methods:** Fifty-one asymptomatic men (n = 14) and women (n = 37) (ages 60-95 yrs.; 79.5 ± 9.9, mean ± SD) were recruited from California State University, East Bay (CSUEB) campus, and local independent-living senior populations. Sit-to-stand performance velocity and power was assessed with an LPT connected to a waist belt and base, and video recorded simultaneously and analyzed with Dartfish. Maximum hand-grip strength was assessed with a Jamar dynamometer. **Results:** The Pearson correlation coefficients of STS velocity and power were r = 0.9702 and r = 0.9651, providing evidence that the LPT and cinematography measurements were similar. The trial-to-trial reliability of the STS measured by the LPT gave an intraclass correlation
coefficient of 0.916-0.966 for velocity and 0.860-0.940 for power. The Pearson correlation between STS performance measured with the LPT and maximum hand-grip strength was $r = 0.631$.

**Conclusion:** Our findings show that the calculations derived from the LPT were very similar to those of cinematography and provide evidence for the validity of this method. The data from the LPT were shown to be reliable. Sit-to-stand performance showed a good association with maximal hand-grip strength in older adults. These results suggest that power measures during the STS may be a safe and cost-effective method of assessing muscular fitness in older adults.

---

**F-38 Clinical Case Slide - Hip and Pelvis III**

**Friday, June 1, 2018, 3:15 PM - 5:15 PM**

**Room: CC-200E**

**Chair:** Benjamin Hasan. *Northwestern Community Hospital Medical Group, Arlington Heights, IL.*

**Discussant:** Bryan Wiley. *Kaiser Permanente, Ontario, CA.*

**Abstract:** Hip injuries in dance can be commonplace and distressing in terms of human and financial impact. Approximately 11% of all time-loss injuries to dancers are because of hip pain and up to 50% of dancer visits to physicians are because of hip pain.

**Purpose:** To assess the clinical presentation of dancers without dysplasia, labral tear or bony deformity in order to understand the movement factors associated with onset and cessation of anterior hip pain. METHODS: 250 student and elite classical dancers (24.1 ± 7.5 years; 72 men, 178 women) were assessed in our physical therapy clinic for strength, flexibility, balance, motor control and joint mobility. RESULTS: 82% of dancers had lower extremity strength asymmetry; 71% had talar occlusal or sub-talar joint hypomobility on the ipsilateral side and 32% on the contralateral side relative to the side of hip pain. On the hip pain side, 100% had a positive Rombé test, 82% had a positive Airplane test and 70% a positive FADIR test. CONCLUSION: Because of the repetitive and movement biased fashion of dance training over many years, it is important for clinicians to understand the presentation of classical dancer hip pain as that of a multi-factorial, postural-behavioral movement impairment syndrome which entails skilled regional interdependent examination and defies a single common diagnostic label.

---

**2668 June 1 4:45 PM - 5:00 PM**

**Bilateral Training Results in Superior Strength Improvements to Unilateral Despite Similar Changes in Fat-Free Mass**

Courtenay Dunn-Lewis, Shawn D. Flanagan. *University of Pittsburgh, Pittsburgh, PA.*

(No relevant relationships reported)

**Purpose:** To determine if strength increases differ between bilateral and unilateral training; to determine whether differences, if any, were mediated by muscle hypertrophy.

**Methods:** College-aged men and women (*n* = 67; age = 19.7 ± 0.9 yr; height = 168.7 ± 9.8 cm; body fat = 22.14 ± 10.23%); provided written informed consent to participate. Subjects were randomized to a unilateral or a bilateral training group for eight weeks. Strength testing (chest press and leg press) was performed at pre, mid, and post, with body composition (air displacement plethysmography) at pre and post. Statistics included a repeated measures ANOVA with LSD post-hoc and planned contrasts.

**Results:** As shown in Figure 1 (leg press), strength increased (significant linear trend for chest press and leg press: *p* < 0.001) across all three time points. While there were no significant differences in strength at any time point, within-subjects contrasts displayed a significant linear trend interaction between time and training group for both leg press (0.049) and chest press (0.029) strength, the slopes of the two lines were therefore significantly different in favor of the bilateral trend.

Although both groups increased FFM, the increase was comparable (mean kilogram change from pre to post: 1.6 ± 0.5, *p* = 0.001 bilateral, 1.4 ± 0.4, *p* = 0.001 unilateral).

**Conclusion:** Bilateral training results in superior strength improvements over eight weeks as compared to unilateral despite similar changes in fat-free mass.

---

**2669 June 1 5:00 PM - 5:15 PM**

**Early Pubertal Children Perceive High Intensity Interval Exercise as Less Strenuous than Young Adults**

Ronen Bar-Yoseph, Pearl Law, Dan M. Cooper, Shlomit Radom-Aizik. *UC Irvine, Irvine, CA.*

(No relevant relationships reported)

High-intensity interval training (HIIT), which consists of repeated sessions of brief, intense bouts of exercise, has been shown to be an effective and time-efficient approach to improve aerobic training. Early pubertal children rely more heavily on aerobic metabolism and recover faster from exercise bouts. Borg’s Rating of Perceived Exertion (RPE), a subjective measure of exercise intensity used to evaluate responses to specific training loads, has yet to be systematically explored in relation to HIIT among children of different maturation stages and sex groups.

**Purpose:** To evaluate RPE during HIIT in children and young adults and to investigate the relationship between RPE, sex, and puberty.

**Methods:** One hundred healthy children and young adults (7-34 y/o, 47 males) participated in two exercise sessions on a cycle ergometer: 1) ramp-type progressive cycle ergometry to determine peak VO$_2$; 2) HIIT - ten times, 2-min bout at 80% peak work rate interspersed with 1-min rest. Borg’s RPE (scale of 6-20) was recorded at the end of each 2-min exercise bout.

**Results:** Fifty two participants completed HIIT at 80% peak work rate. Completion rates were higher in early pubertal children (70%, 26/37) and young adults (68%, 13/19) compared to adolescents (30%, 13/44) with no sex difference.

Among completers, mean RPE was significantly lower in the early pubertal children (14.9 ± 1.7%, “hard”) compared to adults (16.8 ± 1.7%, “very hard”) with no sex-effect. In all 3 groups RPE was increased with the progression of the test. Heart rate recovery was fastest in early pubertal children with no group difference in oxygen uptake.

**Conclusion:** Early pubertal children perceive high-intensity exercise as less strenuous than young adults. Differences in RPE reported by the 3 groups may be partially explained through faster HR recovery and relying more on aerobic metabolism in early pubertal children compared to older children and young adults. Researchers and coaches should take into consideration the age of the participant when using RPE in research or as a training tool. Underlying mechanisms involved in RPE-maturational related differences should be further explored (including cognitive responses).

Supported by NIH R01HD-048721, PERC Systems Biology Fund, SURP grant & NCATS grant #ULTR001414
3. Hemarthrosis
4. Reactive or crystalline synovitis

**TESTS AND RESULTS**

XR pelvis w/L lateral hip: Collapse of superior joint space with subchondral cystic change.
L Hip Aspiration: 4 mL bloody effusion (4.9 million RBCs, 2686 WBC, 69% PMNs). Synovasate positive.

Open I&D w/ resection of the femoral head and placement of antibiotic spacer - Synovitis with small amount of clear joint effusion. No gross purulence. Subchondral collapse and area of necrotic bone in the femoral head.
- 1/5 peritoearticular tissue cultures and 1/1 bone culture positive for Strep mitis/oralis.
- Bone path revealed acute osteomyelitis and osteonecrosis.

**FINAL WORKING DIAGNOSIS**
Septic arthritis and osteomyelitis of the left native hip

**TREATMENT AND OUTCOMES**

1. Six week course of IV ceftriaxone
2. Re-admitted 3 weeks post-op for fever, chills, headache and severe L hip pain following return to riding. Two extra-articular hematomas were identified on MRI and aspirated.
3. Re-admitted 6 weeks post-op for iliofemoral DVT. Underwent catheter-directed thrombolysis and stent placement for May Thurner’s defect. Started on 6 months of anticoagulation.
4. Left THA completed 6 weeks post-DVT.

**DIFFERENTIAL DIAGNOSIS**
- Bone path revealed acute osteomyelitis and osteonecrosis.
- 1/5 periarticular tissue cultures and 1/1 bone culture positive for Strep mitis/oralis.
- Bone path revealed acute osteomyelitis and osteonecrosis.

**EXAMINATION**

Examination of her right leg revealed focal tenderness to palpation of proximal anterior thigh. She had mild weakness or numbness/tingling.

Histories were negative for any pathology. She denied any recent trauma or injury.

**TREATMENT**

1. Case reviewed with multiple surgeons (sports, trauma, pediatric orthopedics)
2. Non-operative management pursued.
4. Femoral neck stress fracture
5. Slipped capital femoral epiphysis
7. Final return to sport pending at the time of submission.

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

**2676 June 1 4:15 PM - 4:35 PM**

**Hip Injury - Soccer**

James Alex, Heather Gillespie, FACSM. Maine Medical Center, Portland, ME. (Sponsor: Heather Gillespie, MD, FACSM)

(No relevant relationships reported)

**ACSM 2018 National Conference**

Clinical Case Abstract Submission

**Title:** Hip Injury - Soccer

**Author:** James Alex, Heather Gillespie, Maine Medical Center, Portland, ME. Email: jalex@mmc.org.

(Sponsor: Heather Gillespie, FACSM)

**History:** A 13 year old male soccer player without significant past medical history sustained an acute onset of anterior right hip pain while sprinting during a soccer game. He was immediately unable to walk and was carried off the field by teammates. He developed occasional transient episodes of pain radiating down his right leg without numbness or tingling noted. He was evaluated in the emergency department that evening, given oxycodone for analgesia, crutches to maintain non-weight-bearing status, and was referred to sports medicine for follow-up.

**Physical Exam:** Examination in the office 2 days after injury revealed no hip, leg, or abdominal abnormalities on inspection. He was able to bear about 50% of his weight on the right leg without crutches. Mild tenderness to palpation was noted anterior to the right lesser trochanter. Right hip active range of motion was limited to 10° of flexion in the supine position with normal passive range of motion throughout and intolerance of resisted hip flexion. Normal resisted adduction strength was noted. Neurovascular testing of the right lower extremity was normal.

**Differential Diagnosis:**
1. Iliopsoas strain
2. Apophysal avulsion fracture: AIBS, ASIS, or lesser trochanter.
3. Adductor strain
4. Femoral neck stress fracture
5. Slipped capital femoral epiphysis

**Tests and Results:**

1. MRI (1st): small area of edema in the left side of the pubic symphysis consistent with stress reaction/ athletic pubalgia.
2. MRI (2nd): small area of edema in the left side of the pubic symphysis consistent with stress reaction/ athletic pubalgia.
3. MRI: small area of edema in the left side of the pubic symphysis consistent with stress reaction/ athletic pubalgia.

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

**2677 June 1 4:35 PM - 4:55 PM**

**Pelvic Pain In A Soccer Player- Soccer**

John T. Nelson1, Delmas Bolin2.1. Carilion Clinic VTC Family Medicine Residency, Roanoke, VA. 2. Edward Via College of Osteopathic Medicine, Virginia Campus, Roanoke, VA. (Sponsor: Delmas Bolin, FACSM)

(No relevant relationships reported)

**HISTORY:** A 23 year old male soccer player presented with left sided pubic bone pain for seventeen months. The injury occurred after collision with another player and falling onto his left side during a soccer game. He developed left sided pubic symphysis pain later that evening. He finished the season followed by complete inactivity for 2 months. At the start of the next season, the same left sided pain returned that was worse with initial steps, change of direction, and lateral movements. He was seen in a sports medicine clinic and had an MRI which showed edema in the rectus abdominis, left abductor, and pubic symphysis. He completed physical therapy with no improvement. He then developed intermittent sharp pain radiating to the left testicle that was worse with initial steps, change of direction, and lateral movements. He was referred to General Surgery, Orthopedics, given NSAIDs, repeated PT, repeat MRI, and finally referred for a biomechanical evaluation and treatment.

**PHYSICAL EXAMINATION:** Pelvic compression test is + left. Palpation: left superior pubic rami pain; mild pain in left ischial tuberosity. ASIS to umbilicus measures 12 cm left, 13 cm right. ASIS is inferior on right. PSIS is superior on left. Left leg 1.5 cm shorter. Palpation of left lower abdominal quadrant lateral to the border of pubic symphysis reproduces left sided scrotal pain. Genitourinary/Hip exam: Unremarkable. Sensation intact bilateral L4-S1 distribution. Reflexes: 2+/4 bilateral knee and ankle. Pulses: 2+ bilateral posterior tibial

**DIFFERENTIAL DIAGNOSIS:** Stress Fracture of Pubic Ramus, Agricultural pubalgia, Inguinal Hernia, Abdominal muscles strain/tear, Nerve Entrapment

**TEST AND RESULTS:** MRI (2nd): small area of edema in the left side of the pubic symphysis and inferior pubic ramus, consistent with stress reaction/athletic pubalgia.
HISTORY: A 15-year-old high school basketball player reported insidious onset of left knee pain. Knee pain was only present when running and pivoting. He denied ankle or hip dysfunction.

PHYSICAL EXAMINATION: Knee range of motion (ROM) and strength were unremarkable. Moderate weakness noted in bilateral hip extensors and abductors, as well as abdominals. Knee pain was reproduced during squatting movements. Significant lumbar spine, hip, and knee movement compensations were observed while squatting due to hip mobility restrictions. Lower extremity (LE) musculature demonstrated decreased extensibility. Hip internal rotation (IR) ROM limited to 10° left and 20° right, while hip external rotation (ER) limited to 30° bilaterally. Hip flexion limited to 70° left and 100° right. He described “pinching” in left groin during hip impingement special test. All other special tests for hip and knee were negative.

Manual assessment of left hip joint accessory mobility revealed hypomobility in all directions.

DIFFERENTIAL DIAGNOSIS:
1. Knee pain compensatory in nature, related to decreased hip joint ROM and LE muscle extensibility
2. Femoral acetabular impingement, due to significant hip mobility deficits
3. Patellar tendinopathy
4. Patellofemoral pain syndrome
5. Quadriceps tendinopathy
6. Chondromalacia patellae
7. Iliotibial band syndrome
8. Other sources of knee pain (such as arthritis and gout)

TESTS AND RESULTS:
Radiographs and MRI of left hip revealed hip tumor, leading to surgery on left hip

FINAL WORKING DIAGNOSIS:
1. Knee pain compensatory in nature, related to decreased hip joint ROM and LE muscle extensibility
2. Femoral acetabular impingement, related to significant hip mobility deficits

TREATMENT AND OUTCOMES:
Patient followed hip surgical dislocation post-operative rehabilitation protocol and returned to basketball without restrictions at 6 months post-operatively. This clinical case exemplifies the concept of regional interdependence and importance of immediate alleviation of symptoms with return to play without pain or discomfort.
Knee Pain in a High School Soccer Player

Brian J. Schutzbach,1 Robert Gillis2. 1Wellspan Health, York, PA. 2Wellspan Health, Gettysburg, PA. (Sponsor: Mark Lavallee M.D., FACSM) (No relevant relationships reported)

HISTORY: A 17 year old male soccer player presented with left knee pain after feeling an acute “snap” while running across field. He described pain as being sharp, stabbing, worse with movement and associated swelling immediately after the injury. He was unable to continue the game or bear weight. He was sent to Emergency Department for further evaluation.

PHYSICAL EXAMINATION: Examination in emergency department revealed athlete in no acute distress with a left knee appearing to have significant swelling, patella was superiorly displaced, and inability to flex or extend knee. Dorsal Pedis pulse was 2-. Skin was warm, dry, pink, with normal capillary refill. No neurological deficits. Vital signs stable.


TEST AND RESULTS: Left Knee anterior-posterior, lateral, and oblique radiographs: Distracted and anteriorly displaced large avulsion fracture involving anterior proximal tibia and anterior tubial tuberosity. Maximum distraction of 18.7 mm. Growth plates not completely fused consistent with continued growth.

FINAL WORKING DIAGNOSIS: Type III tibial tuberosity avulsion fracture

TREATMENT AND OUTCOMES: 1. Initial immobilization, non-weight bearing, pain control.

2. Evaluation by Orthopedic Surgeon in office following day. 3. Open reduction and internal fixation with 2 screws perpendicular to fracture line performed on day 4 after injury. 4. Discharged home the same day with weight bearing as tolerated with knee immobilizer locked in extension with crutches. 5. 10 days post-operation: Transition to hinged brace and leg remained locked straight to prevent hyperextension. 6. 3 weeks: Physical therapy with unlocking brace for range of motion exercises. 7. 7 weeks: Full range of motion. Cleared to play limited minutes in senior night game. 8. 10 weeks: Return to all activities without restriction.

MEDICINE & SCIENCE IN SPORTS & EXERCISE®
Diagnostic ultrasound of the superolateral right knee revealed hypertrophic synovial tissue snapping over a lateral femoral condyle osteophyte. There was no associated synovial hyperemia or joint effusion.

FINAL WORKING DIAGNOSIS:
Right superolateral knee snapping secondary to hypertrophic synovial tissue snapping over a lateral femoral condyle osteophyte.

TREATMENT AND OUTCOME:
An ultrasound-guided diagnostic injection of lidocaine was performed around the osteophyte which provided immediate relief. He was able to squat 135 lbs during the anesthetic phase, and had been unable to body weight squat without significant pain pre-injection. Given the positive response to the diagnostic injection, a repeat injection was performed with Depo-Medrol.

At the two month follow-up, patient reported 60-80% symptom reduction during problematic activity (lunging and squating) and improvement in function. Snapping in the knee can be a difficult diagnosis to obtain in an individual who has a known history of loose bodies in the knee. While several case reports exist describing snapping biceps femoris and popliteus tendons in the lateral knee, this is the first to our knowledge to describe a lateral femoral condyle osteophyte as the culprit of snapping.

2687 June 1 4:55 PM - 5:15 PM
Snapping Knee After Arthroplasty In Recreational Athlete
Angela N. Cortez, Tracy Hoeg, Brian A. Davis, FACSM.
University of California at Davis, Sacramento, CA. (Sponsor: Brian Adam Davis, FACSM) (No relevant relationships reported)

HISTORY: A 63 year-old recreational athlete presented with right knee snapping 3 months after medial unicompartmental knee arthroplasty. Snapping sensation localized to posterior medial knee and aggravated with active knee flexion and extension. She experiences associated pain in the same area, and occasionally at rest. No instability. Surgical incision of anterior knee healing well without pain.

PHYSICAL EXAMINATION: Examination revealed knee extension to 10°, knee flexion to 120°, focal tenderness of distal semimembranosus tendon. Palpable snapping over medial hamstrings with knee extension and flexion between 20° to 90°. No varus or valgus instability. Mild knee effusion. Surgical scar to anterior knee healing well.

DIFFERENTIAL DIAGNOSIS:
1. Snapping Popliteal Recess
2. Hardware Loosening
3. Snapping Hamstring Tendon over Hardware
4. Snapping Popliteus Syndrome
5. Snapping Fabella

TEST AND RESULTS:
- Right Knee AP and lateral radiographs showed slight posterior positioning of hardware, no periprosthetic lucency to suggest loosening or fracture.
- Right Knee MRI Maverick protocol without contrast showed the imaged portions of the biceps, semimembranosus, and semitendinosus are unremarkable. The distal aspect of the semimembranosus and semitendinosus is obscured by susceptibility artifact as it passes posterior to the unicompartmental arthroplasty.
- Right Knee Dynamic Ultrasound Evaluation showed dynamic snapping of the semimembranosus tendon over the gastrocnemius tendon while patient actively flexed and extended her knee.

FINAL WORKING DIAGNOSIS: Snapping semimembranosus and gastrocnemius tendons due to medial unicompartmental arthroplasty hardware impingement in the right knee

TREATMENT AND OUTCOMES:
1. Completion of post-surgical rehabilitative physical therapy, including achieving full knee extension, for a total of 6 weeks.
2. Trial of ultrasound guided steroid injection to tendon site for persistent symptoms.
3. Consideration for semimembranosus tenotomy if symptoms persist despite steroid injection.
4. Consideration of unicompartmental knee revision vs total knee replacement if symptoms persist.
5. Snapping and pain improved though not resolved with rehabilitative exercises 6 months post-op, pending steroid injection to semimembranosus and gastroc tendon.

F-40 Clinical Case Slide - Medical Issues IV
Friday, June 1, 2018, 3:15 PM - 4:55 PM
Room: CC-101CD

2688 Chair: Shawn F. Kane, FACSM. US Army, Carthage, NC. (No relevant relationships reported)

2689 Discussant: Poonam P. Thaker, FACSM. Presence Resurrection Sports Medicine Fellowship, Chicago, IL. (No relevant relationships reported)

2690 Discussant: George Guntur Pujaltte, FACSM. Mayo Clinic, Jacksonville, FL. (No relevant relationships reported)

2691 June 1 3:15 PM - 3:35 PM
Recurrent Chest Pain in an 18 Year Old Male with a History of Viral Perimyocarditis
Paul C. Goleb, Jr, Kyle Yost, Andrew Tucker. University of Maryland Medical Center, Baltimore, MD. (No relevant relationships reported)

HISTORY: An 18 year old male athlete detailed a recent hospitalization for viral perimyocarditis during his pre-participation examination (PPE). His medical and surgical histories were otherwise not significant. He took no medications and had no known allergies. He denied alcohol use, smoking, or illicit drug use. His family history was non contributory. During his PPE he was symptom free and was cleared for all activity. Over the next weeks he reported multiple, brief, self-resolved episodes of substernal chest pain and shortness of breath. He denied syncope or palpitations. His symptoms did not worsen with exercise. One episode of chest pain prompted evaluation in a local ER, where he had a normal chest x ray, negative troponins, and normal vital signs. Following this episode, the patient was withheld from activity and referred to cardiology.

PHYSICAL EXAMINATION:
General: Well appearing male.
HEENT: No jugular venous distention.
Cardiovascular: Regular rate and rhythm, normal S1 and S2, no murmurs, rubs, or gallops. Brisk capillary refill. No tenderness to chest wall palpation. No pulsus paradoxus.
Respiratory: Clear to auscultation bilaterally.
Extremities: No clubbing, no cyanosis, no edema.

DIFFERENTIAL DIAGNOSIS:
1. Coronary artery disease
2. Atrventricular block
3. Pericardial effusion
4. Recurrent perimyocarditis
5. Pulmonary embolism

TEST AND RESULTS:
Initial Hospitalization:
EKG: Sinus rhythm with anterolateral ST elevation. Troponin 11.48.
CPK 2.28.
Thoracostethic echocardiogram: LVEF 56%.
Cardiac Catheterization: Normal coronary artery disease.
CT chest: No pulmonary emboli. No aortic dissection.
Cardiac MRI: Heterogeneous focal enhancement consistent with myocarditis. Normal LV size with low normal LV function (LVEF 51%).
Follow-Up:
TSH 0.6, ANA negative, P-ANCA negative, C-ANCA negative, CRP <0.1, ESR 1, CK 183, BNP 32, Troponin <0.04.
Holter Monitor: Normal sinus rhythm, no arrhythmias.
Exercise stress test: No ischemia.

FINAL WORKING DIAGNOSIS:
Viral Perimyocarditis (Resolved).

TREATMENT AND OUTCOMES:
1. Withheld from activity following ER visit
2. Referred to Cardiology
3. Exercise Stress Test
4. Holter Monitor
5. Lab work-up
6. Repeat Cardiac MRI to be performed 3 months after initial study to re-assess inflammation
7. Return to play decision to be made following results of repeat cardiac MRI
**Abdominal Trauma - Football**
Jonathan Goike, Michael Baria. *Ohio State University, Columbus, OH.*

**HISTORY:** A 15 year old male football player was tackled during practice and sustained blunt force trauma to his abdomen from his opponent’s helmet. He felt immediate right sided abdomen and shoulder pain. He was promptly assessed by the athletic trainer and removed from practice. The athletic trainer examined him and found both right upper quadrant tenderness and pain with rib cage / thorax compression. Though the athlete reportedly felt improved, the athletic trainer recommended further evaluation by a sports medicine physician.

**PHYSICAL EXAM:** Orthostatic vitals revealed a heart rate increase from 66 to 114 on sit to stand. He was alert, oriented and in no distress. He had significant right upper quadrant tenderness with rebound and positive Murphy’s sign with moderate generalized abdominal tenderness. He had minimal right sided tenderness to palpation over the ribs without flail chest. No respiratory distress. Lung fields were clear to auscultation. Heart rate and rhythm were regular.

**TESTS AND RESULTS:**
Abdominal Radiograph – Non-obstructive bowel gas pattern, no pneumoperitoneum
Ultrasound FAST exam – Free peritoneal and retro-vesicular fluid
CT Abdominal/Pelvis – Grade 3 Liver laceration (7.9 cm) and Grade 1 Splenic laceration

**DIFFERENTIAL DIAGNOSIS:**
1. Liver laceration
2. Rib fracture
3. Pneumothorax/hemopneumothorax
4. Diaphragm spasm

**FINAL WORKING DIAGNOSIS:**
Grade III Liver and grade I splenic laceration

**TREATMENT AND OUTCOMES:**
1. Immediate transfer to emergency department for trauma evaluation followed by observation in the ICU and surgical floors for 3 days.
2. Limited to walking for exercise and 10 pound lifting restriction for 6 weeks.
3. Returned to low impact, non-contact exercise and machine based strength training after 6 weeks.
4. Anticipated to return to sport following 6 months no contact and after repeat testing including CT, LFTs.

**June 1 3:35 PM - 3:55 PM**

**Abdominal Trauma - Football**

Jonathan Goike, Michael Baria. *Ohio State University, Columbus, OH.*

**HISTORY:** A 15 year old male football player was tackled during practice and sustained blunt force trauma to his abdomen from his opponent’s helmet. He felt immediate right sided abdomen and shoulder pain. He was promptly assessed by the athletic trainer and removed from practice. The athletic trainer examined him and found both right upper quadrant tenderness and pain with rib cage / thorax compression. Though the athlete reportedly felt improved, the athletic trainer recommended further evaluation by a sports medicine physician.

**PHYSICAL EXAM:** Orthostatic vitals revealed a heart rate increase from 66 to 114 on sit to stand. He was alert, oriented and in no distress. He had significant right upper quadrant tenderness with rebound and positive Murphy’s sign with moderate generalized abdominal tenderness. He had minimal right sided tenderness to palpation over the ribs without flail chest. No respiratory distress. Lung fields were clear to auscultation. Heart rate and rhythm were regular.

**TESTS AND RESULTS:**
Abdominal Radiograph – Non-obstructive bowel gas pattern, no pneumoperitoneum
Ultrasound FAST exam – Free peritoneal and retro-vesicular fluid
CT Abdominal/Pelvis – Grade 3 Liver laceration (7.9 cm) and Grade 1 Splenic laceration

**DIFFERENTIAL DIAGNOSIS:**
1. Liver laceration
2. Rib fracture
3. Pneumothorax/hemopneumothorax
4. Diaphragm spasm

**FINAL WORKING DIAGNOSIS:**
Grade III Liver and grade I splenic laceration

**TREATMENT AND OUTCOMES:**
1. Immediate transfer to emergency department for trauma evaluation followed by observation in the ICU and surgical floors for 3 days.
2. Limited to walking for exercise and 10 pound lifting restriction for 6 weeks.
3. Returned to low impact, non-contact exercise and machine based strength training after 6 weeks.
4. Anticipated to return to sport following 6 months no contact and after repeat testing including CT, LFTs.

**June 1 3:35 PM - 3:55 PM**

**Improved Pulmonary Function in a Patient with Lymphangioleiomyomatosis Following Exercise Training**

Thomas W. Lowder. *University of Central Arkansas, Conway, AR.*

**HISTORY:** Lymphangioleiomyomatosis (LAM) is an interstitial lung disease the results in cystic destruction of the lung parenchyma, resulting in a decline (often rapid) in pulmonary function. There is no cure for this disease and lung transplantation is often required. Even with transplantation, the disease will still present, as the cells originate in the body (origin is at present unknown) and migrate to the lungs. This disease affects women almost exclusively.

**PHYSICAL EXAMINATION:** A 29-year-old female, diagnosed with Tuberous Sclerosis Complex (TSC) at age 5 and LAM at age 21, underwent 12mo of high-intensity exercise 2d/wk. Prior to training and every 3mo pulmonary function, oxygen uptake (VO2), and bone mineral density were assessed.

**DIFFERENTIAL DIAGNOSIS:** LAM is similar to TSC in that TSC is a predisposing condition for LAM and several shared clinical features exist in both diseases (angio/lymphomas, TSC2 gene mutations). LAM shares similarities with both Birt-Hogg-Dube syndrome and Sjogren syndrome.

**TEST AND RESULTS:** After one year of training the patient improved forced expiratory volume in one second (FEV1) by 9%, FEV1/FVC (forced vital capacity) by 10%, peak flow by 47%, and a 20% increase in oxygen consumption.

**FINAL WORKING DIAGNOSIS:** Exercise can be used to improve pulmonary function and work capacity in a patient with TSC/LAM.

**TREATMENT AND OUTCOMES:** Treating LAM with high-intensity exercise resulted in marked improvement in this patient. Improvements were not seen until after 6mo, indicating that short-duration interventions may be insufficient in improving lung function.

**June 1 4:15 PM - 4:35 PM**

**Evaluating The Effectiveness Of The Girls On The Run Program With Respects To Self-esteem, Self-perceived Body Image, And Aerobic Capacity.**

Amanda J. Cunningham. *Grand Valley State University / Central Michigan University, Allendale, MI.*

The aim of this study was to evaluate the effectiveness of the Girls On the Run program. Twenty seven girls who participated in the Girls On the Run for eleven weeks were evaluated pre and post the program on self-esteem, self-perception of body image and aerobic capacity. The girls were evaluated by a written survey and the PACER test. There was a significant positive increase in self-esteem (p = 0.014) and body image (p = 0.05), following the program the girls learned to be more accepting of themselves ad their body image. There was a non-significant increase in mean aerobic capacity starting at 39.8 ml/kg/min and ending at 41.87 ml/kg/min. This could be due to part to low intensity training versus highly structured high intensity training. The Girls On the Run program was shown in this study to have a positive outcome on girls’ overall mental, emotional, and physical health through varying activities and positive leadership in the role models who coach. Future studies should evaluate the effects of high intensity training over a long period of time. As well as showing the effects of self esteem and positive body image in the young girls as they age.

**June 1 4:35 PM - 4:55 PM**

**Hematoma - Cross Country**

Peter Obourn. *University of Connecticut Health Center, Hartford, CT.*

**HISTORY:** 21 year-old female cross country runner with 1 week of gross hematuria. History of microscopic hematuria on several occasions since age 3 with no history of gross hematuria. She was having hematuria on and off for a week. She had one painful void with 3 out of 10 burning pain at the urethra during hematuric void. Her urine color is consistent with fruit punch. Just prior to the episode of gross hematuria she had completed a 4 mile run consistent with her normal daily activity, not significantly more vigorous than her normal training routine. This had occurred about 3 days prior. She denied any increased urinary frequency or feelings of urinary retention. She denied fevers, chills, nausea, vomiting, muscle cramps, or flank pain. She denied unprotected sexual intercourse or vaginal discharge. She denied any recent illnesses, specifically sore throat.

**PHYSICAL EXAMINATION:** Vital signs were normal. Healthy, well appearing, in no apparent distress. Head normocephalic and atraumatic. Sclera and conjunctivae normal with EOM intact. No gross deformities of the ears bilaterally and no obvious hearing deficits. Oropharynx clear without erythema or exudates. No cervical lymphadenopathy. Normal respiratory effort. Bowel sounds were normoactive with no bowel gurgles. No heart murmurs, no gallops, and no friction rub. No pitting edema in the lower extremities. No costovertebral angle tenderness and no pelvic tenderness. Normal mood and affect. No visible skin lesions.

**DIFFERENTIAL DIAGNOSIS:**
1. Pyelonephritis
2. Post streptococcal glomerulonephritis
3. Rhabdomyolysis
4. Nephrolithiasis
5. Cancer
6. IgA nephropathy
7. Idiopathic exercise induced hematuria

**TESTS & RESULTS:**
CMP: unremarkable
ANA screen: negative
ANCA screen: negative
24 hour urine total protein: normal
Renal/bladder ultrasound: unremarkable

**FINAL WORKING DIAGNOSIS:** Thin basement membrane disease

**TREATMENT AND OUTCOMES:**
- Patient is believed to have thin basement membrane disease at this time. Her hematuria workup has been negative to this point. It was determined that she has a brother with thin basement membrane disease.
- Reflected to nephrology for further recommendations
- Cleared to continue normal activities for cross country
- Though likely benign, we may need to obtain further testing including possible biopsy to prove benign diagnosis
Wheelchair racing has been one of the official events in Paralympic Games since 1964. Understanding the energetic profiles in wheelchair racing may provide information in developing training strategies. However, there is lack of concrete quantitative research on energetic profile of Wheelchair Racing 1500m.

PURPOSE: To quantify the energy contribution of wheelchair racing 1500 m in high level athletes.

METHODS: Eight males (24±5 years, 174.4±5.9 cm, 67.3±9.1 kg, training experience of 15±10 years) from the Chinese national team participated in the research for a graded exercise test and a 1500 m all-out test. A portable gas analyzer (K4b2, Commed, Lyon, France) was used to measure VO2 at every breath. A GPS sports HPU (Cosmed, Italy) was used to monitor speed and HR changes. Capillary blood was taken from the earlobe before and after the warm-up, immediately before the time trials and the during the 1st, 3rd, 5th, and 7th minute of the recovery. Then it was assessed with a lactate analyzer (Biosen C, line, EKF, Germany). The energetic contribution was measured with the maximal accumulated oxygen deficit (MAOD).

RESULTS: Results showed that the accumulated oxygen deficit, the maximal heart rate and the peak blood lactate values were 2667±3894.5 ml, 188.9±9.0 bpm, and 11.1±2.3 mmol, respectively. The total energy contribution of the 1500 m test was 205.5±29.2 kJ. The aerobic and anaerobic energy contributions were 146.6±21.6 kJ (71.7%) and 58.9±18.9 kJ (28.3%), respectively. Significant (P<0.05) negative correlations were noted between race performance, the peak blood lactate and accumulated blood lactate for the 1500 m test (r = -0.638 and -0.735, respectively).

CONCLUSION: Wheelchair racing 1500 m is an aerobic-dominated event. The knowledge of energy supply in this event underestimates the importance of aerobic contribution. Anaerobic glycolysis exerts a significant influence on the performance of this event. Supported by Shanghai Key Lab of Human Performance(Shanghai University of sport) (NO. 11DZZ261100).

PURPOSE: Leukocyte telomere length (LTL), a biological marker of aging, is longer in elderly endurance runners than age-matched controls, but the underlying mechanisms are poorly investigated. The LTL, nitric oxide (NO) and redox balance of master endurance runners (ER) were analyzed and compared to untrained middle-aged (MC) and young controls (YC).

METHODS: Participants (n = 38) from both ER (n = 10; 51.6 ± 5.2yrs; 28.4 ± 7.1yrs) and YC (n = 11; 21.8 ± 4.0yrs) attended to the laboratory for anamnesis, anthropometrics and blood collection for biochemical and molecular analyzes. Pro and antioxidant measures as well as DNA extraction were performed using commercial kits following the fabrication protocols. Relative LTL was measured using qPCR analysis.

RESULTS: The LTL of YC group (T/S = 1.85 ± 1.59) was longer than MC (T/S = 0.47 ± 0.51; p < 0.05) but did not differ from ER (T/S = 0.89 ± 0.50; p < 0.05). A large effect-size between TL of ER and MC (d = 0.85) was also observed. The comparison of antioxidant/pro-oxidant ratios indicated a better redox balance for the ER and young adults in comparison to middle aged untrained participants, which showed lower values for TEAC/TBARS, SOD/TBARS and CAT/TBARS (p < 0.05). Furthermore, the NO levels for the ER (175.2 ± 31.9pM) were higher (p < 0.05) than MC (67.2 ± 23.3pM) and YC (129.2 ± 17.3aM), with a positive and strong correlation with LTL (r = 0.766; p < 0.05).

CONCLUSIONS: In conclusion, master endurance runners have longer LTL than age-matched controls, what in turn may be related to their better NO bioavailability and redox balance status.
INTRODUCTION: The Polar M430 (M430) uses optical technology to measure heart rate (HR) from a sensor that is built into the back of the watch. The Polar V800 (V800) uses a wireless chest transmitter that is held in place by a chest strap. Both of these watches estimate exercise energy expenditure (ExEE) for numerous types of exercise. Although there is evidence that suggests that the wireless transmitters provide accurate estimates of ExEE, there is little information that shows that watches equipped with optical sensors provide accurate measurements of ExEE. PURPOSE: The purpose of this study was to compare the ExEE values obtained from the M430 and the V800 to ExEE values measured using indirect calorimetry during different bouts of exercise. METHODS: Two females (age = 20 ± 1 y, BMI = 24.2 ± 2.0 kg/m²) and ten males (age = 22.8 ± 1.0 y, BMI = 26.1 ± 1.3 kg/m²) reporting to the lab and were fitted with a chest strap HR transmitter (Polar H7) to measure and transmit HR data to the V800. The M430 was fitted on the participant’s wrist according to the manufacturer’s instructions. Participants’ then completed four, 5-min bouts of exercise which consisted of the following: walking 3.5 mph at 0% grade, walking 3.5 at 5% grade, running at 5.5 mph at 0% grade, and running at 5.5 mph at 5% grade. Indirect calorimetry was used to measure actual ExEE.

RESULTS: There were no significant differences between the three methods when walking at 0% or 5%. When running at 0% there was a significant difference between methods (p=0.048), with the M430 underestimating ExEE when compared to indirect calorimetry (5.8±2.0 kcal, p=0.045). When running at 5% grade, there was a significant difference between methods (p=0.002). Both the M430 and the V800 underestimated ExEE compared to indirect calorimetry (5.8±2.0 kcal, p=0.044), with the M430 underestimating ExEE when compared to the V800 (7.5±2.1 kcal, p=0.018) and when compared to indirect calorimetry (5.8±2.0 kcal, p=0.044). When running at 5% grade, there was a significant difference between methods (p=0.001). The M430 underestimated ExEE when compared to the V800 (7.5±2.1 kcal, p=0.018) and when compared to indirect calorimetry (14.5±3.7 kcal, p=0.008).

CONCLUSIONS: The V800 provided accurate estimates of ExEE during each bout of exercise. The M430 provide accurate estimates of ExEE only when walking. When running, the M430 consistently underestimated ExEE and the underestimation increased with exercise intensity. At the highest exercise intensity, the M430 underestimated ExEE when compared to both the V800 and indirect calorimetry. Caution should be taken when using the ExEE values obtained from the M430 when running.

The recent trend in activity tracking has increased the demand for smart watches that estimate exercise energy expenditure (ExEE) during different types of exercise. Wearable fitness trackers are relatively cheap and convenient tools that track an individual’s physical activity. Such qualities have led to an emergence of various fitness trackers available on the market for consumers, but does convenience and relatively low cost compromise accuracy? For this study, we compared Garmin Forerunner 230 and Forerunner 235 to ExEE values measured using indirect calorimetry during different bouts of exercise. METHODS: Two females (BMI=24.2 ± 2.8 kg/m², age=20 ± 1.4 y) and ten males (BMI=26.1 ± 4.1 kg/m², age=22.8 ± 3.3 y) were strength tested to determine their 3-5 repetition max (RM) on a universal chest press machine. Total exercise volume (TV) was calculated as sets*reps*weight lifted. A Multiple Linear Regression (Stepwise Removal) was used to determine the best model to predict kcal consumption based on the highest adjusted R² and least amount of variance inflation.

Results: Table:  

Table:  

Energy expenditure from resistance exercise (RE) is an important consideration for exercise prescription, yet prediction models are lacking. PURPOSE: To develop regression equations to predict energy expenditure (kcal) for RE involving major muscle group using commonly measured demographic & exercise variables as predictors. METHODS: Fifty-two healthy, active subjects (27 men, 25 women, age 20-58 yrs, height 174.1 ± 10.5 cm, weight 88.1 ± 42.6 kg, VO₂ max 36.8 ± 9.2 ml/kg/min) were strength tested to determine their 3-5 repetition max (RM) on commercial pneumatic RE equipment 1 week prior to their experimental RE bout. Body composition was assessed using DEXA. For the experimental RE, a warm-up set followed by 2-3 sets of 8-12 reps at 60-70% predicted 1RM were performed for each exercise. Each set started every two minutes. Exercises progressed order: leg press, chest press, leg curl, lat pull, leg extension, triceps extension, biceps curl. VO₂ was measured continuously throughout the RE bout via automated metabolic cart. Total exercise volume (TV) was calculated as sets*reps*weight lifted. Our data indicate that there was no correlation between G and C’s accuracy in determining energy expenditure via kcals (EE). The mean EE for C was 49.91 ± 8.2 and G was 47.42 ± 19.7.  

CONCLUSIONS: Energy expenditure for a total RE bout and for specific RE exercises can be reasonably estimated in adult men and women using commonly measured demographic and RE variables. With regards to fitness, performance, and weight management, these equations will aid practitioners and exercising adults in documenting kcal expenditure from RE.

CONCLUSIONS: Exercise energy for a total RE bout and for specific RE exercises can be reasonably estimated in adult men and women using commonly measured demographic and RE variables. With regards to fitness, performance, and weight management, these equations will aid practitioners and exercising adults in documenting kcal expenditure from RE.
In the field of exercise science, the Actigraph GT3X (A) accelerometer is regarded as one of the most accurate field measurement devices for physical activity (PA). Many PA devices have recently been added to the market to measure PA for individuals. The Garvin Vivosmart HR (G) watch is currently among the top devices on the market to measure PA. The underlying question that needs to be answered is; how accurate is the G watch? In this study, we compared the accuracy of the G to A in regards to measuring energy expenditure in kcals (EE). **Purpose:** To compare the accuracy of G to A in measuring EE. **Methods:** Individuals were recruited via word of mouth to participate in this study. The study required individuals to attach the G to the left wrist and A placed around the waist with the measuring device on the left side of the subject. The duration of the study consisted of a ten minute low-moderate intensity walk on a treadmill. Prior to exercise, weight, height, and heart rate (HRH) and RHR were obtained. We recruited 19 subjects, 18 years and older, of varying activity levels. **Results:** The mean EE from A was 83.92 ± 24.58, while G was 47.42 ± 19.72. **Conclusion:** The data showed no correlation between the two devices in regards to EE (r-value = -0.194; p-value = 0.456). Our data suggests further research is needed in order to determine which device is more accurate when measuring energy expenditure.

Injections of recombinant human erythropoietin (rHuEpo) have been shown to increase endurance performance and has been banned by the World Anti-Doping Agency (WADA). Recently a study has identified several gene transcripts differentially expressed after rHuEpo administration (Wang et al, 2017). There is a lack of knowledge on the effect altitude has on these genes and if they can identify rHuEpo abuse from altitude exposure. The primary aim of this study is to investigate the haematological and transcriptomic changes induced by altitude exposure. The secondary aim of this study is to compare these alterations with those caused by rHuEpo abuse from altitude exposure. **Purpose:** The primary aim of this study is to investigate the haematological and transcriptomic changes induced by altitude exposure. The secondary aim of this study is to compare these alterations with those caused by rHuEpo abuse from altitude exposure. **Methods:** Fourteen endurance trained athletes were recruited, blood samples were taken at sea level, during altitude exposure and after return to sea level. Subjects traveled to Sutahia, Ethiopia (-2800 m) for 27 days and provided blood for 27 days on return to sea level. Samples were analysed for haemoglobin concentration (HGB), haematocrit (HCT) and reticulocyte percentage (RET%). **Results:** Compared with baseline, HGB significantly increased 9 days after arrival at altitude (14.1±0.7 vs 15.4±0.7 g.dL⁻¹, p<0.01) and remained significantly elevated 27 days after return to sea level (14.7±0.7 g.dL⁻¹, p<0.01). HCT significantly increased upon arrival compared with baseline (41.3±2 vs 43.8±2%, p<0.01) and remained significantly elevated 27 days after return (44.6±2%, p<0.01). There were no significant differences in RET%. These results show HGB and HCT increased by 14.2% and 13.6% respectively, which is similar to the increase following rHuEpo administration (10.5% and 11.5%, respectively, Wang et al, 2017). **Conclusion:** Following 27 days of altitude exposure, there are significant increases in HGB and HCT but a blunted response in RET%. There appears to be a similar response to altitude exposure and rHuEpo on HGB and HCT, further analysis is required. Ongoing analysis of transcriptomic markers may aid differentiation between altitude and rHuEpo abuse. This work was supported in part by a grant from WADA.

Selection of prospective law enforcement officers can be facilitated with the use of simple, field-expedient fitness tests. Identification of qualified candidates has been demonstrated to significantly reduce costs for work-related injuries. **Purpose:** Develop a simple, field expedient, pre-hire muscular fitness tool to predict success in effecting an arrest and other essential job functions in the form of a Criterion Task Test (CTT). **Methods:** A Job Task Analysis (ITA) was conducted via survey, on-site observations, and interviews of incumbent federal officers (n=1025) with the objective of creating a surrogate (CTT) for the essential function of foot pursuit and effecting an arrest. Respondents were asked to provide best estimates of distances, heights, and weights associated with critical and arduous tasks. **Subjects:** Applicants (N ~ 641, including 55 females (9%)) who presented for employment served as subjects for this study. Because they had received no prior physical screening these subjects represent a sample of applicants that was not range restricted on physical ability. A test for maximum pushups in 2-minutes was administered twice, separated by one day to determine test-retest reliability (intraclass coefficient= 0.95, p > 0.001, n = 444). **Results:** Incumbent and supervisory personnel, (n ~ 77) acting as Subject Matter Experts (SMEs) independently reviewed and rated (acceptable or unacceptable) five representative paces of an actor performing the CTT. The cantrip for graduation success was established through a consensus model (2/3rd agreement). A two-way contingency table for sensitivity and specificity was developed to demonstrate the predictive power of the 2-minute push-up test. There was no evidence of sex bias for any of the fitness predictors. The ability to perform pushups was highly correlated with success on the CTT (pushups predict 42% of the variance in CTT, p < 0.001). **Conclusions:** The ability to perform a minimum of 10 push-ups correctly predicted a pass rate of 89% (sensitivity); conversely, failure identified 100% (specificity) of those who failed the CTT. Supported by the Department of Homeland Security.
Some authors have suggested concussion symptoms may be due to subtle visual problems because they are similar to those that occur with difficulty focusing the eyes. Although binocular vision tests (BVTs) are frequently used to evaluate visual symptoms, their reliability has not been evaluated. The 10 BVTs under investigation measure: 3D vision (gross stereoscopic acuity (GSA)), saccades, anatomic deviation (AD) at 30cm and 3m, and the eye’s ability to move/focus in-sync (convergence motor punctum proximum (CMP)), binocular fusion with convergence (BFC) and divergence (BFD) at 30cm and 3m, convergence fusional proximum (CFP).

**PURPOSE**: To determine the one-week test-retest reliability of 10 BVTs in healthy participants.

**METHODS**: One clinician examined each participant at their earliest convenience (T1), and one week after their first visit (T2). We assessed test-retest reliability using intraclass correlation coefficient (ICC) and limits of agreement (LoA). We judged an ICC of <0.5 as poor, 0.51-0.74 as moderate, 0.75-0.89 as good, and ≥0.90 as excellent reliability. We present 95% LoA for the % difference i.e. the difference in scores (T1-T2) divided by the average of the scores (T1-T2)2 times 100.

**RESULTS**: We tested 20 participants (1 lost at T2, excluded from analysis). There were 10 males and 10 females with a mean age of 25.5 (SD = 4.0) years. Our ICC results suggest good reliability for AD 3m (0.88), and moderate reliability for GSA (0.62), AD 30cm (0.69), CMP (0.54), BFC (0.54) and BFD (0.66) at 30cm, and CFP (0.64). There was poor reliability for saccade (0.34), and BFC (0.49) and BFD (0.43) at 3m. LoA was best for saccade (-3.34%) and worst for AD 30 cm (-1.21%), and ranged from ±58% to ±70% for 7 other tests. For AD 3m, LoA (<200%) did not provide an accurate summary as it assumes a Normal distribution of values. In fact, 18/20 pairs of measurements were identical, one paired scored 0 and 1, the other scored 0 and 2.

**CONCLUSIONS**: Our results demonstrate moderate to good test-retest reliability for 7 out of 10 BVTs, and poor reliability for saccades, and BFC and BFD at 3m. LoA results suggest the effect of concussion must have a moderate to large effect on the scores of most of the tests if they are to be clinically helpful.

---

**Studies and Reports**

- **Gender Differences In The Association Of Grip Power With Other Physical Strength Among Japanese**
  - Yasushi Sera, Koichiro Azuma, Shiori Horisawa, Shogo Tabata, Masafumi Nagano, Hiroyuki Ishida, Hideo Matsumoto. KEIO UNIVERSITY SCHOOL OF MEDICINE, Tokyo, Japan.
  - (No relevant relationships reported)

- **Maximal Heart Rate (MHR) is an important physiological reference for prescribing and monitoring exercise in both clinical and sports settings. Because obtaining a true MHR via graded exercise test (GXT) is often impractical or undesirable, equations are used to predict MHR from age. Unfortunately, these equations were developed in adult populations, potentially limiting their applicability to youth populations.**
  - **PURPOSE**: The primary aim of this systematic review and meta-analysis was to examine the validity of age-based MHR prediction equations in children and adolescents.
  - **METHODS**: Included studies were peer-reviewed, published in English, and compared measured MHR to predicted MHR using the Fox and/or Tanaka equations in participants <18 years of age. The difference between measured and predicted MHR was assessed using Hedges’ e effect size (ES) to adjust for small sample bias, and random-effects models were used to calculate the mean ES and explore potential moderators.
  - **RESULTS**: Six articles published between 2011 and 2015 met our inclusion criteria. The cumulative results of 18 effects indicated that MHR prediction equations may not be accurate in children and adolescents (ES = 0.7317, 95% CI 0.2967 to 1.1666). Post-hoc analyses indicated that the Fox equation (MHR = 220 - age) overestimated MHR by roughly 12.933 BPM, (k = 11, ES = 1.4131, 95% CI 1.1035 to 1.7227), and the Tanaka equation (MHR = 207 - 0.72*age) overestimated MHR by roughly 2.0999 BPM (k ~ 7, ES = -0.3850, 95% CI -0.7578 to -0.0122).

  - **CONCLUSIONS**: The Tanaka equation resulted in smaller mean differences between measured and predicted MHR than the Fox equation. However, neither equation accounted for the large range in variability of MHR between subjects, which suggests that age may not be the only predictor of MHR in younger populations. Caution should be exercised when using these equations for prescribing and monitoring exercise intensity in children and adolescents.
RESULTS: There were no differences in VO2 max between tests (Bruce= 46.9 ± 7.7, 5-5= 45.7 ± 7.9, 10-5= 44.7 ± 7.3, p = 0.51). VO2 max of the Bruce Protocol was strongly related to both 5-5 (r= 0.96) and 10-5 (r= 0.90) tests. Bland-Altman plots between 5-5 test and the Bruce Protocol revealed 93% of data falls within ± 4.5ml/kg/min and 100% fall within 5ml/kg/min.

CONCLUSIONS: These results suggest that both the 5-5, and 10-5 tests are valid alternatives to the Bruce Protocol. Additionally, these results demonstrate that a non-running VO2 max test is effective in determining VO2 max in a healthy population.

Abstract:
Only a few studies have examined the validity of heart rate (HR) measurements for the Apple Watch and Fitbit Charge HR devices. PURPOSE: This study examined the validity of heart rate measurements for the Apple Watch and Fitbit Charge HR 2 devices. METHODS: Thirty young adults (15 females, 15 males, age 23.5±3.0) completed the Bruce Protocol while HR measurements were recorded from the electrocardiogram (EGC) and each device every minute. Average HR for each participant was calculated for very light, light, moderate, vigorous and very vigorous intensities based on ECG-measured HR. A concordance correlation coefficient (CCC, r) was conducted to examine the strength of the relationship between the ECG measured HR and the device measured HR. Relative error rates (RER) were calculated to indicate the difference in HR measurement between each device and ECG. RESULTS: The HR from the Apple Watch was significantly lower compared to the ECG HR (122.78±13.40 vs 128.83±4.96 BPM, P<0.01) for moderate intensity. For very vigorous intensity, the Apple Watch HR was significantly lower compared to the ECG HR for females (174.47±8.79 vs. 180.39±13 BPM, P=0.05). The HR measured by the Fitbit Charge HR 2 was significantly lower compared to the ECG measured HR for light intensity (100.25±6.93 vs. 104.24±9.09 BPM, P<0.01), for moderate intensity (106.66±23.74 vs 117.79±10.27 BPM, P<0.01), for vigorous intensity for males (143.00±13.61 vs 159.39±9.58 BPM, P<0.001) and for females (137.24±18.86 vs 155.11±9.86 BPM, P<0.05) and for very vigorous intensity (157.47±15.44 vs 181.35±9.44 BPM, P<0.001). The Apple Watch also showed lower RER (2.4%-5.1%) compared with the Fitbit (3.9%-13.5%) for all exercise intensities. For both devices, the strongest relationship between the device measured HR and the ECG measured HR was found for very light intensity with a very high CCC (r > 0.90). The strength of the relationship declined as exercise intensity increased for both the Apple Watch and the Fitbit. CONCLUSION: Our study indicated an inverse association between exercise intensity and HR measurement accuracy for the Apple Watch and the Fitbit Charge HR 2. The Apple Watch revealed lower error rates for all exercise intensities compared to the Fitbit Charge HR 2.

Keywords: heart rate measurement; wearable devices; validity

Learning effects, biological changes, and motivation contribute to variability in performance on standardized exercise tests. Performance improvement on short-duration, high-intensity tests, such as a 30-second Wingate test of anaerobic power, may be more sensitive to motivational and learning changes in novice, healthy subjects. PURPOSE: To examine performance changes during serial Wingate tests in healthy, college-aged students. METHODS: Twenty college students were recruited to do three 30-second Wingate tests over three days. They were given identical instructions before each test. Sleep and nutrition were controlled. Standard Wingate parameters were collected. Multivariate analysis was used to examine changes in performance parameters; data are highlighted for the singular variable: peak power.

RESULTS: Eighteen subjects completed all three tests. The overall multivariate analysis for test number was not significant, and there were no significant differences across test days for peak power, power decline, average power, minimum power, power at max speed, or total energy expended. For peak power; averages for test 1 (1.72 ± 0.31 W/kg), test 2 (1.74 ± 0.28 W/kg), and test 3 (1.79 ± 0.32 W/kg) were similar, but examination of percent changes in performances illustrates why results appear homogeneous. Thirteen of 18 subjects improved their performance with repeated trials. The average improvement in peak power for those subjects was 9.8 ± 5.2%. Five subjects had performance declines from the first trial of 4.9 ± 3.9%. One subject had no change in performance. CONCLUSION: The fluctuation from zero to as high as 22% illustrates high variability of these power measurements (power decline ranged as much as 97% within one subject). This degree of variability is well outside.

Abstracts were prepared by the authors and printed as submitted.
what would normally be expected for biological variation and could be construed as problems with equipment calibration. Without application of criteria for subject effort, such as applied to cardiological pathology, the evaluation, it is difficult to make objective intra-group or intra-subject comparisons for Wingate testing.

2738 Board #21 June 1 2:00 PM - 3:30 PM Bilateral Deficit: A Comparison of Maximal Strength Between the Bilateral And Unilateral Leg Press Exercise
James L. Ramsey, Justin Burley, Shel Levine, John W. Carbone, Rebecca W. Moore, 1 Eastern Michigan University, Ypsilanti, MI. 2 Eastern Michigan University, Ypsilanti, MI (Sponsor: Lanay Mudd, FACSM)

The bilateral deficit (BLD) is a phenomenon in which the maximal strength of both limbs contracting simultaneously is less than the sum of the weight lifted by each limb contracting in isolation. The connection between the BLD and how it influences performance is unknown.

Purpose: To determine if the BLD is present during a dynamic leg press in trained participants. Methods: Thirty volunteers (19 male, 11 female; 19-37 years old) reported to the EMU Running Science Laboratory on three separate occasions 72 hours apart. On day 1, participants performed a movement screening consisting of 8-10 repetitions at 30% of one repetition maximum (1RM) for both the bilateral and unilateral dynamic leg press training conditions to ensure that all exercises were safely performed. On day 2, participants were randomly assigned to either the maximal bilateral or maximal unilateral condition. For both conditions, participants performed 6-8 repetitions at 50%1RM, followed by a single repetition at 70% of 1RM. Afterwards, the amount of weight lifted was increased by 10% between each successful lift to ensure standardization. This process continued until participants could no longer increase weight for either testing condition. On day 3, participants completed whichever condition, maximal bilateral or maximal unilateral, that was not completed on day 2 following the same procedures. A paired samples t-test was conducted to determine if there was a significant difference between the maximal bilateral condition and the sum of the left and right maximal unilateral conditions (p<0.05). Results: The 30 participants were 22.96 ± 3.72 years old, had a height of 1.70 ± 9.3 cm, and weighed 73.7 ± 11.5 kg, a significant difference was observed and the maximal strength was greater for the bilateral condition (495 ± 209 lbs) compared to the unilateral condition (387 ± 208 lbs). Conclusion: A BLD was not observed in this study. Research suggests that the BLD is associated with unilateral training while bilateral training reduces the phenomenon. The participants in this study reported knowledge of the lack of BLD. Future investigations are necessary to determine how various resistance training protocols influence the BLD.

2739 Board #22 June 1 2:00 PM - 3:30 PM Inter-individual Variability in Metabolic and Neuromuscular Responses During Continuous Exercise Above and Below Critical Power
Haley C. Bergstrom, Terry J. Housh, FACSM, Kristen C. Cochrane-Snyman, Nathan D. M. Jenkins, M. Travis Byrd, Taylor K. Dinyer, Richard J. Schmidt, Glen O. Johnson, FACSM, 1 University of Kentucky, Lexington, KY. 2 University of Nebraska, Lincoln, NE. 3 California State University-Fresno, Fresno, CA. 4 Oklahoma State University, Stillwater, OK.

Reported Relationships: H.C. Bergstrom: Honoraria; GNC talk at the NSCA national conference.

Theoretically, critical power (CP) reflects the demarcation of the heavy and severe exercise intensity domains, which are defined by distinct metabolic responses and motor control strategies. PURPOSE: This study examined the metabolic (oxygen consumption rate [VO2]) and neuromuscular (electromyographic amplitude [EMG AMP]) responses during exercise above and below CP. METHODS: Six women and six men (mean ± SD age; 21 ± 2 years) performed a graded exercise test to exhaustion (GXT) to determine the VO2peak and peak power output (Wpeak). During separate visits, CP was determined from the 3-min all-out test followed by two, randomly ordered, rides to exhaustion at CP minus 10% (CP<sub>-10%</sub>) and CP plus 10% (CP<sub>+10%</sub>). The VO2 and EMG AMP measured from the vastus lateralis as well as time to exhaustion (T<sub>ex</sub>) were recorded during the GXT and continuous exercise protocols. VO2 was exhausted from the CP<sub>-10%</sub> and CP<sub>+10%</sub> rides were compared with VO2<sub>peak</sub> using a one-way repeated measures ANOVA and follow-up pairwise comparisons (p < 0.05). Linear regression was used to examine the individual VO2 and EMG amplitude responses after the first 3 min to T<sub>ex</sub>. RESULTS: The CP<sub>-10%</sub> (74.9W±122%) and CP<sub>+10%</sub> (90% Wpeak) rides resulted in T<sub>ex</sub> of 24.61 ± 9.29 min (range = 15.02 - 38.87 min) and 7.67 ± 4.08 min (range = 3.65 - 15.57 min), respectively. The mean VO2 at exhaustion for CP<sub>-10%</sub> (3.086 ± 0.995 L min<sup>-1</sup>), but not CP<sub>+10%</sub> (3.511 ± 1.70 L min<sup>-1</sup>), was significantly lower than VO2<sub>peak</sub> (3.488 ± 1.06 L min<sup>-1</sup>). Two of the 12 subjects at CP<sub>-10%</sub> and 9 of the 12 subjects at CP<sub>+10%</sub> reached VO2<sub>peak</sub> at exhaustion. The VO2 increased for all 12 of the subjects from 3 min to T<sub>ex</sub> at CP<sub>-10%</sub> and for 9 of the 12 subjects at CP<sub>+10%</sub>. At CP<sub>-10%</sub>, there was no change in VO2 over time of 3 of the 12 subjects and the VO2 was maintained within 3% of VO2<sub>peak</sub>. The EMG AMP increased for 6, decreased for 4, and did not change for 2 of the 12 subjects at CP<sub>-10%</sub>. At CP<sub>+10%</sub>, the EMG AMP increased for 6 and did not change for 6 of the 12 subjects. CONCLUSION: These findings suggested CP does not demarcate the heavy from severe exercise intensity domains for all subjects as ~17% of subjects reached VO2<sub>peak</sub> at CP<sub>-10%</sub>. In addition, the EMG AMP suggested there was individual variability in motor control strategies (i.e., muscle activation) above and below CP and EMG AMP was dissociated from VO2 for 50% of the subjects at both intensities.

2740 Board #23 June 1 2:00 PM - 3:30 PM Relationship Of %HRmax And %VO2max For Running And Cycling In Trained Triathletes

No relevant relationships reported

Since relative maximum heart rate (%HRmax) correlates highly (r=0.98) with relative maximum oxygen uptake (%VO2max) for all modes of exercise (cycling, running, swimming, kayaking, rowing) it can be used by athletes and coaches to accurately determine the usage of certain %VO2 values for training and racing purposes by knowing only the value of HRmax. The effect of equal cycle and running training (Triathlon) on the relationships of %HRmax with %VO2max for cycling and running exercise is not clear. PURPOSE: The purpose of this study was to examine the relationships among %HRmax and %VO2max in trained triathletes during running and cycling exercise. METHODS: Sixteen male trained triathletes (33.2 ± 4.3 y 78.61 ± 3.42 kg, 12.6 ± 1.8 % body fat) performed an incremental maximal exercise test to exhaustion on cycle ergometer (30-watt increment 3min stages) and on a treadmill (1km.h<sup>-1</sup> increment 3min stages) with 3-4 days apart. Individual linear regressions based on HR and VO2 values measured of each stage and maximum, were used to calculate slopes and intercepts, to predict %VO2max from %HRmax, for given exercise intensities (50, 60, 70, 80, 90 and 100%HRmax). RESULTS: Mean prediction ± of the %VO2max from %HRmax was significantly higher (p<0.01) during running compared to cycling exercise from 50-80%HRmax (50%: 32.03 ± 7.46 v 19.77 ± 6.75; 60%: 45.18 ± 5.85 v 35.80 ± 5.65; 70%: 58.53 ± 4.37 v 51.65 ± 4.54; 80%: 71.59 ± 5.03 v 67.45 ± 4.07). The prediction of the running %VO2max was significantly (p<0.01) overestimated at 50, 60, 70 and 80% HRmax by 26.2, 26.2, 13.3 and 6.1% respectively compared to cycling. The regression equations are: Run%VO2max = 0.738*%HRmax + 26.67 and Cycle%VO2max = 0.620*%HRmax + 37.85 (R2=0.99). Mean %VO2max corresponding with 90% and 100%HRmax was not different (p<0.05) between exercise modes. CONCLUSIONS: For submaximal (%<90%) VO2max exercise intensities during running and cycling the use of the above regression equations may produce reasonably accurate exercise intensity for training and racing purposes and help athletes better quantify training stimuli, stress and adaptations.

2741 Board #24 June 1 2:00 PM - 3:30 PM The Creation of Effective Standardized Instructions for a Novel Flexibility Test
Mark G. Cullum, Justin R. Bland, Kenneth T. Turley, FACSM. Harding University, Searcy, AR. (Sponsor: Kenneth T. Turley, FACSM)

No relevant relationships reported

Previous research has demonstrated the validity and reliability of a new test of hip and lower back flexibility that can be performed with minimal equipment.

PURPOSE: This study’s purpose was to determine if an individual could perform the test correctly using only standardized instructions.

METHODS: 44 college age subjects attempted to perform the test procedures correctly, followed by a measurement by a trained technician. Based on the results, changes were made to the instructions to account for the most common errors. 45 new subjects then completed the revised procedures to the best of their ability, followed again by a measurement by a technician. The results of the individuals were compared to those of the technician by Pearson correlation and a Paired T-test.

RESULTS: For both groups the values of the instructions of the technicians who performed the test correctly were compared to the technician’s values, a very high correlation was found (r=0.969 for group 1, r=0.868 for group 2). The technician’s scores tended to indicate greater flexibility, with a significant difference found for the first group (p<0.01 for group 1, p=0.095 for group 2). This was expected, as the technician’s measurements were always made after the individual’s effort, and with repeated stretches flexibility tended to improve. A noticeable number of subjects in the first group made an error (21 of 44 subjects), primarily mathematically in nature. When the instructions were revised, the mathematical error did occur less frequently, though overall more errors occurred (28 of 45), primarily not performing the procedure three
The maximum rate of oxygen consumption ($V_{O_{2max}}$) is the gold-standard index for assessing cardiorespiratory fitness. The presence of a $V_{O_{2}}$/work-rate plateau at the highest work rates during incremental testing represents the primary way to confirm that a “true $V_{O_{2max}}$” was attained; however, such a plateau is often lacking. Instead, $V_{O_{2max}}$ is often confirmed using “secondary criteria” based on arbitrarily-determined values for heart rate, RPE, and/or blood-lactate concentration. A constant-work-rate “verification bout” can also confirm $V_{O_{2max}}$; however, support for this practice comes predominantly from studies performed on recreationally-active/athletic populations. **PURPOSE:** To compare the peak $V_{O_{2}}$ responses from an incremental and verification bout in sedentary, normal and overweight/obese adults. **METHODS:** Twenty-eight sedentary, but otherwise healthy normal-weight (n=15; BMI 22.6±1.4 kg/m²) or overweight/obese (n=13; BMI 31.3±2.9 kg/m²) subjects (male/female, n=15/13; age, 28.1±4.9 years) performed a “ramp” incremental cycling test (15-20 W/min) to limit of tolerance on a lower-body ergometer followed (10 minutes) by a constant-work-rate cycling to limit of tolerance at the highest work rate attained. **RESULTS:** Intra-class correlation coefficient (.980) and coefficient of variation (4.6±3.69%) indicate good reliability for peak $V_{O_{2}}$ measurement across protocols; however, the value was significantly higher during the verification bout (2.19±0.57 vs. 2.10±0.56 L/min; p=0.001) with 18 of 28 subjects demonstrating a value ≥ 2% above that derived from incremental testing. This implies that incremental testing does not reveal a true $V_{O_{2max}}$ for a substantial proportion of these subjects. However, the peak incremental response would have been accepted as $V_{O_{2max}}$ in all but eight subjects if the method often used (i.e., attainment of two of three criteria based on heart rate, RPE and RER) was employed. Indeed, despite the lower peak $V_{O_{2}}$ response, peak heart rate and RPE were not lower for the incremental bout while peak RER was higher (1.23±0.09 vs. 1.18±0.09; p=0.003). **CONCLUSION:** The ramp incremental protocol revealed an underprediction of $V_{O_{2max}}$ in normal and overweight/obese sedentary adults. Use of secondary criteria resulted in false $V_{O_{2max}}$ acceptance in 32% of subjects.

**Purpose:** Vertical jump can be assessed using a number of different methods including the Sargent jump, a force platform and methods based on the time-of-flight. The Sargent jump has the advantage of being simple and inexpensive, but is known to lack precision. The force platform is the most accurate method but is very costly. The methods based on time-of-flight offer a good compromise but are dependent on the take-off and landing positions. To alleviate this constraint, we propose a novel method of assessing vertical jump height using a low cost ultrasonic ranging technology. The proposed method consists of placing the system on the ceiling and continuously measuring the distance to the closest body part (head). The purpose of this study is to demonstrate the proposed principle and determine its validity. The validity of the device was tested both in a static and a dynamic context. Static tests were performed by placing the ultrasonic sensor at 10 known distances from the top of the participant’s head, ranging from 20cm to 110cm. Average and maximum errors were calculated. In the dynamic portion of the test, a participant was asked to perform 5 test jumps and to land in the same position as the one during take-off. The height of each jump was evaluated using both a time-of-flight device and the proposed method. The measurements from both devices were compared using the Student t-test for repeated measures. **Results:** No significant differences were observed between the proposed method (22.1±3.1 cm) and the time-of-flight method (22.6±3.1 cm). The correlation coefficient was excellent between the two types of measurement systems (r=0.97).

**Conclusion:** The proposed device is not sensitive to the landing position (biggest drawback of the time-of-flight system). The main difficulty of the proposed device is to ensure that the participant remains in the area covered by the ultrasonic beam. Indeed, if the participant has a large horizontal displacement during the jump, it may provide incorrect measurements. A possible solution could be to perform a 2nd order polynomial surface-fitting on each participant’s data. The proposed device is an excellent alternative to evaluate vertical muscular power. In addition to being low cost, the proposed device does not suffer from the drawbacks associated to time-of-flight methods.

**Purpose:** To compare the peak $V_{O_{2}}$ responses from an incremental and verification bout in sedentary, normal and overweight/obese adults. **METHODS:** Thirty elderly volunteers without cardiovascular diseases (67 ± 5 years, 170 ± 10 cm, 76 ± 15 kg) underwent two different step test protocols with five stages, in a randomized order. In protocol 1 (P1), the step height was constant at 25 cm. The load was increased by the climbing frequency (5 steps per minute, same) every two minutes, from 10 to 30 (n=2). In protocol 2 (P2), the load was increased by the step height (5 cm, every two minutes, from 10 to 30 cm) at a constant stepping frequency of 25 spm. HR, VO2, blood lactate (La) and evaluation of perceived exertion (RPE) were recorded before ($T_{0}$) and at the end of each stage ($T_{1}$ – $T_{5}$) and three minutes afterwards ($T_{6-10}$). For comparison of the differences, the root mean square error (RMSE) was calculated. **RESULTS** All five stages were achieved by 27 probands, five probands aborted at stage four and one at stage three. Between the protocols, the RMSE of the HR differed from 5.7 to 7.8 bpm independently of measuring time point. The lowest deviations of La were found in $T_{5}$; the highest differences were found in $T_{3}$ and $T_{6-10}$ with 0.52 - 0.66 mmol/l. The VO2 differed about 0.9 - 2.3 ml/min/kg, with the highest amount in $T_{2}$; RPE was significantly higher at $T_{1}$ in P2 (Wilcoxon p<0.05). **Conclusion** The measured differences are close to the expected day by day variations in step test protocols. The modest differences in the protocols, both are suitable for practical application in elderly people. Considering the differences in HR between the protocols, an adaptation of the maximum oxygen uptake estimation could be necessary.
around the waist of the dummy and on the signal “go” the wrestlers quickly exploded up, lifting the dummy by getting triple extension with the ankles, knees and hips as one would in a powerful set. After the wrestler was fully extended, he turned in midair in order to drive the dummy onto its stomach on the ground, where the wrestler was on top of the back of the dummy (a common position after an opponent has been thrown). The participant then repositioned the dummy to the original position to execute another throw. The participants completed as many dummy throws as possible during the one minute trials. The trials were separated by 15 minutes. The trials were scored by judges. The resulting scores were used to establish the reliability of the dummy throw test as an assessment of AP. The inclusion of additional dummy throw trials to the assessment protocol may enhance the degree of reliability of the dummy throw test as a measure of AP.

Muscular power is the rate at which work can be performed and is evaluated by obtaining velocity measurements. Currently, there are several devices available to measure muscular power through velocity measurements, including the Tendo Fortidyna Sports Power Analyzer (Tendo Sports Machines, Slovakia). However, the ability for such devices to produce consistent results is still questioned. Additionally, the reproducibility of measurement between free weight and machine exercises has yet to be examined. PURPOSE: To determine the test-retest reliability of peak velocity during barbell bench press and leg press exercises at 20-80% of one repetition maximum (1RM). METHODS: Fifteen men (height 183 ± 10.0 cm; weight 85.3 ± 12.4 kg) and fifteen women (height 169.6 ± 7.0 cm and weight 68.9 ± 7.7 kg) performed 1RM testing for the bench press and leg press (total n = 30, x̅ ± SD): x̅leg press = 189.5 ± 49 kg and bench press 66.8 ± 32.4 kg; females = 15, x̅ leg press = 163.2 ± 33.3 kg and bench press = 40.9 ± 13.8 kg; males n = 15, x̅ leg press = 206.3 ± 53.6 kg and bench press = 90.2 ± 30.5 kg). Following at least 48 hours, each subject returned to perform one repetition at 20, 30, 40, 50, 60, 70, and 80% of their 1RM for each exercise, in randomized order with the Tendo Unit attached to each device. To determine test-retest reliability, the subjects returned to the lab one week later to perform the velocity assessment again at each intensity, in randomized order. RESULTS: The test-retest intraclass correlation coefficients (ICC) at each percentage of 1RM, averaged across all subjects were 0.982, 0.951, 0.892, 0.884, 0.722, 0.638 and 0.777 for leg press and 0.935, 0.945, 0.981, 0.981, 0.970, 0.952 and 0.816 for the bench press. When reliability was assessed based on gender, the average ICC for leg press and bench press was 0.816 and 0.689 for females and 0.832 and 0.745 for males, respectively. CONCLUSION: The findings from this study found stronger correlation coefficients for lower percentages of 1RM (20-60%) compared to higher loads (70-80% 1RM), especially for the leg press compared to the bench press. Additionally, males had slightly stronger test-retest correlations compared to the females.

Critical power (CP) is considered a distinct exercise threshold, where at workloads above CP a metabolic steady state is thought to be achieved, allowing exercise to be maintained for a long duration (>30 min). The ventilatory responses to constant load exercise below and above CP are yet to be determined. PURPOSE: To characterize ventilatory responses during cycling exercise performed at constant load exercise below and above CP. METHODS: Ten highly trained subjects (6M/4W; age: 24 ± 4 years; height: 1.76 ± 0.10 m; weight: 66.3 ± 9.1 kg; VO₂max: 59.1 ± 7.3 ml/kg/min) performed a ramp incremental test, a 3MT (275 ± 75 W), and two constant load cycling trials to exhaustion at 10% below (CP−) and 10% above (CP+) CP. Critical power was determined as the mean power output over the last 30 s of the 3MT. Ventilatory (e.g. minute ventilation (VE), breathing frequency (fB), tidal volume (TV), end-tidal partial pressure of CO₂ (PetCO₂), ventilatory equivalents for O₂ (VE/O₂) and CO₂ (VE/CO₂)) and metabolic

## References

For a comprehensive list of references, please consult the original publication. Each reference is cited within the text as needed.
parameters, dyspnea and arterial oxygen saturation (SpO2) were compared at 25, 50, 75 and 100% of time to exhaustion (TTE) within each trial. The same variables were compared between CPmax and CPat exhaustion. Results: TTE was 1215±396 and 288±95 s for CPmax and CPat exhaustion, respectively. Within each constant load trial heart rate, ßh, VE/VO2 and VE/VCO2 were significantly (p<0.05) higher and PetCO2 significantly (p<0.05) lower at 75 and 100% compared to 25% TTE. During CPmax VO2, VE, TV, VO2 were also different (p<0.05) between 75 and/ or 100% compared to 25% TTE. However, average values of oxygen uptake (VO2ave) were different at 75 and 100% of TTE within each trial indicating a delayed steady state was achieved at both CPmax and CPat exhaustion. In addition, PetCO2, VE, TV, VO2 were also different (p<0.05) at exhaustion between CPmax and CP at exhaustion. Conclusion: Despite reaching different values at exhaustion, ventilatory parameters stabilized during exercise at 10% below and above CP. Furthermore, subjects reached exhaustion, on average suggesting CP may be overestimated in highly trained subjects when CP is defined using the 3MT.

Evaluation of the Accuracy of the ACSM Walking Metabolic Equations During the Bruce Protocol

Kayla E. Brennan, Patricia I. Fitzgerald, Kristofer S. Wisniewski, Saint Francis University, Loretto, PA

The metabolic equations from the American College of Sports Medicine (ACSM) are used to determine energy expenditure during exercise. However, the equations have been shown to overestimate measured values of oxygen uptake (VO2). PURPOSE: To determine the validity of the ACSM walking metabolic equations in predicting VO2 during stages 1-3 of the Bruce Protocol Treadmill Test. METHODS: 50 subjects (25 males, 25 females) aged 31.6±13.1 years and BMI of 25.0±3.4 kg/m² completed a maximal treadmill test using the Bruce Protocol. A Parvo Medics TruOne 2400 system was calibrated before each test and used to collect and measure VO2. Steady state, defined as a heart rate ± 5 bpm for the last 2 minutes of each stage, was attained in all subjects. The measured VO2 values during the last minute of each stage were compared to predicted values calculated using the ACSM walking metabolic equation. RESULTS: Depending on t-tests were used to compare predicted against measured VO2 values for each stage. Predicted and measured values ± SD of stages 1-3 were 16.3±1.8 ml/kg/min and 15.5±1.8 ml/kg/min (p=0.05), 24.7±2.7 ml/kg/min and 22.3±2.3 ml/kg/min (p=0.0001), and 35.6±4.2 ml/kg/min and 32.0±4.2 ml/kg/min (p=0.0001), respectively. The equation overestimated VO2 values during stages 1-3 in 38 (76%), 47 (94%), and 44 (91.7%) subjects, respectively. CONCLUSION: The ACSM walking metabolic equation consistently overestimated the measured VO2 for all three stages. The ACSM states the metabolic equations can have up to 7% error. However, the predicted VO2 for stages 2 and 3 were both 11% greater than the measured. Due to the variability between the predicted and measured VO2 values, caution should be taken when using the ACSM walking metabolic equation to estimate VO2 during stages 1-3 of the Bruce protocol.

Reproducibility of Force-Velocity Test Outputs Using 10-s Sprints Against Different Braking Forces

1Faculté of Physical Education and Sport, Lusofona University of Humanities and Technologies, Lisboa, Portugal. 2CIDAF (UDG) (04213/2016), University of Coimbra, Coimbra, Portugal. 3School of Health and Technology, Polytechnic Institute of Coimbra, Coimbra, Portugal. 4University of Rome Foro Italicco, Rome, Italy.

The current study was aimed to examine the reproducibility of estimated peak power (PP) and estimated pedal velocity (PV) in a multi-trial 10-s all-out cycling test among adult athletes of different sports. METHODS: The sample comprised 22 adult male athletes (23.50±4.73 years). Stature, sitting height and body mass were measured. Leg length was estimated as stature minus sitting height. Thigh volume was estimated from anthropometry. Body volume was obtained from air displacement plethysmography and was subsequently converted to fat mass. Fat-free mass was derived. The short-term power outputs were assessed from the force-velocity test (FVT), using a friction-braked ergometer on two repeated occasions. Differences between repeated measurements were examined with paired t-test and effect sizes calculated. RESULTS: Mean values for session 1 (898 Watt, 142 rpm) and session 2 (906 Watt, 142 rpm) did not differ (p>0.05). Moreover, test-retest procedure evidenced reasonable intra-individual stability for estimated PP output. Technical error of measurement (TEM) was 31.9 Watt; % coefficient of variation (CV) was 3.5% and intra-class correlation coefficient (ICC) was 0.986. For PV, TEM was 5.4 rpm, %CV was 3.8 and ICC was 0.924. CONCLUSIONS: Estimated PP derived from the optimal load and correspondent PV outputs seemed to be reproducible in adult athletes. Future research may examine the agreement between the estimated outputs from the Force-Velocity Test. However, PV and PP measurements were performed using the Wingate Anerobic Test protocol using the optimal load from the FVT.


2752 Board #35 June 1 2:00 PM - 3:30 PM A Validated Model to Predict Maximal Oxygen Consumption Using a 9-minute Walk Test

Taylor Rowley, Chris Cho, Ann Swartz, FACSMD, Nora Miller, Scott Strath, FACSMD. University of Wisconsin-Milwaukee, Milwaukee, WI. (Sponsor: Dr. Scott Strath, FACSMD)

Introduction: Assessing maximal oxygen consumption (VO2max) is not always feasible, so alternative testing methods to predict VO2max have been established. The purpose of this study was to assess and validate a field test to predict VO2max using measures obtained during a 9-minute walk test. METHODS: A subsample of 147 adults, aged 18-79 years, completed this test. Demographic variables included resting heart rate (RHR), age, gender, and body mass. Participants completed three 3-min walking stages at a less than, normal and greater than normal walking pace. Heart rate (HR), distance covered, and gait speed was calculated for each stage. Recovery HR was collected every 30-seconds for 2-minutes after the end of the 9-min test. Hierarchical multiple regression analysis was used to predict VO2max utilizing variables of age, gender, and mass, and variations of heart rate, distance, speed, and recovery data. The validity of the final prediction equation to estimate VO2max was assessed using jackknife cross-validation. Root mean square error (RMSE) and percent bias was calculated. Results: 57.7% of the sample was female, with an average age of 46.4±17.2 years, BMI 25.8±4.6 kg/m², VO2max 44.7 ml/kg/min, and RHR 60.5±9.2 bpm. Model 1 included age, gender, and body mass (R²=0.71). Model 2 included variables from model 1 entered in step 1, with the addition of gait speed for each 3-min stage (R²=0.74). The final model included all steps from model 2, and recovery HR after 30-seconds. This model accounted for 80.4% of the variance in VO2max (R²=0.804, RMSE=4.651 ml/kg/min). Bias between the original model and the jackknife sample (R²=0.804, RMSE=4.651 ml/kg/min, Bias Adjusted RMSE=4.6220 ml/kg/min) was 0.1% for each variable entered into the model. Discussion: The final model accounts for ~80% of the variance in VO2max, which is in line with previously published field tests.

2753 Board #36 June 1 2:00 PM - 3:30 PM Your Activities of Daily Life, YADL_Ballet: An Image-Based Survey Technique for Healthy and Injured Dancers

Marjimeen Liederbach1, Evangelos Pappas2. ‘NY Langone Orthopedic Hospital, New York, NY. University of Sydney, Sydney, Australia. (Sponsor: Malachy P. McHugh, FACSMD)

Under ideal circumstances, clinicians and educators seek to detect risk for injury prospectively, often through screening efforts. It is known that screening has been very useful for rapport building, improving health literacy and facilitating entryways to local healthcare systems. However screening, as we have been conducting it, has still not proven to be predictive of injury despite implementation of preventative interventions such as pre-season conditioning programs. This may be due, at least in part, to the fact that most screenings are annual in their periodicity whereas athlete schedule loads and health status changes are very dynamic. PURPOSE: To describe a daily monitoring approach to assess patient self-rated outcome (PRO) using a personal device, image-based patient reported survey functional measure (YADL_Ballet) that possesses concurrent validity with the SF-12 Physical Component Summary, which when measured by factor analysis, explains 61.2% percent return to activity following injury (p<0.0000). METHODS: 241 elite classical dancers (21.5±5.0 years; 69 men, 172 women) who received regular onsite care consented to participate in a prescreening monitoring and injury tracking study. Data was analyzed with a multivariate logistic regression model for the outcome variables “injured in subsequent season” and “visits in subsequent season”. RESULTS: PRO variables were associated with the primary outcome variables (p=0.003, R²=0.492, R²=0.424, adjusted R²=0.205). CONCLUSION: Compliance with personal device image-based survey was excellent, further suggesting injury prevention screening tactics for dancers should include serial PRO score assessments to predict those at greatest risk for time loss injury. <-EndFragment->
Individuals with physical disabilities have few choices for enjoyable physical activity. One option is playing active video games (AVG), but many are inaccessible or offer limited play options. Making AVGs accessible offers an innovative approach to overcoming many barriers to participation. PURPOSE: To examine energy expenditure and enjoyment in persons with mobility impairment during AVG play using an off-the-shelf (OTS) and an adapted Wii Fit balance board (WFBB).

METHODS: Participants completed a functional assessment and familiarization period. Metabolic data (COSMED) were collected during 20-minute baseline, followed by four 10-minute bouts of AVG play. Participants performed two 10-minute bouts of select AVG and WFBB games on the OTS and adapted WFBB. During rest participants completed the PACES enjoyment scale. Data were analyzed by player ability game play groups: 1) both boards standing (StdStd), 2) seated OTS board, standing adapted board (xStd), and 3) seated on OTS board only (xStd). RESULTS: Sample included 58 participants, 31 men, mean age 41.21 (±12.70) yrs. Energy expenditure (METs) during AVG play was significantly greater than rest for all players. Only 17 participants (StdStd group) were able to play using the OTS board. During game play on the adapted WFBB average MET values for the three groups on the two game sets respectively were: xSit (n=31) 2.26±0.72, 2.23±0.75 kcal/kg/hour; xStd (n=10) 3.15±1.03, 2.99±1.12; StdStd (n=17) 2.80±0.82, 2.88±0.90. PACES scores indicated that all players enjoyed the AVGs with median scores of 4 on a 5-point scale. CONCLUSION: The adapted WFBB provided an opportunity for persons with mobility impairments, including wheelchair users, to engage in AVG. All participants were able to utilize and enjoyed the adapted WFBB activity. Although average MET values achieved during AVG represented light intensity exercise, several participants achieved moderate intensity (3-6 METs) on at least one game set. Factors not accounted for that may have influenced exercise intensity include: 1) game selection, 2) limited familiarization, and 3) discomfort wearing CSMED system. Next step includes further development of adapted gaming controller and assessment of associated health and fitness outcomes. Supported by NIDLRR grant 90RE5009-01-00.

**Table 1. Cardiorespiratory Fitness and Skin Temperature data for HT and MT groups**

<table>
<thead>
<tr>
<th>Variable</th>
<th>HT (n=37)</th>
<th>MT (n=55)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>33±9</td>
<td>39±7</td>
<td>.004*</td>
</tr>
<tr>
<td>BMI (kg/m-2)</td>
<td>22.9±1.6</td>
<td>24.8±2.1</td>
<td>.000*</td>
</tr>
<tr>
<td>Peak run speed (km/h)</td>
<td>7.3±1.4</td>
<td>14.8±1.3</td>
<td>.000*</td>
</tr>
<tr>
<td>VO2 peak (ml/kg/min)</td>
<td>57.1±3.4</td>
<td>47.1±4.4</td>
<td>.000*</td>
</tr>
<tr>
<td>HR (bpm)</td>
<td>185±9.7</td>
<td>178±8.9</td>
<td>.01*</td>
</tr>
<tr>
<td>RER</td>
<td>1.05±0.53</td>
<td>1.04±0.51</td>
<td>.327</td>
</tr>
<tr>
<td>VE (l/min)</td>
<td>146.5±19.9</td>
<td>129.1±15.6</td>
<td>.000*</td>
</tr>
<tr>
<td>Tikin baseline (ºC)</td>
<td>34.5±0.73</td>
<td>34.06±0.77</td>
<td>.003*</td>
</tr>
<tr>
<td>Tikin peak (ºC)</td>
<td>35.7±0.84</td>
<td>35.45±1.14</td>
<td>.026*</td>
</tr>
<tr>
<td>Tikin end (ºC)</td>
<td>35.28±0.40</td>
<td>35.03±1.46</td>
<td>.859</td>
</tr>
<tr>
<td>Tikin recovery (ºC)</td>
<td>35.97±0.25</td>
<td>35.55±1.20</td>
<td>.111</td>
</tr>
<tr>
<td>Note: values are mean (Standard Deviation) Abbreviations: BMI (body mass index); VO2 peak (peak oxygen uptake); HR (heart rate); RER (respiratory exchange rate); VE (ventilation); Tikin (skin temperature).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Between-groups differences (p &lt; .05).</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 2. Overall correlation between skin temperature and cardiorespiratory fitness data**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Age</th>
<th>BMI</th>
<th>Peak Run</th>
<th>VO2 peak</th>
<th>HR</th>
<th>RER</th>
<th>Tikin Bas</th>
<th>Tikin End</th>
<th>Tikin Rec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tikin peak (ºC)</td>
<td>r</td>
<td>-0.3</td>
<td>-0.12</td>
<td>-0.269</td>
<td>0.279</td>
<td>0.08</td>
<td>-0.227</td>
<td>0.62</td>
<td>0.903</td>
</tr>
<tr>
<td>p</td>
<td>.004*</td>
<td>.256</td>
<td>.009*</td>
<td>.007*</td>
<td>.043</td>
<td>.030*</td>
<td>.000*</td>
<td>.000*</td>
<td>.000*</td>
</tr>
</tbody>
</table>

* Significant correlation (p < .05)
Purpose: To monitor national team development camp ice hockey players with player worn sensors (PWS) to identify fatigue by reduced on-ice accelerations and changes in heart rate. **Methods:** 46 (15 yr; 174.83 ± 7.53 cm; 72.17 ± 11.80 kg) USA Hockey 15 national development camp participants consented to procedures approved by the EMU-HSRC. PWS measured tri-axial accelerations (ACC) and heart rate (HR) (Zephyr, MD) for each on-ice session (n=7) during the 5-day camp. Exponentially weighted Dynamic Accelerations (DYNA) were calculated from raw ACC. Three traditional games (G1, G2 and G3) were played on days 2, 4 and 5 and a 3v3 small-sided game on day 3. Peak ACC (g’s) were divided into neuromuscular (NM) (10 sec), anaerobic (AN) (20, 30, 40, 60 sec) and aerobic (AE) (90, 120, 180, 300, 600, 1200, 1800, -- 3600s) time domains to determine relevant physiological fatigue factors. DYNA(s) were determined for time frames longer than the AN domain. Peak HR (bmp) were divided into AN and AE domains at same time frames as ACC. MANOVAs for G only, P only and G vs P were performed (α = .05), in the case of significance a Tukey’s post hoc was performed using SPSS 24.0 (IBM, NY). **Results:** ACC were greater for G vs P in the NM (10 s), AN (20-60 s) and AE (90 --180 s), while P were greater than G for ACC from 300 - 3600 s; (p<.05). DYNA were greater for G than P for AN (60 s) and AE (90 - 180; 1200 - 1800; p<.05) respectively. HR was greater at AE (300 - 1200 s; p<.05) domain for P vs G. Non-significant, small effects (η² = .01 - .042) were seen for reduced accelerations in the NM (10 s), AN (20-60 s) and AE (90 - 2700 s) from G1 to G3. Significant decreases in ACC were observed in NM (10 s) AN (20-60 s), AE (90 - 2400 s) and DYNA in the AN (60 s), AE (90 and 2400 s) domains from P1 to P3 (p<.05). HR also declined in the AE domain (60 - 1200 s; p<.05) from P1 to P3. **Conclusion:** Games elicited increased ACCs and DYNA for majority of the time points observed between 10 and 180 s, while practices elicited greater ACC and HR for durations longer than 300 s. Along with the fact that DYNA were higher for games vs practices, these data indicate that games exhibit a more intense exertion profile with greater emphasis on anaerobic energy systems than practices. Although not as profound as expected, effects for declining ACC and DYNA from G1 to G3 indicate fatigue was evident. Supported by USA Hockey Foundation

**Purpose:** The purpose of this study was to compare the Hexoskin smart garment (Hx) to established methods (teamPRO®, Polar Electro Oy., Finland) for the assessment of distance during linear and agility-based movements. **Methods:** Fifteen male collegiate soccer players (means: SD, age 20±1 years; height 177.0±7.5 cm; mass 71.57±7.17 kg) volunteered to participate in this study. Subjects performed a linear task consisting of two trials at each velocity: walking 4.8-7.9 km·h⁻¹ (W), jogging 8.0-12.7 km·h⁻¹ (J), running 12.8-20.0 km·h⁻¹ (R), and sprinting >20.1 km·h⁻¹ (S) with timing gates placed at 40m and 100m. Peak velocities were verified using a laser gun. Subjects also performed two trials of an agility task (team-sport simulated circuit, TSSC) through a 120m course, at various velocities, accelerations, decelerations, changes in direction, and stopping. Validity of total distance (TD) during the linear tasks and TSSC were established using the mean difference (MD) and independent t-tests (p<.05) compared to criterion measures. Reliability for TD was determined independently during linear and TSSC tasks via coefficient of variation (%CV). **Results:** TD during the 40m was significantly less than the criterion measure during the J (MD±SD, -1.04 ±1.18m, p<0.001), R (-1.48±1.22m, p<0.001), and S (-2.78±2.99m, p<0.001). TD during the 100m was overestimated during the W (1.18±1.38m, p<0.001), but underestimated during the S (2.28±2.43m). With the exception of the S during the 40m (%CV<8.2), the reliability (%CV) of the units for measuring TD during the 40m and 100m tasks was <5% for the W, J, R, and S. The device did not differ compared to criterion (tape measured distance) for TD during the TSSC (0.23±1.15m; p=0.339) with a very small error (-1.0%). **Conclusions:** Overall these results indicate that the novel shirt-based GPS device was a valid measure of TD during the 100m for the R and J velocity zones. As velocity increased, MD for TD was also increasingly underestimated. Reliability data for TD suggest that the shirt-based sensor demonstrated good levels of consistency in all but one linear (40m S) and sport-specific tasks. The practical value of this device for athletes and coaches should be noted despite the statistically significant differences.
TITLE: Not All Are Created Equal: A Meta-Analysis of Wearable Devices for Tracking Physical Activity.

Wearable physical activity trackers have become popular and many vendors introduce various products. Currently, there are more than fifteen vendors competing in a share-market that projected over $19 billion by 2018. Physical activity trackers are being used in research studies as well as self-monitoring, reinforcement, and measurement. Many previous studies have examined the quality of commercially available devices. However, segmentary results from individual studies may not help users when selecting physical activity trackers for multiple purposes, including tracking and monitoring their daily physical activity patterns. PURPOSE: To compare convergent validity of different commercially available trackers from various vendors using meta-analysis. METHODS: Four databases including Medline, were searched using key words representing physical activity tracker, physical activity, and validation studies. Inclusion criteria were the studies examining convergent validity evidence between wearable physical activity trackers and research graded accelerometers (e.g., ActiGraph GT3X+). Physical activity trackers that had less than two previous independent studies were excluded. A total of 70 studies were identified through the systematic search and thirteen articles met the inclusion criteria, including nine different products introduced by seven different vendors. RESULTS: The sample sizes from individual studies were varied, ranging from 19 to 99. A wide range of confidence intervals (CI) in several products was found. Using the criteria of convergent validity coefficient of 0.8, three products demonstrated good validity and had both the mean validity coefficient and CIs were above the criteria. The mean validity coefficients of four products were the above 0.8, but lower limits of CIs were below the criteria while the mean validity coefficients of two products were below expected value. Interestingly, the cost of these trackers was not related to the strength of validity evidence. CONCLUSION: Since the accuracy of physical activity trackers is a contributing factor to continue engaging in physical activity (Kaewkannate & Kim, 2016), it is important to carefully examine validity evidence.

2762 Board #45 June 1 2:00 PM - 3:30 PM Accuracy Of The Polar M430 To Predict VO\textsubscript{2}\text{max} Using Optical Technology

Grace Shryack, Joshua Patterson, Olivia Hanzel, Courtney Willoughby, Bryant Smith. Southern Illinois University - Edwardsville, Edwardsville, IL. (No relevant relationships reported)

There are a number of fitness watches currently on the market that can predict VO\textsubscript{2}\text{max} based upon resting heart (HR) values. Traditionally these watches have measured HR using a wireless chest transmitter but the Polar M430 uses optical technology which is built into the watch to measure HR. There is evidence that suggests this optical technology will accurately measure resting HR but there is limited information that suggests this technology will accurately measure VO\textsubscript{2}\text{max}. PURPOSE: The purpose of this study was to compare predicted VO\textsubscript{2}\text{max} values obtained from the Polar M430 watch (\(M_{\text{A}}\)) and actual VO\textsubscript{2}\text{max} values (\(A_{\text{B}}\)) obtained from indirect calorimetry. METHODS: Seven females (age = 24.0 ± 4.5 y, BMI = 26.3 ± 5.9 kg/m\(^2\)) and fourteen males (age = 24.9 ± 4.5 y, BMI = 28.1 ± 5.2 kg/m\(^2\)) were recruited. These participants were fitted with a wireless chest transmitter which was held in place with a chest strap. This transmitter sent HR information to the V800. The M430 was then fitted to the participant according to the manufacturer’s instructions. Once HR values were being displayed on all watches, the resting fitness test was started in order to obtain VO\textsubscript{2}\text{max} values from each watch. At the end of the test, the VO\textsubscript{2}\text{max} values were recorded from the watch. RESULTS: There were no significant differences between \(O_{\text{A}}\) and \(CT_{\text{B}}\) (48.2±13.5 and 48.3±12.9 ml/kg/min, respectively). In males, there were no significant differences between \(O_{\text{A}}\) and \(CT_{\text{B}}\) (52.0±14.2 and 51.9±13.8 ml/kg/min, respectively). CONCLUSIONS: This study shows that there are no significant differences between the VO\textsubscript{2}\text{max} estimates based upon resting HR values obtained from optical sensors (M430) or from a wireless chest transmitter (V800). Although both technologies produce similar estimates of VO\textsubscript{2}\text{max} this project does not examine the accuracy of these estimates when compared to an individual’s actual VO\textsubscript{2}\text{max}.

2764 Board #47 June 1 2:00 PM - 3:30 PM Comparing Positional Differences In Physical and Performance Assessments Among Acrobatics and Tumbling Athletes

Nicole J. Uccello, Courtney L. Stack, Michael J. Ryan, Paul D. Reneau, Shinichi Asano. Fairmont State University, Fairmont, WV. (No relevant relationships reported)

Physical and physiological profiles are biomarkers of athlete’s performance level. The fitness profile of positional differences has been described in collegiate football, basketball, and soccer, but not in Acrobatics and Tumbling (A & T). A & T is a new and emerging collegiate sport for competitive female athletes, thus there is not enough physical and performance data. PURPOSE: The purpose of this study was to compare the anthropometric characteristics and fitness levels of A & T athletes based on the two positions which include tops (T) and bottoms (B). METHODS: Subjects were 21 Fairmont State University female athletes who participated in the sport Acrobatics and Tumbling (20±0.9 years of age). A test of the five-fitness component’s, which included body composition, flexibility, muscular endurance and strength and cardiorespiratory endurance, was given to each participant. RESULTS: The mean value of flexibility (cm ± SD) was significantly higher in tops (T) compared with bottoms (B) (p<.05). Body Composition (% ± SD) showed a difference between the groups Body composition showed a significant difference (p=.05) within the tops and bottoms (T=23.7±2.2, B=26.4±2.2, p<.05). Muscular strength and endurance, cardiovascular endurance and vertical jump height did not show significant differences. CONCLUSIONS: The current study describes the important positional differences in body composition and flexibility in collegiate A & T athletes. Coaches can use these physical and physiological profiles to determine which positions that the athletes are suited for.
Commercially available GPS sports watches are now able to estimate VO\textsubscript{2\text{max}}. Purpose: To examine predicted VO\textsubscript{2\text{max}} from a GPS watch compared to measured VO\textsubscript{2\text{max}}. A secondary purpose was to determine if fitness level affects the ability of the watch to predict VO\textsubscript{2\text{max}}. Methods: Twenty-eight participants, (14 M, 14 F; age 18-55 yr) came to the laboratory. On day one, participants completed a treadmill graded exercise test to determine measured VO\textsubscript{2\text{max}} (MVO\textsubscript{2\text{max}}). Participants completed the test using a self-selected pace while grade increased 2% every two minutes until exhaustion. On day two, participants were fitted with a GPS watch and completed a 15-minute submaximal outdoor run to determine predicted VO\textsubscript{2\text{max}} (PVO\textsubscript{2\text{max}}). PVO\textsubscript{2\text{max}} was based on subject characteristics, distance, pace, time, and heart rate measured at the radial pulse. Participants were then required to record three additional runs of at least 30 minutes on their own time to produce a modified VO\textsubscript{2\text{max}} (ModVO\textsubscript{2\text{max}}). Participants were separated into two groups determined by MVO\textsubscript{2\text{max}} (high = n=17, VO\textsubscript{2\text{max}} > 50 ml/kg/min; low = n=11, VO\textsubscript{2\text{max}} < 50 ml/kg/min). A two-way repeated measures ANOVA was conducted to determine if there was a significant difference among MVO\textsubscript{2\text{max}}, PVO\textsubscript{2\text{max}} and ModVO\textsubscript{2\text{max}}. A one-way repeated measures ANOVA was conducted to determine if a significant difference in recorded VO\textsubscript{2\text{max}} values was observed within groups (P < 0.05). Results: The 28 participants were 22.7 ± 5.7 yr, 169 ± 7 cm tall, and weighed 67 ± 15 kg. Overall, there were significant differences between all VO\textsubscript{2\text{max}} variables (MVO\textsubscript{2\text{max}}: 55 ± 10 ml/kg/min; PVO\textsubscript{2\text{max}}: 52 ± 5 ml/kg/min; and ModVO\textsubscript{2\text{max}}: 51 ± 6 ml/kg/min, P < 0.05 for all). After participants had separated by fitness, a significant difference remained between MVO\textsubscript{2\text{max}} and PVO\textsubscript{2\text{max}} (mean difference = 6.9 ml/kg/min, P < 0.05) and MVO\textsubscript{2\text{max}} and ModVO\textsubscript{2\text{max}} (mean difference = 7.6 ml/kg/min, P < 0.05) in only the high fitness group. No significant difference was observed between any values in the low fitness group (P > 0.05). Conclusion: In healthy adults the GPS watch was unable to accurately predict VO\textsubscript{2\text{max}}. After subjects had been stratified into groups based on measured VO\textsubscript{2\text{max}}, the GPS watch was able to accurately predict VO\textsubscript{2\text{max}} in the low fitness group but was unable to accurately predict VO\textsubscript{2\text{max}} in the high fitness group.

Wearable fitness tracking devices have become common tools for runners of all levels. Using accelerometers, GPS, and heart rate, these devices are able to estimate running variables such as maximum oxygen capacity, step frequency, stride length, and ground contact time which can be used to evaluate technique and performance. Purpose: To assess the ability of a low cost, wear-on-the-waist accelerometer (Actigraph GT1M). Methods: Sixteen participants (n = five females, 27.0 ± 6.0 years old) were given both the commercially-available Movband (mounted on the wrist) and the research-grade Actigraph (mounted on the waist) to wear over the period of one week during free-living activity. Participants were required to simultaneously wear the two monitors for a minimum of five hours per day on five of the seven days. Participants completed daily diaries indicating the time of day in which the two monitors were worn. Physical activity data from each monitor was then divided by the duration of time participants wore the two monitors. Therefore, physical activity data for each monitor was expressed as activity counts/minute worn for each day. Pearson’s correlation analyses were then performed to assess the relationship between counts/minute of the two monitors for each participant individually across all days the two devices were worn for a minimum of five hours. These individual correlation coefficients were then averaged across all participants and presented as a single value. Results: There was a large, positive effect size for the association (r = 0.57) between Movband and Actigraph activity counts/minute during free-living activity. In other words, as physical activity counts/minute increased in the Movband, activity also increased in the Actigraph. Conclusion: The low-cost, commercially-available wearable activity monitor (Movband) appears to provide a valid assessment of physical activity behavior in a free-living setting.
Muscle strains are one of the most common complaints treated by physicians. Standard therapy for acute muscle strains usually involves rest, ice, and nonsteroidal anti-inflammatory medications, but currently there is no clear consensus on how to accelerate recovery. It is now known that mesenchymal stem cells (MSCs) have myogenic potential by contributing to development of new muscle and enhancing satellite cell function. A treatment that shortens recovery time could have a large impact in athletics, but could have a tremendous impact in patients with muscular dysstrophies.

**CONCLUSION:** To determine the effects of MSCs on injured muscle. We hypothesized that MSC delivery at the site of muscle injury will shorten recovery time. METHODS: The tibialis anterior muscles (TAs) of anesthetized Sprague-Dawley rats (n=5) were injured by lengthening contractions. The injured TA was injected with either MSCs (1E5, Lonza Biotechnologies), “sham” treatment (equivalent volume of sterile saline), or received no treatment (N=5 per group). Tissue sections were fixed, stained with hoescht and anti-smooth muscle actin, and imaged using a confocal microscope. RESULTS: All animals sustained almost identical loss of muscle force after injury (60 +/-2%). MSC treatment had a beneficial effect at within 3 days after injury, resulting in a faster and overall greater, recovery of function compared to sham and no treatment groups. The sham injections had no effect compared to no treatment. CONCLUSIONS: We conclude that MSC injection may be a promising treatment option for muscle strain injuries. Our data suggest that MSC injection reduced muscle damage and facilitated muscle regeneration and subsequent functional recovery of the injured muscle.

**Methods:**

- Prior to the intervention, anterior displacement (AD) and inversion-eversion (IE) direction. Ankle joint motion can be restricted by both ligaments and muscles.
- Muscle strain injuries differ among different tissue types.
- To determine the effects of MSCs on injured muscle.
- Methods: The tibialis anterior muscles (TAs) of anesthetized Sprague-Dawley rats (n=5) were injured by lengthening contractions. The injured TA was injected with either MSCs (1E5, Lonza Biotechnologies), “sham” treatment (equivalent volume of sterile saline), or received no treatment (N=5 per group).
- Tissue sections were fixed, stained with hoescht and anti-smooth muscle actin, and imaged using a confocal microscope.

**Results:**

- All animals sustained almost identical loss of muscle force after injury (60 +/-2%).
- MSC treatment had a beneficial effect at within 3 days after injury, resulting in a faster and overall greater, recovery of function compared to sham and no treatment groups.

**Conclusions:**

- We conclude that MSC injection may be a promising treatment option for muscle strain injuries.
- Our data suggest that MSC injection reduced muscle damage and facilitated muscle regeneration and subsequent functional recovery of the injured muscle.

**F-54 Free Communication/Poster - Injury/Injury Prevention/Recovery/Rehabilitation**

**Board #52**

**June 1, 3:30 PM - 5:00 PM**

**Use of Mesenchymal Stem Cells to Treat Muscle Strain Injuries**

Megan Lerner, Shama R. Iyer, Joseph P. Stains, Frank Henn, III, Craig H. Bennett, Richard M. Lovering. University of Maryland School of Medicine, Baltimore, MD. (Sponsor: E.G. McFarland, FACS/M)

(no relevant relationships reported)

The use of heat and ice is commonly used in the clinical setting. Heating before exercise is reported to increase range of motion and tissue pliability while icing after exercise is reported to decrease the inflammatory response and pain. Exercise is reported to increase range of motion and tissue pliability while icing after exercise is reported to decrease muscle hardness recovery shown in this study might be caused by the increased muscle blood flow. The present study suggested that high concentration artificial CO\(_2\) water immersion may contribute to rapid recovery from the high intensity exercise-induced muscle fatigue.

**Methods:**

- Prior to the intervention, anterior displacement (AD) and inversion-eversion (IE) direction. Ankle joint motion can be restricted by both ligaments and muscles.
- Muscle strain injuries differ among different tissue types.
- To determine the effects of MSCs on injured muscle.
- Methods: The tibialis anterior muscles (TAs) of anesthetized Sprague-Dawley rats (n=5) were injured by lengthening contractions. The injured TA was injected with either MSCs (1E5, Lonza Biotechnologies), “sham” treatment (equivalent volume of sterile saline), or received no treatment (N=5 per group).
- Tissue sections were fixed, stained with hoescht and anti-smooth muscle actin, and imaged using a confocal microscope.

**Results:**

- All animals sustained almost identical loss of muscle force after injury (60 +/-2%).
- MSC treatment had a beneficial effect at within 3 days after injury, resulting in a faster and overall greater, recovery of function compared to sham and no treatment groups.

**Conclusions:**

- We conclude that MSC injection may be a promising treatment option for muscle strain injuries.
- Our data suggest that MSC injection reduced muscle damage and facilitated muscle regeneration and subsequent functional recovery of the injured muscle.

**F-54 Free Communication/Poster - Injury/Injury Prevention/Recovery/Rehabilitation**

**Board #54**

**June 1, 3:30 PM - 5:00 PM**

**Artificial CO\(_2\)-water Leg-bath Facilitates Recovery From Muscle Hardness Caused By Resistance Exercise**

Noriyuki Yamamoto\(^1\), Tadashi Wada\(^2\), Funiko Takenoya\(^3\), Masaaki Hashimoto\(^4\), ‘Japanese Red Cross Hokkaido College of Nursing, Kitami, Japan. (Kokushikan Univ., Tokyo, Japan. (Hoshi Univ., Tokyo, Japan. Teikyo Univ. Sci., Tokyo, Japan. (Sponsor: E.G. McFarland, FACS/M)

(no relevant relationships reported)

Facilitation of the blood stream and oxygen consumption of the muscle by a local immersion of the extremities into high concentration carbon dioxide water (CO\(_2\) water, CO\(_2\)≥1000ppm), suggests an improvement of muscle performance and joints flexibility. PURPOSE: In the present study, we investigated whether the immersion of extremities including agonist muscles into artificially made CO\(_2\) water increased recovery of the increased muscle hardness induced by a resistance exercise. METHODS: The healthy male college students (n=11, age; 18-19 yrs, height; 168.6±4.5 cm, weight; 66.2±9.3 kg) participated in this study. The subjects performed 100 times call raise resistance exercise and immersed lower legs into tap-water or artificial CO\(_2\)-water at 35°C for 10 minutes after the exercise. Blood flow in the immersed skin (BF\(_{erm}\)) and electrocardiogram (ECG) were recorded continuously throughout the experiment. Hardness of the gastrocnemius medialis (MG) was evaluated using ultrasound real-time tissue elastography. Visual analog scale test on muscle pain (VAS) and muscle hardness measurements were performed at 3 time points (prior to exercise, immediately after exercise, at 10 min after exercise). The strain ratio (SR) between the MG and a reference material was calculated. RESULTS: BF\(_{erm}\) in the CO\(_2\)-water leg-bath was significantly higher than that in the tap-water leg-bath (CO\(_2\)-water vs. tap-water, 5.1±1.8 vs. 2.1±1.2 ml·min\(^{-1}\)·100g\(^{-1}\), p<0.05). At 10 min after exercise, CO\(_2\)-water treatment compared with the tap-water treatment, SR decreased significantly quicker (1.37±0.28 vs. 0.67±0.08, p<0.05). In addition, VAS at recovery 10 min became smaller in the CO\(_2\)-water than tap-water (18.1±10.2 vs. 33.9±16.2 mm, p<0.05). CONCLUSIONS: We reported previously that the muscle blood flow in the immersed part was larger in CO\(_2\)-water than tap-water of a same temperature. In addition to a local effect of CO\(_2\), suppression of muscular sympathetic activity may also contribute to the increase in local blood flow. Facilitation of muscle hardness recovery shown in this study might be caused by the increased muscle blood flow. The present study suggested that high concentration artificial CO\(_2\)-water immersion may contribute to rapid recovery from the high intensity exercise-induced muscle fatigue.

**Methods:**

- Prior to the intervention, anterior displacement (AD) and inversion-eversion (IE) direction. Ankle joint motion can be restricted by both ligaments and muscles.
- Muscle strain injuries differ among different tissue types.
- To determine the effects of MSCs on injured muscle.
- Methods: The tibialis anterior muscles (TAs) of anesthetized Sprague-Dawley rats (n=5) were injured by lengthening contractions. The injured TA was injected with either MSCs (1E5, Lonza Biotechnologies), “sham” treatment (equivalent volume of sterile saline), or received no treatment (N=5 per group).
- Tissue sections were fixed, stained with hoescht and anti-smooth muscle actin, and imaged using a confocal microscope.

**Results:**

- All animals sustained almost identical loss of muscle force after injury (60 +/-2%).
- MSC treatment had a beneficial effect at within 3 days after injury, resulting in a faster and overall greater, recovery of function compared to sham and no treatment groups.

**Conclusions:**

- We conclude that MSC injection may be a promising treatment option for muscle strain injuries.
- Our data suggest that MSC injection reduced muscle damage and facilitated muscle regeneration and subsequent functional recovery of the injured muscle.
Tseng et al. (2016) reported that changes in MaxECC-induced muscle damage (EIMD) of the pre-conditioning MVC training of the knee extensors (KE) for untrained men was significantly smaller than control group. No studies have recruited untrained participants, and targeted on hamstring muscle strains in which the most frequent sporting injuries to clarify whether non-damaging exercise of MVC can be attenuated muscle damage induced by MaxECC of knee flexors (KF). PURPOSE: This study investigated the neural factors (surface electromyography, EMG) of two maximal isometric contractions (2MVC) at 20° knee flexion on changes in indirect muscle damage markers following 60 MaxECC of KF performed 2 days later. METHODS: Sixteen untrained young males were randomly placed into the control group (CON) that did not perform 2MVC, or the experimental group (2d, n = 8 per group) who performed 2MVC 2 days before MaxECC. Changes in muscle soreness (SOR), non-dominant upper thigh circumference (CIR), resting knee angle (RANG), maximal voluntary isokinetic concentric contraction (MVC–CON), and surface EMG [median frequency (MF), root mean square (RMS)] before, immediately after, and 1-5 days after MaxECC were compared between groups by a mixed-design of two-way ANOVA. RESULTS: 1) Significant (p < .05) changes in some dependent variables after 2MVC compared to baseline for the 2d group. 2) Changes in the muscle damage variables (e.g. MVC–CON: -13.1%; CIR: +1.5 mm) following MaxECC immediately for the 2d group were smaller than CON group (-22.4%; +4.8 mm). 3) Changes in the surface EMG activity following MaxECC for the 2d group showed smaller changes (MF: 60.2 ± 9.1 Hz) than CON group (70 ± 13.2 Hz). CONCLUSION: These results suggest that protective effect conferred by non-damaging exercise of 2MVC against subsequent MaxECC-induced muscle damage is likely to be related to neural adaptations. Therefore, the RBE protocol of this study may provide some useful information for men to minimize muscle damage when they start to participate exercise. It is also required to further understand the underpinning mechanisms of the repeated bout effect in both physiological and pathological contexts.

Traumatic injuries are strong risk factors for future osteoarthritis (OA) of the knee. Maximal-muscle force immediately after the trauma is likely to lead to increased susceptibility. Identification of these pathways could lead to early intervention and potential limitation of damage. One such mechanism may be the release of RNA molecules by the affected tissues. PURPOSE: This study set out to characterize systemic extracellular RNA (exRNA) by characterizing RNA from plasma following traumatic injury. METHODS: Our cohort consisted of 14 subjects (ages 19 to 47) undergoing ACL and/or meniscal repair surgery (0.5 to 180 months post injury). Radiograph analysis found duration. There was noted expression of inflammatory genes (CXCL5, CCL5, and IL16), catabolic genes (MMP-21, -17, and -13, and ADAMTS8), and previously reported miRNA biomarkers (miR16, miR29, and miR146a). CONCLUSIONS: There is an unmet need for determining the etiology and potential novel approaches in patients with knee trauma to mitigate future progression of OA. This study demonstrates that exRNA can be isolated and characterized from plasma in a high throughput manner. Our results indicate that plasma from subjects with injured knees contains inflammatory, catabolic, and potential arthritic biomarkers. Future studies are required to more fully characterize the biological roles of these exRNA and the timing and cadence of their respective release that may lead to translational treatment options for patients with post-traumatic OA.

The previous studies proposed that two maximal voluntary isometric contractions (2MVCs) at 20° elbow flexion did not change any variables for exercise-induced muscle damage (EIMD) and delayed onset muscle soreness (DOMS) (Chen et al., 2012, 2013). These results may not apply for real outcomes resulting from the lower limb [ex: knee extensors (KE)]. PURPOSE: To investigate the protective effect conferred by MVCs of the KE on changes in muscle damage markers and pulse wave velocity (PWV) by maximal eccentric contractions of the same muscle performed 1 day later. METHODS: Twenty untrained male students were randomly assigned to a control group that did not perform 2MVCs or 1d group who performed 2 MVCs at 120° knee flexion 1 day before maximum isokinetic (30/’s) eccentric exercise (MaxEC). Changes in maximal isokinetic contraction torque (MVC–CON), range of motion (ROM), DOMS, PWV and blood creatine kinase (CK) activity were compared between the groups by two-way repeated measures ANOVA. RESULTS: No significant changes in any variables were evident after 2MVCs (p < .05). The changes in all variables after MaxEC smaller showed -43.2% for the 1d group compared with control group. CONCLUSION: The results of this study show that isometric contraction of KE at a longer muscle length did not induce muscle damage and produced a protective effect.

Trauma to skeletal muscle results in tissue and membrane damage and an inflammatory response. Current treatments are merely management strategies. Nitric oxide (NO)-donation has shown therapeutic promise in mouse models of muscular dystrophy, and therefore, may be beneficial for the treatment of acute muscle injuries. PURPOSE: To clarify the role of treatment-derived NO on muscle tissue response to trauma. METHODS: Using a contusion injury model (n=10 uninjured controls and n=58 injured), rats were treated with either placebo (Plac) or NO-donor administered with gelatine blocks immediately and one day after the injury. Time points for sample collection were 1, 3, 5 and 21 days post-intervention. Content of two selected proteins in the injured tissue homogenates were assessed with Western blots and band density analysis. In addition, the expression of two selected genes was assessed by qRT-PCR. RESULTS: In the placebo group, we observed maximal injury on day 3. NO-donor treatment reduced injury as early as day 3, as indicated by reduced cell death, preserved muscle architecture, and improved tissue integrity. In the NO-donor group, we observed a decrease in pro-inflammatory cytokines and a decrease in myostatin expression. These results suggest that NO-donor treatment can mitigate muscle damage and improve tissue repair.

Traumatic injuries are strong risk factors for future osteoarthritis (OA) of the knee. Maximal-muscle force immediately after the trauma is likely to lead to increased susceptibility. Identification of these pathways could lead to early intervention and potential limitation of damage. One such mechanism may be the release of RNA molecules by the affected tissues. PURPOSE: This study set out to characterize systemic extracellular RNA (exRNA) by characterizing RNA from plasma following traumatic injury. METHODS: Our cohort consisted of 14 subjects (ages 19 to 47) undergoing ACL and/or meniscal repair surgery (0.5 to 180 months post injury). Radiograph analysis found duration. There was noted expression of inflammatory genes (CXCL5, CCL5, and IL16), catabolic genes (MMP-21, -17, and -13, and ADAMTS8), and previously reported miRNA biomarkers (miR16, miR29, and miR146a). CONCLUSIONS: There is an unmet need for determining the etiology and potential novel approaches in patients with knee trauma to mitigate future progression of OA. This study demonstrates that exRNA can be isolated and characterized from plasma in a high throughput manner. Our results indicate that plasma from subjects with injured knees contains inflammatory, catabolic, and potential arthritic biomarkers. Future studies are required to more fully characterize the biological roles of these exRNA and the timing and cadence of their respective release that may lead to translational treatment options for patients with post-traumatic OA.

The previous studies proposed that two maximal voluntary isometric contractions (2MVCs) at 20° elbow flexion did not change any variables for exercise-induced muscle damage (EIMD) and delayed onset muscle soreness (DOMS) (Chen et al., 2012, 2013). These results may not apply for real outcomes resulting from the lower limb [ex: knee extensors (KE)]. PURPOSE: To investigate the protective effect conferred by MVCs of the KE on changes in muscle damage markers and pulse wave velocity (PWV) by maximal eccentric contractions of the same muscle performed 1 day later. METHODS: Twenty untrained male students were randomly assigned to a control group that did not perform 2MVCs or 1d group who performed 2 MVCs at 120° knee flexion 1 day before maximum isokinetic (30/’s) eccentric exercise (MaxEC). Changes in maximal isokinetic contraction torque (MVC–CON), range of motion (ROM), DOMS, PWV and blood creatine kinase (CK) activity were compared between the groups by two-way repeated measures ANOVA. RESULTS: No significant changes in any variables were evident after 2MVCs (p < .05). The changes in all variables after MaxEC smaller showed -43.2% for the 1d group compared with control group. CONCLUSION: The results of this study show that isometric contraction of KE at a longer muscle length did not induce muscle damage and produced a protective effect.

Trauma to skeletal muscle results in tissue and membrane damage and an inflammatory response. Current treatments are merely management strategies. Nitric oxide (NO)-donation has shown therapeutic promise in mouse models of muscular dystrophy, and therefore, may be beneficial for the treatment of acute muscle injuries. PURPOSE: To clarify the role of treatment-derived NO on muscle tissue response to trauma. METHODS: Using a contusion injury model (n=10 uninjured controls and n=58 injured), rats were treated with either placebo (Plac) or NO-donor administered with gelatine blocks immediately and one day after the injury. Time points for sample collection were 1, 3, 5 and 21 days post-intervention. Content of two selected proteins in the injured tissue homogenates were assessed with Western blots and band density analysis. In addition, the expression of two selected genes was assessed by qRT-PCR. RESULTS: In the placebo group, we observed maximal injury on day 3. NO-donor treatment reduced injury as early as day 3, as indicated by reduced cell death, preserved muscle architecture, and improved tissue integrity. In the NO-donor group, we observed a decrease in pro-inflammatory cytokines and a decrease in myostatin expression. These results suggest that NO-donor treatment can mitigate muscle damage and improve tissue repair.
Muscle injuries often lead to structural and functional deficits and recurrent injuries. Nitric oxide (NO) is an endogenous bioactive molecule with multiple physiological roles. Pharmacological NO inhibition negatively affects regeneration, with excessive fibrosis, suggesting that treatment with NO may prove to be beneficial. **Purpose:** To assess a) anti-fibrotic and pro-regenerative roles of NO following muscle trauma and b) muscle function recovery following injury by treating with either NO donor or inhibitor. **Methods:** The gastrocnemius of adult male rats were contusion injured (250g drop-mass) followed by one of four treatments (placebo, NO-donor, NO-inhibitor or combination) administered immediately and one day post-injury and in un-injured controls. Rats were sacrificed at 5 (D5) and 21 (D21) days after intervention (n=8/group; total n=72). In situ mechanics testing was done pre-injury and before sacrifice to determine plantar flexor contractility. Fibrosis staining was done using Masson’s trichrome and Sirius red. Embryonic MHC (eMHC) was used to identify new and regenerating muscle fibers, including cross-sectional area (CSA).

**Results:** Maximal isometric force was significantly reduced D5 post-injury (19.5 ±3.1 N/kg; p=0.0001) compared to pre-injury (26.0 ±2.5 N/kg; p>0.0001). D21 maximal force was significantly higher in the NO-donor group (27.2 ±3.3 N/kg) versus L-NAMe (21.7 ±3.7 N/kg; p<0.05) and combination (21.6 ±3.8 N/kg; p<0.05). NO-donor significantly increased eMHC expression (5.29 ±2.64 AU versus Plac: 0.65 ±0.64; L-NAMe: 0.58 ±0.51; Comb: 0.45 ±0.9 AU; p<0.001) and new fiber CSA (501 ±34 um²) versus other treatments (Plac: 421 ±27 p<0.01; L-NAMe: 240 ±38 p<0.001; Comb: 313 ±66 um²; p<0.001). Picoriruos red staining indicated that NO-donor treatment reduced fibrosis (7.33 ±1.87 %; Plac: 18.28 ±3.94; P<0.0001). Masson’s trichrome staining indicated a significant increase in fibrosis following NO inhibition (22.88 ±1.57 %; p<0.01). **Conclusion:** Maximal force production recovered fully 21 days after injury in placebo-treated rats. NO influenced recovery of physiological function and NO-inhibiting in further increased maximal force production at D21, compared to a reduction following L-NAMe treatment. This may be due to improvement in regenerative myogenesis and reduction in fibrosis.

**References**

Foam Rolling (FR) is widely used as an intervention therapy device to alleviate, treat, and possibly prevent myofascial condition in exercise and in high performance sports. Its use may be beneficial on the sensitive pressure muscle tissue via reperfusion therapy; however, these effects have been insufficiently investigated. **Purpose:** The aim of this investigation was to assess whether the use of FR may benefit muscle tissue compliance via myotonometric intervention training (MINT) and subsequent muscle regeneration after exhausting high intensity strength training experiment (EXP). **Methods:** Twenty sport students (7 male and 15 female; age 24.7±2.9 yrs, BMI 22.2±2.4 kg/m²) performed a single exhausting strength training session (leg extension with both legs) followed by FR session (using right leg only). The FR session (2x45s) was conducted again after 24, 48 and 72 hours. The left leg served as a control (CON). Prior to exhaustion and after every FR session, we determined muscle tissue compliance of rectus femoris muscle (MTR). We utilized the frequency analysis to assess tissue compliance. **Results:** The time effect was as follows: (pre: EXP 14.53±1.12, CON 14.37±0.99; post: 0 EXP 14.60±1.28, CON 14.63±1.01; post-24 EXP 14.56±1.31, CON 14.25±1.11; post-48: EXP 14.36±1.22, CON 14.33±1.16; post-72: EXP 14.33±1.31, CON 14.25±1.15 Hz). The investigation revealed significant increase in Hz frequency (greater compliance) immediately post exhausting strength training session but returned to base values day after (P=0.006).

There was no significant main effect between EXP and CON (P=0.08). There was also no interaction effect for FR (P=0.399). **Discussion:** Although scientific literature report fatigue and recovery effects; however, we did not find regenerative effects of FR when using MMT. From practical point of view, we were able to document at least partially the regenerative use of MMT immediately after the EXP but we were not able to ascertain that even treated FR session daily will beneficially effect muscle compliance and the desired outcome. Future studies utilizing different dose, duration, and repetitions may yield results that are more promising.

The remarkable capacity of skeletal muscle to adapt and repair following injury is attenuated with age. Studies in young organisms suggest that acute changes in both extrinsic and intrinsic factors in the muscle environment are critical in regulating reparative potential. **Purpose:** To uncover potential factors involved in the impaired regenerative response of aged human skeletal muscle, we comprehensively assessed the molecular stress response following muscle damage in young and old individuals. **Methods:** 11 young (22.7 ± 2.25 yrs) and 8 physically active old (70.9 ± 7.5 yrs) subjects completed a bout of 300 lengthening contractions (LC) on a Biodex dynamometer. Functional tests were performed as an indirect assessment of muscle damage and muscle biopsies were taken pre-exercise and at 3, 24, and 72 hours post-exercise. High throughput multiplexing bead assays were used to analyze biopsy samples for content of inflammatory cytokines and protein concentrations of the mitogen activated protein kinase (MAPK) signaling pathway. **Results:** After the bout of LC’s, muscle damage was evident by the loss of isometric force production in both groups (Young: 54.1 ± 22 and Old: 33.86 ± 17 %). Old muscle displayed higher expression of iNOS (501 ±34 um²) that appeared at the later 24 and 72 hour time points. There was also a rapid increase in NF-κB activity in the old following the bout of lengthening contractions (group x time, p=0.05). In the old, p38 protein content increased significantly at the 3 hour time point (Young: 0.8 ± 0.09 vs Old: 1.70 ± 0.47 fold) before returning to pre-exercise levels (group x time, p=0.0043). Additionally, by 3 hours post-exercise, INK protein levels increased only in the old (Young: 1.6 ± 0.26 vs Old: 5.1 ± 0.77 fold) and remained significantly elevated (Young: 0.76 ± 0.20 vs Old: 4.5 ± 0.46 fold) 24 hours post-exercise (group x time, p=0.038) before returning to pre-exercise levels. **Conclusion:** Skeletal muscle of physically active older individuals is characterized by a dysregulated and asynchronous inflammatory and MAPK response, each of which may individually or collectively contribute to the deterioration of muscle repair mechanisms that accompanies aging. **References**
2781: Efficient Concentration of Plasma and Platelet-WBC-Rich Plasma Proteins Using a Polycrylamide Device

Sean M. Muir, Michael Baria, Natalie Reisbig, Christopher C. Kaeding, FACS, Alicta L. Bertone. The Ohio State University, COLUMBUS, OH. (Sponsor: James Borchers, FACSAM)

Concentration of functional proteins has used methods such as dialysis, precipitation, and freeze-drying, which are poorly scalable, not compatible with cell viability, and often damages proteins. Currently, platelet-poor plasma (PPP) is a discarded waste product of platelet-rich plasma (PRP) and may contain valuable chondrogenic proteins. PURPOSE: to determine the efficiency of a novel patient-side method of concentrating plasma and platelet- and white blood cell (WBC)-rich plasma as a potential adjunctive therapy for OA. METHODS: A laboratory study was conducted, with IRB and IACUC approval, using residual human clinical plasma (PPP) and equine blood samples. Samples and products were characterized for platelet, WBC, and total protein content then quantified by enzyme-linked immunosorbent assays specific to IGF-1, TGF-β, IL-1α, and IL-1β as an anabolic and inflammatory mediators to cartilage. RESULTS: Plasma total and IGF-1 protein were concentrated by the device in both human (P < 0.001) and equine (P < 0.0001) plasma. TGF-β, IL-1α, and IL-1β were very low in plasma. The polycrylamide concentrator device highly concentrated platelets, WBCs, and plasma proteins over PRP and whole blood, most dramatically TGF-β (P < 0.001). 29-fold over blood and 10 IL-1α (P < 0.01) fold over plasma results in a > 2000-fold increase in IL-1/IL-1α ratio over plasma (P < 0.001) and 1668-fold increase over PRP (P < 0.001). Interestingly, patients with OA had a lower anabolic protein profile (IGF-1 and TGF-β) and a higher inflammatory-related protein profile (IL-1β and IL-1α) compared to healthy equine athletes without OA. This work identified concentration of plasma System (Polycrylamide Systems Top) to test the hypothesis that concentrating plasma not found in PRP and that further protein concentration of PRP can produce greater platelet proteins such as TGF-β and greater anti-inflammatory proteins such as IL-1α. CONCLUSION: the polycrylamide device efficiently concentrated plasma and PRP proteins and is commercially available as an injectable therapy.

2782: Hip Muscle Strength Analysis of Individuals with Chronic Low Back Pain

Minjia wang, Yushu Hu, Yuanpeng Liao, Kaiwen Li, Siqi Song, Xiaofan Pang. Chengdu Sport Institute, Chengdu, China.

(No relevant relationships reported)

Chronic Low back pain (CLBP) is a common clinical disease, and most individuals require long-term treatment. PURPOSE: Analysis the hip joint muscle characteristics of individuals with CLBP, in order to provide reference for rehabilitation and prevention of chronic low back pain. METHODS: 64 subjects with CLBP (age: 35.2±1.5 years, 34 males and 30 females, weight: 66.5±3.7kg) were recruited as C group (experimental group), while 29 healthy subjects (age: 39±2.18 years, 16 males and 13 females, body weight: 64.8±3.2kg) were recruited as Y group (control group). Recorded the degree of pain (VAS, Visual Analogue Scale/Score) questionnaire, and used the isokinetic muscle testing System (Con-Trex System Top) to test the hip isokinetic muscle strength. RESULTS: 1) There were no differences of hip flexor, extensor or adductor between C group and Y group (P> 0.05); 2) Hip flexors’ extensor ratio (isokinetic strength of C group were significant higher than Y group bilaterally, about 2.2 times higher (p< 0.01). This interesting result indicated that although the flexor or extensor as an independent index shows no difference between CLBP individuals and healthy individuals, but when it comes to consider the flexor and extensor as a functional group of body posture and movement, the CLBP individuals show a decrease of extensor compared with flexor, and this also indicate the coordination of these two muscle groups may decrease in the CLBP ones; 3) Hip abductor isokinetic muscle strength of Y group was significantly higher than C group, about 26% higher (p< 0.05), which means muscle strength of hip abductor of the CLBP individuals decreased; 4) In C group, according VAS score, the strength of flexor, extensor and abductor of mild one(VAS 0-3) were significantly higher than moderate ones(VAS 4-7) (P< 0.05), the differences were 37%, 38% and 31% respectively. CONCLUSIONS: The significant reduce of muscle strength of hip abductor is related to CLBP; CLBP individuals show a decrease of extensor compares with the flexor, and this indicate the coordination of these two muscle groups may decrease in the CLBP ones. And the more pain of CLBP, these muscle strength decrease more.

2783: High Incidence Of Lumbar Intervertebral Disk And A Possible Risk Factor For Collegiate Weightlifters

Kenshiro Ohyi1, Koichi Nakazato2, Koji koyama2, Kazuo Funato1, Naoyuki Kobatake1, Toshiya Kita1, Seiji Kubo1, Fukuju Goto1, Kenji Hirumata2. 1Nippon sport science university, tokyo, Japan. 2Tokyo Arika University of Medical and Health Science, tokyo, Japan.

(No relevant relationships reported)

Weightlifters experiences high mechanical stresses in their lumbar region. The intervertebral disks act as shock absorbers between each of the vertebrae in the spinal column. The disks of weightlifters may be injured by repetitive overload during weightlifting maneuvers. Previous studies have shown that excessive trunk rotation is a major risk factor for lumbar intervertebral disk degeneration (LIDD) in athletes. Although trunk rotation is not included in most weightlifting maneuvers, we hypothesized that there would be a high incidence of LIDD in collegiate weightlifters. PURPOSE: the purpose of this study was to examine the prevalence of LIDD in collegiate weightlifters. We also investigated possible risk factors for LIDD, except for excessive trunk rotation. METHODS: Forty Japanese collegiate weightlifters (25 men and 15 women; age, 19.6±1.1years; starting age, 15 ±1.09years; height, 164.7±8.0cm; weight, 71.9±14.4kg). LIDD were evaluated using T2-weighted magnetic resonance images. Pfirrmann’s classification was used to define LIDD and classify the subjects into either the LIDD group or the non-LIDD group. We also investigated physical characteristics such as body composition (height, weight, muscle mass, fat mass), joint range of motion (thoracic, lumbar, and hip), and lumbosacral alignment (lumbar angle, sacral angle, and lumbosacral angle). Student’s t-test and logistic regression were used for statistical analyses. RESULTS: The prevalence of LIDD among weightlifters was 55.0% (22/40). Weight(77.3±16.0 vs. 65.7±10.2, p<0.02), fat mass (38.5±8.0 vs. 29.5±7.4, p=0.02) and body mass index(27.5±4.78 vs. 24.71±2.10, p<0.02) were significantly higher than those in the non-LIDD group. Hip flexion angle (left: 121.5±10.10 vs. 126.9±6.15, p=0.05; right: 121.9±8.00 vs.127.9±7.06, p=0.04) and lumbar angle(18.3±6.04 vs. 24.2±6.45, p<0.01) were lower in the LIDD group compared to the non-LIDD group. By using logistic regression analysis including sex was differences, lumbar angle was significant independent variable for LIDD (odds ratio, 1.34; 95%confidence interval 1.08-1.67, p<0.01). CONCLUSION: A high incidence of LIDD was observed in Japanese collegiate weightlifters. Lumbar angle is a possible risk factor.
Kinesio Tape (KT) is a popular therapeutic intervention in sports, aimed at optimizing athletic performance and preventing musculoskeletal injury. The manufacturers of KT claim it can alter characteristics of skeletal muscle recruitment, facilitating or inhibiting contraction depending on the nature of its application. Evidence of this claim is conflicted. PURPOSE: To assess the effectiveness of KT in changing recruitment properties of the rectus femoris. METHODS: Twenty college-aged, recreationally-active men and women with no history of injury were enrolled (11 men, 9 women). A Cybex Humac Norm dynamometer measured force output in the dominant leg in 3 taping conditions: 1) No tape applied (control), 2) KT applied to enhance muscle recruitment (facilitation), and 3) KT applied to impair muscle recruitment (inhibition). Subjects were tested on 3 separate days with 48 hours of rest between each; they performed no other exercise prior to and throughout the testing protocol. Subjects performed all 3 trials (control, facilitation, and inhibition) during each testing session, with randomization of the testing order. A certified KT practitioner applied the tape to each subject; subjects were blinded to the orientation of the tape (facilitation vs. inhibition). Mixed-design ANOVA tested differences in taping conditions (and taping conditions by gender) on force output. The between-subjects factor was gender; the within-subjects factor was taping condition. Differneces in the within-subjects factor were tested with the Bonferroni post hoc correction. RESULTS: There were no differences between taping conditions (F(2,190) = 0.829) nor effects of treatment group by gender (F(1,634) = 0.226). Post hoc tests using the Bonferroni correction revealed no differences between any two treatment groups (p<.001 for each comparison). CONCLUSIONS: The application of KT did not elicit changes in muscle recruitment patterns. KT neither facilitates skeletal muscle contraction nor inhibits it based on its application.

INTRODUCTION: Ankle bracing is used ubiquitously as an injury prophylactic in both healthy and chronic ankle instability (CAI) populations. However, research shows that during walking ankle bracing diminishes coordination variability in the lower extremity in individuals with and without CAI, potentially limiting the adaptability of the motor system. An understanding of the systemic kinetic adaptations that drive coordination patterns is necessary to bolster aforementioned findings. Analysis of support moment (MS) variability during walking can provide information of systemic kinetic adaptations that occur in response to constraints acting on the system. PURPOSE: Examine bracing effects on MS variability during walking in healthy (H), ankle sprain “cooper” (LAS), and CAI groups. METHODS: 48 individuals (16 per group) participated in the study. Participants performed 15 trials of walking during NB and B conditions. Position data were collected using a motion capture system, and reaction forces were obtained from force platforms. Joint kinetics were calculated using inverse dynamics, and the MS was calculated as the sum of ankle, knee, and hip moments in the sagittal plane. Variability of the MS was expressed as the percent coefficient of variation (%CV) across stance phase. A mixed ANOVA was conducted to compare the effects of condition across groups. RESULTS: A significant condition by group interaction was observed (F(2, 45) = 7.51, p < .002, partial η2 = .25). Paired samples t-tests revealed that for H, %CV was significantly lower during
B (11.85±3.06%) compared to NB (16.17±8.61%) (p < .02). For LAS, %CV was significantly greater during B (23.66±9.84%) compared to NB (20.06±6.48%) (p < .05).

CONCLUSION: Based on diminished %CV in the H group suggesting a limited capacity to adapt to task and environmental perturbation. Bracing had the opposite effect in the LAS group, suggesting that the motor system of “copers” may be more attuned to adaptation in response to neuromusculoskeletal constraints. More research is needed to explore how individual joint kinetic adaptations contribute to the %CV measure across groups and in response to bracing.

2789 Board #72
June 1 3:30 PM - 5:00 PM

History of Ankle Sprains Related to Hindered Proprioception in College-Age Male Soccer Players
Paul N. Whitehead1, Kim Beals2, Mitra Lovalekar2, Kentaro Onishi1, Takashi Nagai1, Chris Connaboy1.1 The University of Alabama in Huntsville, Huntsville, AL. 2University of Pittsburgh, Pittsburgh, PA. 3Mayo Clinic, Rochester, MN. (No relevant relationships reported)

A deficit in proprioception following lateral ankle sprains (LAS) has been observed using various methods. The majority of studies on ankle proprioception focus on joint position sense, which measures the accuracy of position replication. However, threshold to detect passive motion (TDPDM) assesses one’s ability to detect a change in positional homeostasis and tests the sensitivity of the slow-adapting mechanoreceptors required to adequately signal musculature to contract correctly during perturbation.

PURPOSE: To examine the role of ankle injury history on TDPDM following ankle injuries.

METHODS: Fifty-eight male, club-level soccer players were divided into two equal groups: those with chronic ankle instability as a result of LAS (CAI-LAS; n=29, 22.8±4.5 yr, 78.1±11.1 kg, 180.0±6.7 cm) and those with no history of ankle injuries (CON; n=29, 21.5±3.1 yr, 78.2±11.6 kg, 180.0±6.6 cm). Subjects were positioned in an isokinetic dynamometer testing chair to align the heel with the axis of rotation. Visual and auditory cues were masked during testing. Trials were initiated at ~7 degrees of inversion, with the dynamometer moving at 0.25/sec. When movement could be detected, subjects pressed a button to stop the dynamometer. Six successful trials were randomly collected and averaged for inversion and eversion. The primary outcome variable was angle error, measured as the number of degrees toward inversion or toward eversion from the initial position. Higher TDPDM values indicate worse proprioception. Following tests for normality of data distribution, Mann-Whitney U tests were used to compare group differences. Alpha level of 0.05, 2-sided was set as a priori as a significance level. RESULTS: There was a significant difference between groups for inversion (p=0.016), with a 56.5% greater median angle error in CAI-LAS. Although there was not a statistically significant difference for inversion (p=0.181), CAI-LAS had 24.1% greater median angle error compared to CON. CONCLUSION: If TDPDM is used as a screening tool, it may highlight individuals at an increased risk of injury, signifying the requirement for corrective balance and/or strength training to be implemented as a means of preventing injury occurrence.

Supported by the Freddie H. Fu, MD Dissertation Research Award; the SHRS Research Development Grant at the University of Pittsburgh.

2790 Board #73
June 1 3:30 PM - 5:00 PM

Effects of Three Prophylactic Tape Techniques on Kinematics and Muscle Pre-activation in Chronic Ankle Instability
Adrian Pettaway1, Youngmin Chun1, Emi Takahashi1, Songah Chae1, Russell Baker2, Sae Yong Lee1, Hyung-pil Jun1, 1University of Idaho, Moscow, ID. 2Yonsei University, Seoul, Korea, Republic of. (Sponsor: Lee Brown, FACSM) (No relevant relationships reported)

Prophylactic taping of the ankle is commonly used to prevent ankle sprains. Data supports the use of ankle taping strategies for limiting excessive range of motion often associated with ankle injuries. However, there is a paucity of evidence regarding the effects of ankle taping techniques on kinematics and muscle pre-activation in patients with chronic ankle instability (CAI). PURPOSE: To observe the effects of traditional tape (TT), fibular positioning tape (FRT), and kinesio tape (KT) on kinematics and muscle pre-activation during a stop-jump task in individuals with and without CAI.

METHODS: A total of 28 subjects (14 healthy: age = 27.57 ± 3.23 years, height = 169.61 ± 8.33 cm, weight = 76.98 ± 17.95 kg; 14 CAI: age = 24.07 ± 4.46 years, height = 175.06 ± 5.09 cm, weight = 82.24 ± 10.38 kg) participated in the study. After collecting EMG data of reference voluntary contraction (RVC) by maximal vertical jump, all 6 EMG signals (tibialis anterior [TA], soleus [SOL], rectus femoris [RF], peroneus longus [PL], biceps femoris [BF], gluteus medius [GM]) were normalized by RVC, % RVC and lower extremity kinematics in the frontal and sagittal planes were collected at 100 ms prior to initial contact. All participants were assigned to three different tape applications applied in a randomized order. Participants executed the stop-jump task baseline assessment without tape and then with TT, FRT, and KT respectively. To examine differences in muscle pre-activation and kinematics, a 2-way mixed ANOVA (2 groups * 4 condition) was performed. RESULTS: A significant interaction was observed in soleus pre-activation (F1,16.79 = 5.913; p < .05; ηp² = 0.185). The CAI group demonstrated significantly decreased SOL pre-activation after applying FRT and KT compared to ST (baseline = 1.40 ± 0.62 %; FRT = 1.20 ± 0.55 %, KT = 1.54 ± 0.50 %, P < .05). No significant differences in joint angles were found between condition or group.

CONCLUSION: In contrast to previous findings, KT application reduced SOL pre-activation. Further research is needed to examine if reduced SOL pre-activation after KT and FRT influences joint mechanics, which may affect the efficacy of the taping techniques.

Individuals with chronic ankle instability (CAI) often have balance and performance impairments. The use of Kinesio Tape (KT) to address these impairments has mixed findings with little evidence beyond immediate effects.

PURPOSE: To assess the prolonged use of KT versus a sham tape on static balance and functional performance in individuals with CAI.

METHODS: Twenty people with CAI (Age: 23.4±3.1 years; height: 169.3±8.3 cm; mass: 71.7±12 kg; Cumberland Ankle Instability Tool: 19.3±3.5) were randomly assigned to the KT (n= 10) or sham (a non-elastic) tape (ST) (n=10) group. Both groups had tape applied in consistent manner on the tibialis anterior, fibularis longus, and from the medial malleolus, across the plantar surface of the foot, to the lateral malleolus. The tape was worn for 3 days. Participants performed a single limb standing balance test (SLSB) on a force plate for 20s with eyes closed and a side hop test (SHT) 10 times laterally and medially. They were tested before (T1), immediately after (T2), and 3 days after tapping (T3). Primary outcome measures included the velocity (m/s) of the center of pressure in the mediolateral direction (VCOP,), anteroposterior direction (VCOP,∞) and total excursion (VCOP,) during SLSB and total time (t) to perform SHT. A two-way repeated measure multi-analyses of variance was used for data analysis.

RESULTS: There was no significant interaction effect between time point in the KT compared to ST groups on SLSB and SHT (p >.05). While VCOP, (T1: 5.02±1.46, T2: 4.53±1.71, T3: 4.13±1.91), VCOP,∞ (T1: 6.19±2.6, T2: 5.33±2.54, T3: 4.79±2.66), VCOP, (T1: 8.83±3.08, T2: 7.7±3.25, T3: 7.02±3.57), and the total time (T1: 11.47±4.21, T2: 10.12±3.36, T3: 9.48±2.95) decreased steadily over time in KT group, this was not a significant decrease compared to ST group VCOP, (T1: 5.08±1.69, T2: 4.83±1.93, T3: 5.32±2.43), VCOP,∞ (T1: 6.62±3.36, T2: 6.36±3.41, T3: 5.99±2.7), VCOP, (T1: 9.32±3.92, T2: 8.87±4.13, T3: 8.93±3.89), and total time (T1: 8.9±1.49, T2: 8.11±1.34, T3: 7.67±1.19) with p-values of .48, .58, .43, and .09 for each variable.

CONCLUSION: The prolonged use of KT on the ankle joint is not helpful to improve static balance and functional performance in people with CAI.

This study was supported by the University of Nebraska at Omaha University Committee on Research and Creative Activity.

2792 Board #75
June 1 3:30 PM - 5:00 PM

Altered Movement Dynamics Between Individuals With and Without Chronic Ankle Instability Before and After Bracing
Rebecca S. Angles1, Adam E. Jagodinsky1, Christopher Wilburn2, Wendi H. Weimar2. 1Illinois State University, Normal, IL. 2Yonsei University, Seoul, Korea. (Sponsor: Dave Thomas, FACSM) (No relevant relationships reported)

INTRODUCTION: Sports medicine paradigms stress the importance of introducing variability into interventions aimed at improving function in individuals with chronic ankle instability (CAI). However, questions remain surrounding systemic variability patterns exhibited by CAI groups, particularly when additional constraints (i.e. brace) are imposed on the system. Analysis of support moment (MS) variability during walking can provide information of systemic kinetic adaptations that occur in response to neuromusculoskeletal constraints acting on the system. PURPOSE: Examine MS variability characteristics during walking in healthy (H), ankle sprain “copers” (LAS), and CAI groups during brace (B) and no brace (NB) conditions. METHODS: 48 individuals (16 per group) participated in the study. Participants performed 15 trials of walking during NB and B conditions. Position data were collected using a motion capture system, and reaction forces were obtained from force platforms. Joint kinetics were calculated using inverse dynamics, and the MS was calculated as the sum of ankle, knee, and hip moments in the sagittal plane. Variability of the MS was expressed as a percentage of total walking during NB and B conditions. Position data were collected using a motion capture system, and reaction forces were obtained from force platforms. Joint kinetics were calculated using inverse dynamics, and the MS was calculated as the sum of ankle, knee, and hip moments in the sagittal plane. Variability of the MS was expressed as a percentage of total walking during NB and B conditions.
Individuals with chronic ankle instability (CAI) display poor static postural control due to impaired proprioception. While previous researchers have reported specific ankle tape applications enhance neuromuscular control, many clinically used applications have not been evaluated in patients with CAI. PURPOSE: To examine the effects of traditional tape (TT), fibular repositioning tape (FRT), and kinesiology tape (KT) on static balance control in individuals with CAI. METHODS: A total of 14 subjects, with CAI (age = 24.07 ± 4.46 yr; height = 175.16 ± 10.50 cm; weight = 72.43 ± 10.38 kg; CAIT = 17.64 ± 4.14; FAAM-ADL = 86.69 ± 6.71; FAAM-SS = 75.45 ± 6.70) participated in the study. Participants performed three trials of a single-leg balance task on a force plate with a 10 second eyes-open (EO) and 10 second eyes-closed (EC) condition. The task was performed before and after applying TT, FRT, and KT. Dependent variables were standard deviation of the mean center of pressure (COP) displacement (SD_cop, SD_s), COP excursion (Range_cop, Range_s), the velocity of COP (Vel_cop, Vel_s) in mediolateral (ML), anteroposterior (AP) directions and area of COP excursion (COP area). A repeated measure ANOVA was performed to examine differences across the conditions (baseline [BL], TT, FRT, KT). RESULTS: A significantly reduced Vel_cop was observed after applying FRT (BL = 2.67 ± 0.29cm/s; FRT = 2.34 ± 0.36cm/s; p<0.05) with EC. With KT, a significant decrease in Vel_cop (BL = 5.21 ± 0.83 cm/s; FRT = 4.43 ± 0.68 cm/s; p<0.05) and Vel_s (BL = 4.47 ± 0.70 cm/s; FRT = 3.85 ± 1.01 cm/s; p<0.05) was also found. The application of KT significantly reduced Vel_cop (BL = 5.21 ± 0.83 cm/s; KT = 4.60 ± 0.99 cm/s; p<0.05). Significant differences between BL and tape interventions were not found for SD_cop, Range_cop, and COP area. The application of TT produced increased SD_cop (TT = 1.33 ± 0.20 cm; FRT = 1.20 ± 0.16 cm; p<0.05; Range_cop (TT = 5.98 ± 0.98 cm; FRT = 5.67 ± 0.68 cm; p<0.05), and COP area (TT = 26.52 ± 6.33 cm²; p<0.05; FRT = 22.83 ± 4.86 cm²; p<0.05) compared to FRT application. Based on our findings, FRT is a more effective technique to enhance static postural control than TT, or no tape. Further study is needed to investigate the effect of FRT on dynamic postural control, as well as kinematics during specific movements, to guide FRT application in clinical practice.

Altered Movement Neuromechanics during Jump Landing and Cutting in Patients with Chronic Ankle Instability

Hyunsoo Kim1, S. Jun Son2, Matthew K. Seelye3, J. Ty Hopkins, FACSM1, West Chester University, West Chester, PA; Brigham Young University, Provo, UT. (Sponsor: J. Ty Hopkins, FACSM) (No relevant relationships reported)

Lateral ankle sprains are common lower extremity injury during sport activities, which often lead to chronic ankle instability (CAI). However, no one has comprehensively examined the effects of CAI on lower extremity movement neuromechanics during jump loading and cutting tasks. PURPOSE: To investigate the effect of CAI on landing and cutting lower-extremity kinematic, electromyography (EMG), and ground reaction force (GRF). METHODS: 100 CAI patients (22(2) yrs, 174±10 cm, 71±14 kg, 82±9% FAAM ADL, 62±13% FAAM Sports, 4.5±2.6 ankle sprains) and 100 controls (22(3) yrs, 172±13 cm, 72±18 kg, 100% FAAM ADL & Sports) participated. Participants performed five successful trials of a jump landing and cutting task. Sagittal and frontal planes of ankle, knee and hip joint angles, EMG activation, and GRF were collected during jump landing and cutting. Functional analyses of variance (FANOVA) were used to evaluate between-group differences for these dependent variables throughout the entire ground contact phase of the task. RESULTS: Figure 1. Relative to the control group, the CAI group revealed (i) reduced dorsiflexion and hip flexion angles, (ii) increased inversion and reduced foot abduction angles, (iii) increased posterior and vertical GRF during initial landing, and reduced posterior and vertical GRF, and (iv) increased EMG activation of peroneus longus, and gluteus medius during mid-landing and cutting phase. CONCLUSION: Our data suggest that CAI patients demonstrated different movement strategies during jump landing and cutting. Compared to controls, patients with CAI utilized the proximal (hip) joint with heightened corresponding muscle activation to compensate for a potentially unstable distal (ankle) joint (e.g., more inversion and less dorsiflexion angle) in an attempt to reduce ground impact force. This apparent compensation may be due to sensorimotor deficits in the ankle.

Dorsiflexion Range of Motion Alters Energy Absorption and Generation during Landing/Cutting in Chronic Ankle Instability

Andrew Harris, S. Jun Son, Dustin Bruening, Brent Feland, Matthew Seelye, Ty Hopkins, FACSM. Brigham Young University, Provo, UT. (Sponsor: J. Ty Hopkins, FACSM) (No relevant relationships reported)

Decreased dorsiflexion range of motion (DFROM) has been identified as a risk factor for ankle sprains. Patients with chronic ankle instability (CAI) demonstrate reduced DFROM during walking, running, landing, and cutting. However, variation in DFROM exists within the CAI population. It remains unclear whether varied DFROM affects lower extremity joint energetics during a jump landing/cutting task. PURPOSE: To examine a relationship between varied DFROM within the CAI population and lower extremity energy absorption (eccentric power) and generation (concentric power) during jump landing/cutting.

METHODS: 100 CAI subjects were classified into 3 subgroups based on DFROM, measured by the weight-bearing lunge test: a Hypo (14M, 10F; ≤ ≤ 39°; 35±2.5°, 23±2 yrs, 176±13 cm, 80±13 kg), Normal (25M, 32F; 40–50°; 46±2.6°, 21±2 yrs, 174±7 cm, 72±14 kg), and Hyper DFROM group (11M, 8F; ≥ ≥ 51°; 54±3°, 22±2 yrs, 175±11 cm, 74±14 kg). Subjects performed 5 jumps consisting of a max vertical jump-landing plus a side-cut. Functional liner models were used to detect between-group differences. If 95% confidence intervals did not cross zero, differences were significant. RESULTS: Figure 1 shows that CAI subjects with Hypo DFROM showed decreased ankle and knee energy absorption and generation power and increased hip absorption and generation power compared to Normal and/or Hyper DFROM groups (p < 0.05). CONCLUSIONS: While CAI subjects with Normal and Hyper DFROM show similar lower extremity energetic patterns during the task, CAI patients with Hypo DFROM appear to have a limited ability to absorb and generate kinetic energy in the ankle and knee, which seems to increase a kinetic compensation at the hip (greater energy absorption and generation). These kinetic alterations may increase injury risk and performance deficiencies.
Numerous taping methods have been used to prevent ankle sprains in patients with chronic ankle instability (CAI). The effects of different taping methods on dynamic postural control in patients with CAI, however, are not fully understood. **PURPOSE:** To examine the effects of traditional taping (TT), fibular repositioning taping (FRT), and kinesiology taping (KT) on joint angles and modified Y-balance test (YBT) performance in participants with and without CAI. **METHODS:** A total of 28 subjects (14 CAI: age = 24.07 ± 4.46 yr, height = 175.16 ± 5.10 cm, weight = 82.24±10.38 kg; 14 Healthy: age = 27.57 ± 3.23 yr, height = 169.61 ± 8.33 cm, weight = 76.98 ± 17.95 kg) participated in the study. Subjects performed three trials of the modified YBT before and after receiving TT, FRT, and KT. Hip, knee, and ankle joint angles in sagittal and frontal planes at the moment of maximum reach distance in the anterior (Ant), posterolateral (PL), and posteromedial (PM) directions were collected. Each reach distance was measured and a composite score (CS) was calculated. A 2-way mixed ANOVA (2 groups * 4 conditions) was performed to examine differences across treatments (baseline [BL], TT, FRT, KT). **RESULTS:** Significant interactions were not found. However, a significant decrease in PM reach distance was found across all tape applications for both groups (FT:1.97,51.16) = 55.58, p < .05, n2 = .68). KT and FRT resulted in significant improvement in the modified YBT CS compared with TT (Healthy: KT = 92.24 ± 5.72%, p < .05, TT = 89.76 ± 5.97%, p < .05, FRT: KT = 91.83 ± 6.53%, p < .05, FRT = 90.01 ± 6.49%, < .05, TT = 90.17 ± 6.83%, p < .05, FRT = 87.88 ± 8.39%, p < .05). The CS was also significantly increased when comparing KT to BL (Healthy: BL = 90.17 ± 7.28%, p < .01, KT = 92.24 ± 5.72%, p < .05, CAI: BL = 87.47 ± 6.62%, p < .05, KT = 90.01 ± 6.49%). Analysis of kinematic data revealed a significant increase in dorsiflexion during the PM reach when KT was applied (PT:2.65,56.66) = 3.89, p < .05, n2 = .13). CONCLUSIONS: Even though PM reach distance significantly decreased after applying any of the tape conditions, only KT significantly increased DF and an improved YBT CS compared to BL. The findings suggest KT might enhance dynamic postural control more than the other tape applications. Further research is necessary to explain the mechanism for these changes after KT application.

**2797 Board #79 June 1 3:30 PM - 5:00 PM Immediate Effects of Ankle Tapes on Dynamic Postural Control and Kinematics in Chronic Ankle Instability**

Emi Takahashi1, Youngmin Chun1, Jinah Kim2, Adrian Pettaway3, Russell Baker3, Sae Yong Lee3, Hyung-pil Jun3.

*University of Idaho, Moscow, ID. University of Seoul, Seoul, Korea, Republic of (Sponsor: H. Bruce Brown, FACSM)*

(No relevant relationships reported)

Subgroups of ankle instability (AI) subjects, based on specific movement strategies, were identified, and joint stiffness values for each of the clusters were calculated and compared to a control group using functional linear models (P<.05). **RESULTS:** Table 1. Several clusters demonstrated reduced stiffness at the ankle (C1, 3, 5), reduced stiffness at the knee (C1-4), and increased stiffness at the hip (C1, 2, 6). **CONCLUSIONS:** Multiple, distinct joint stiffness patterns were identified in clusters of AI subjects. Generally, distal joints were more involved in controlling the body. Maximal joint stiffness was greater than controls, supporting the idea that the hip plays a key role in controlling lower extremity movement in AI subjects. Joint stiffness varies according to the movement strategy adopted by each AI subject, and alterations in joint stiffness patterns are a potential source of acute and chronic (re)injury.

**Table 1. Joint stiffness means ± SD (Nm/kg/º) for each of the clusters.**

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Ankle</th>
<th>Knee</th>
<th>Hip</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>0.044±0.014*</td>
<td>0.047±0.020*</td>
<td>0.11±0.12*</td>
</tr>
<tr>
<td>C2</td>
<td>0.048±0.019</td>
<td>0.041±0.020*</td>
<td>0.15±0.31*</td>
</tr>
<tr>
<td>C3</td>
<td>0.047±0.035*</td>
<td>0.041±0.017*</td>
<td>0.088±0.052</td>
</tr>
<tr>
<td>C4</td>
<td>0.046±0.020</td>
<td>0.040±0.016*</td>
<td>0.092±0.062</td>
</tr>
<tr>
<td>C5</td>
<td>0.048±0.012*</td>
<td>0.056±0.021</td>
<td>0.10±0.078</td>
</tr>
<tr>
<td>C6</td>
<td>0.062±0.034</td>
<td>0.055±0.025</td>
<td>0.13±0.076*</td>
</tr>
<tr>
<td>Normal</td>
<td>0.055±0.031</td>
<td>0.058±0.022</td>
<td>0.092±0.065 *</td>
</tr>
</tbody>
</table>

**2798 Board #81 June 1 3:30 PM - 5:00 PM Recommended Number of Trials for Balance and Hopping Tests between Male and Female CAI Subjects**

Jordan R. Read1, S. Jun Son2, Dustin Bruening2, Brent Feland2, Matthew Seeley2, Ty Hopkins, FACSM1. *University of North Texas Health Science Center, Fort Worth, TX. Brigham Young University, Provo, UT (Sponsor: Ty Hopkins, FACSM)*

(No relevant relationships reported)

The recommended number of practice trials for the Biodex static balance (3 trials) and star excursion balance test (SEBT; 4-9 trials) are available in the literature, but, previous studies on these tests did not report the recommendations for male and female and used a small sample size (n = 16-20). Moreover, no data are available for the recommended number of practice trials for triple cross-over hop and figure 8 hop tests. Considering physiological differences in gender, a large sample size is necessary to clarify this issue. **PURPOSE:** To determine the number of practice trials necessary to achieve functional performance for static and dynamic balance and hopping tests between male and female. **METHODS:** 50 male (22±2 yrs, 182±8 cm, 81±12 kg) and 50 female (21±2 yrs, 166±6 cm, 67±12 kg) subjects with chronic ankle instability (CAI) performed 6 practice and 3 test trials of the Biodex static balance test (single-leg), SEBT (anterior, posterolateral, posteromedial), triple cross-over hop for distance test, and figure 8 hop test for time test, 2-3 days apart. The order of the tests were randomized. One-way repeated-measures ANOVAs with multiple comparisons using Dunnett’s Method were used to detect time and gender effect (p < .05). **RESULTS:** Table 1 shows that the required number of practice trials for the hopping tests is 3-4 for male and 2-3 for female subjects prior to testing. The number of required trials for the SEBT is 2-5 for male depending on the direction and 3 for female. For the Biodex static balance, 5 practice trials are needed for both male and female prior to testing. **CONCLUSIONS:** Considering physiological differences in gender, the required number of practice trials appears to vary in the SEBT, triple cross-over and figure 8 hop test between genders. Male subjects may need more practice trials than female to achieve their best performance. Researchers should allow subjects to perform practice trials based on gender to obtain accurate data on these functional performance tests.
Good countermovement vertical jump (CMVJ) performances, as defined by CMVJ height, exhibit quicker countermovements than poor jumpers via quicker unloading phases. Still, it is unknown how good jumpers manipulate ground reaction force (GRF) and velocity to more quickly complete unloading. PURPOSE: To assess GRF and velocity profiles between good and poor jumpers. METHODS: 12 men (27.3 ± 3.0 y; 88.1 ± 16.4 kg; 1.8 ± .1 m) performed 8 CMVJ as GRF data were obtained. Velocity was computed from GRF. Data were normalized to 101 data points to define the time from unloading to takeoff. Mean and standard deviation profiles were computed from GRF. Data were compared at each data point using effect sizes (large ≥ .80). The unloading, eccentric, and concentric phase times were compared visually from the mean GRF and velocity data. RESULTS: Good jumpers unloaded less weightbody and showed shorter unloading and longer eccentric phases (Fig 1). For GRF and velocity, trivial, small, moderate, and large differences were detected for 25%, 42%, 26%, and 8% and for 18%, 64%, 11%, and 8% of the CMVJ, respectively (Fig 2). CONCLUSION: Good jumpers perform quicker unloading phases by unloading lesser weightbody. Thus, they achieve greater GRF and velocity prior to takeoff. Poor jumpers might benefit from performance cues promoting quicker unloading and enhanced eccentric braking. Such cues might allow for enhanced CMVJ performance. Partially supported by a National Strength and Conditioning Association Foundation Grant.
PURPOSE: To investigate the differences in joint mechanics between adolescent and adult males performing countermovement and drop jump tasks. METHODS: Eleven adolescent basketball players (age: 16.5 ± 0.7 years; height: 1.78 ± 0.07 m; mass: 68.9 ± 8.8 kg) and eleven resistance-trained adults (age: 22.3 ± 1.9 years; height: 1.80 ± 0.10 m; mass: 84.3 ± 9.3 kg) performed two trials of a countermovement jump (CMJ) and a drop jump from a height of 0.40 m (DJ). Force plates (1000 Hz) and an 8-camera 3-D motion analysis system (200 Hz) were used to determine the following kinetic variables for the hip, knee, and ankle joints during the propulsive phase of each jump: normalized work performed by the moment (Jw_NORM), normalized power output of the moment (Pw_NORM), and normalized joint stiffness (Stiff_NORM). Results: The adults produced significantly greater Jw_NORM across the two jumps (mean difference [MD]: 0.32 J/kg, p < 0.014). JW_NORM at the knee was greater than that at the hip (MD: 2.09 J/kg, p < 0.001). While JW_NORM was greater at the hip compared to the ankle (MD: 0.52 J/kg, p < 0.001). The adults produced greater Jw_NORM at the hip compared to the adolescents (MD: 0.75 J/kg, p < 0.005). Jw_NORM at the knee was greater than that at the hip (MD: 4.49 W/kg, p < 0.001) and ankle (MD: 6.29 W/kg, p < 0.001) across the two jumps while Pw_NORM was significantly greater in DJ compared to CMJ (MD: 0.49 W/kg, p < 0.10). The adolescents produced significantly greater Jw_NORM at the ankle compared to the adults (MD: 1.35 W/kg, p < 0.002). The adults produced significantly greater JS_NORM compared to the adolescents (MD: 0.021 Nm/kg, p < 0.001). Both groups produced significantly greater JS_NORM in DJ compared to CMJ (MD: 0.14 Nm/kg, p < 0.001 and 0.20 Nm/kg, p < 0.001, respectively). There were no significant differences in JS_NORM at the knee compared to the adults (MD: 0.02 Nm/kg, p < 0.001). The increase in JS_NORM at the hip (MD: 0.05 Nm/kg, p < 0.033) and knee (MD: 0.023 Nm/kg, p < 0.046) between CJ and DJ was significantly greater in adolescents compared to adults. Conclusion: Adolescent males produce different joint mechanics compared to adults during jumping tasks and rely on a strategy of increasing joint stiffness at the hip and knee joints when performing DJ. These differences may have implications for musculoskeletal injuries in adolescent males.
Drop landing tasks are used to screen for anterior cruciate ligament (ACL) injury risk. Soft landing with greater knee and hip flexion is considered ACL protective. Greater vertical excursion of the center of mass is thought to improve shock attenuation by reducing ground reaction forces and increasing the contribution of hip extensors. It is not known if vertical excursion of the L5S1 accurately reflects sagittal plane flexion at the knee and/or hip. **Purpose:** To examine the relationship between L5S1 displacement with peak knee and hip flexion during the deceleration phase of a drop landing task.

**Methods:** Female soccer players (n = 93; 14 ± 2.49 years; 52.9 ± 12.4 kg) performed a drop jump (36cm box). Kinematic data was collected (250 Hz) with 8 camera motion system. Peak knee (pkkn) and hip (pkhp) flexion angles were identified during deceleration (contact to minimum L5S1). Total flexion (totflex) was calculated as the sum of pkkn and pkhp. Data were averaged between limbs. Vertical L5S1 excursion (L5S1ex) was calculated as the difference between minimum L5S1 and L5S1 in standing and normalized by standing L5S1. A stepwise linear regression was used to determine which variables best explain L5S1 excursion during a drop landing task.

**Results:** L5S1ex was positively correlated with pkkn (r = 0.95; p < 0.00), pkhp (r = 0.74; p < 0.00) and totflex (r = 0.892; p < 0.00). Of these variables, pkkn was the only predictor of L5S1ex (r² = 0.91; p < 0.00; prediction equation: L5S1ex = 2.27 + 0.005 pkkn). **Conclusion:** Vertical L5S1 excursion during a drop land is reflective of knee flexion angle explaining 91% of the variance. When considering the difference between actual pkkn and pkkn calculated with the prediction equation the differences ranged from 0.03-11.17 degrees (average: 3.03 ± 2.37 degrees). L5S1ex may be used as a surrogate for knee flexion angle during ACL risk factor screening with a drop land. Further research is needed to investigate the relationship between L5S1ex and shock attenuation.

**RESULTS**

- **Valgus angle at initial contact displayed no difference (males: -4.81 ± 7.83°; females: -3.01 ± 8.99°; p = 0.40).** It was found that knee flexion at initial contact was different (males: 16.1 ± 10.5°; females: 20.7 ± 8.10°; p < 0.05). No differences were observed in valgus ROM (males: 2.75 ± 17.3°; females: 6.68 ± 14.2°; p = 0.32) nor knee flexion ROM (males: 37.1 ± 19.0°; females: 40.2 ± 10.7°; p = 0.42).

**CONCLUSIONS:** These results suggest that the knee kinematic profiles for non-contact ACL injury are not present in pre-adolescent subjects and may develop during maturation.

**Mechanics of Countermovement and Drop Jump Tasks Performed by Adolescent and Adult Males**

- **Purpose:** To investigate the mechanical differences between adolescent and adult males performing countermovement and drop jump tasks. **Methods:** Eleven adolescent basketball players (age: 16.5 ± 0.7 years; height: 1.78 ± 0.07 m; mass: 68.9 ± 8.8 kg) and eleven resistance-trained adults (age: 22.3 ± 1.9 years; height: 1.80 ± 0.10 m; mass: 84.3 ± 9.3 kg) performed two trials of a countermovement jump (CMJ) and a drop jump from a height of 0.40 m (DJ). Force plates (1000 Hz) and an 8-camera 3-D motion analysis system (200 Hz) were used to determine the jump height (JH), the duration of the propulsive phase (PT), countermovement depth during the absorption phase (CM), normalized peak power output during the propulsive phase (\(P_{O_S}^{max}\)), and vertical stiffness (\(VS_{calculated}\)) during each jumping task. **Results:** JH (mean difference: 0.05 m, p > 0.001) and \(P_{O_S}^{max}\) (mean difference: 2.4 W/kg, p > 0.001) were significantly greater during CMJ compared to DJ with no significant differences between the adolescents and adults. PT were significantly greater during CMJ compared to DJ (mean difference: 0.03 s, p < 0.033). The adolescents produced significantly shorter PT (mean difference: 0.08 s, p < 0.001) and significantly lower CM (mean difference: 0.13 m, p < 0.001) than the adults across the jumping tasks. Significantly greater \(W_{O_S}^{max}\) was performed during the CMJ compared to the DJ task (mean difference: 1.10 J/kg, p < 0.001) and the adults performed more work during the propulsive phases of both jumping tasks compared to the adolescents (mean difference: 1.48 J/kg, p < 0.001). The adolescents produced significantly greater \(VS_{calculated}\) during both jumps compared to the adults (mean difference: 39.6 Nm/kg, p < 0.001). **Conclusion:** Adolescent and adult males use different neuromuscular strategies to attain similar power outputs during jumping tasks with the adolescents producing shorter propulsion times through the modulations of vertical stiffness while the adults generate a greater amount of work over a longer duration.

**Patellofemoral Joint Loading During a Variation in Jump-landing Movements**

- **Purpose:** To examine the relationship between knee flexion and knee joint forces during jump-landing with the effect of direction (side) and leg use (unilateral/bilateral). **Methods:** Nineteen males (Age: 22.2 ± 1.6 yrs.; Height: 177.7 ± 8.1cm; Mass: 74.5 ± 11.1 kg) performed 4 jump-landing variations: bilateral (B) forward-backward (FB), bilateral (B) side (S), unilateral (U) forward-backward (FB), and unilateral (U) side (S). Kinematic and kinetic data were collected. Quadriceps muscle forces (QF) were determined from static optimization. PFJS were estimated using a patellofemoral joint model. A repeated measures multivariate analysis of variance with two within-subject factors [leg (U/B) and direction (S/FB)] was used to examine differences in knee range of motion (KROM), quadriceps force (QF), and PFJS \((p = 0.05)\). **Results:** There were multivariate effects for leg (U/B) \((p < 0.001)\) and a leg (U/B) by direction (S/FB) interaction \((p < 0.001)\). No direction (S/FB) main effect \((p = 0.081)\) occurred. Univariate tests revealed greater KROM \((p < 0.001)\) but lower QF and PFJS during B jump-landing \((p < 0.001)\). Leg by direction interaction indicated KROM had greater differences between directions (S/FB) during the U jump-landing \((p < 0.01)\) showing lower KROM during S jump-landing. The interaction also revealed higher QF and PFJS during the B S jump-landing compared to the B FB jump-landing \((p < 0.001)\). QF and PFJS were lower during the U S jump-landing compared to the U FB jump-landing \((p < 0.001)\). **Conclusion:** U jump-landing had greater PFJS than B jump-landing. The effect of direction (S/FB) depended on leg use (U/B). Results may provide insight into both training and rehabilitation efforts in those with PFPS.
Official Journal of the American College of Sports Medicine

2810 Board #93 June 1 3:30 PM - 5:00 PM
Knee Kinematics During a Single-Leg Backwards Jump-Landing With and Without External Load
Colin W. Bond1, Alexander J. Hron2, Benjamin C. Noonan3, Sanford Health, Fargo, ND. 1University of North Dakota, Grand Forks, ND.

(No relevant relationships reported)

External load may increase the demand on the neuromuscular system to safely control knee motion above its capacity, resulting in knee injury. PURPOSE: To assess the influence of external load on knee motion during a backwards single-leg jump-landing. It was hypothesized that external load would increase motion in the frontal plane, but not in the sagittal plane. METHODS: Eleven recreationally active participants (25.1 ± 3.1 y, 1.78 ± 0.08 m, 78.2 ± 11.6 kg) performed backwards single-leg jump-landings without (BW) and with (BW10%) external load applied via a weight vest worn around the torso. Participants jumped backwards over a 15 cm hurdle on the dominant leg, landed on the same foot on the force plate, and stabilized. Trials were completed per condition and averaged for analysis. Frontal and sagittal plane knee angles were identified at initial contact (IC) and peak vertical ground reaction force (vGRF). Effect size (d) was used to evaluate differences in the means between conditions. RESULTS: Participants were in greater knee flexion at IC with external load compared to without (d = 0.40; BW10% = -42.3° [30.6 - 48.7]; BW = 38.8° [33.4 - 44.2]). During the weight acceptance phase participants extended at the knee in both conditions, but extension was greater with external load than without (d = 0.53; BW = 10% + 7.9° [0.5 - 15.2]; BW = 2.4° [-4.2 - 8.9]; resulting in similar sagittal plane angles at peak vGRF (d = 0.20; BW10% = -34.5° [28.2 - 40.7]; BW = 36.4° [30.2 - 46.2]). Participants were in a comparable valgus position at IC (d = 0.00; BW10% = 2.2° [-1.1 - 5.4]; BW = 2.1° [-1.3 - 5.5]) and moved similarly towards a varus position during the weight acceptance phase (d = 0.08; BW10% = -1.7° [-3.9 - 0.4]; BW = -1.5° [-2.4 - 0.3]). Ultimately, resulting in comparable valgus positions at peak vGRF (d = 0.02; BW10% = -0.5 [-2.1 - 3.0]; BW = 0.6° [-2.4 - 3.6]). CONCLUSIONS: Frontal plane knee kinematics were similar between conditions, possibly because the external load was not great enough to exceed the ability to safely control knee motion. Participants landed in greater knee flexion with external load but extended the knee during the weight acceptance phase, possibly due to the unique movement challenges of backwards jumps. This may heighten vertical stiffness, challenge the lower extremity’s passive stability, and increase the risk for knee injury.

2811 Board #94 June 1 3:30 PM - 5:00 PM
Trunk Muscle Fatigue and Activation are Associated with Drop Jump Performance
Yasuyuki Uchida1, Makoto Iuchi2, Norihito Shima3, Yohei Shimokochi4, 1Osaka University of Health and Sport Sciences, Osaka, Japan. 2Kansai University of Health Sciences, Osaka, Japan. 3Tokai Gakuen University, Aichi, Japan.

(No relevant relationships reported)

Although the importance of core muscles on human motions has been recognized, little is known about the effect of trunk muscle fatigue and activation on drop jump (DJ) performance. PURPOSE: To examine how trunk muscle fatigue and activation relate to DJ performance. METHODS: The study included 7 healthy, well-trained males (age 20.8±1.4 years, height 168.4±5.7 cm, weight 67.1±8.0 kg). Subjects held vertical trunk position against an in-ground force plate and kinematics were quantified using three-dimensional electromyography was recorded from the dominant side of the anterior and posterior trunk muscles during DJs. Mean differences before and after the fatiguing task were evaluated using paired-sample t-tests. Simple linear regression analyses tested the relationship of relative changes before and after the fatiguing task in the jump performance index and trunk muscle activation during preactivation, braking, and push off phase of each DJ. RESULTS: After the fatiguing task, MVC was significantly decreased to 68.8±11.5% (p=0.01), DJ (Pre vs. Post fatigue for double- and single-DJ: 1.18±0.31 vs. 0.94±0.36, 0.52±0.13 vs. 0.41±0.15) and DJH (Pre vs. Post fatigue for double- and single-DJ: 22.12±5.09 vs. 20.01±5.24, 13.21±3.04 vs. 11.07±3.64 cm) were significantly decreased (p<0.01), and CT (0.19±0.02 vs. 0.22±0.03 s) was significantly extended (p=0.01). Regression analyses revealed that greater ensemble trunk muscle preactivation reduction rate was associated with CT lengthening rate in double-DJ (R2=0.582, B=-0.257, p=0.046), and DJJ reductions rate in single-DJ (R2=0.910, B=0.309, p=0.001) and that greater rectus abdominis (R2=0.779, B=0.138, p=0.008) and external oblique activations reduction rate during breaking phase (R2=0.703, B=0.276, p=0.018) were associated with greater DJJ reduction rate.

CONCLUSIONS: Trunk muscle fatigue and decreased trunk flexor muscle activation during DJ have negative effects on both double- and single-DJ.
attenuate ground reaction forces. Although small, these impairments may increase ACL injury risk and be heightened with greater loads, fatigue, and unanticipated movements.

2814 Board #97 June 1 3:30 PM - 5:00 PM
Effects of Increased Gluteus Muscle Activation on Hip and Trunk Kinematics during Single-leg Landing
Yohei Shimbokoi1, Kanae Hosaki2, Akiko Takiguchi3, Issei Ogasawara4. 1Osaka University of Health and Sport Sciences, Sennan-gun, Osaka, Japan. 2Funabashi Orthopaedic Hospital, Funabashi-shi, Chiba, Japan. 3Tsujimoto Orthopedic Clinic, Amagasaki-shi, Hyogo, Japan. 4Osaka University, Toyonaka-shi, Osaka, Japan. (No relevant relationships reported)

The gluteus maximus (GM) has a triplanar function at the hip joint. It was hypothesized that increased GM activation before and after foot contact (FC) on landing would affect triplanar hip and trunk kinematics and anterior cruciate ligament (ACL) injury risk. PURPOSE: To examine how increased GM activation before and after FC affect hip angles and trunk inclination during single-leg landing. METHODS: A double-leg drop jump from a 30-cm box, followed by single-leg landing onto a force plate, was performed by 13 males and 15 females in both control (CC) and experimental conditions (EC). In EC, cutaneous electrical stimulation was applied to increase GM activation immediately before FC and during single-leg landing. Kinetic and kinematic data were collected on a force plate and 3-dimensional electromagnetic motion tracking system, respectively. Hip joint angles and sacrum and thorax inclination angles in space on FC, peak ground reaction force (GRFpk), and peak knee extensor moment (KEMpk) during single-leg landing were calculated. Comparisons were performed using two-way (sex × condition) repeated measures analysis of variance with a significance level < .05. RESULTS: The hip joint exhibited more abduction (EC vs. CC at FC, GRFpk, and KEMpk, respectively: -13.2 ± 7.8° vs. 9.5 ± 6.3°, -8.9 ± 7.7° vs. -4.9 ± 6.8°, -3.3 ± 8.9° vs. -2 ± 6.5°) and external rotation (-14.8 ± 8.5° vs. -9.8 ± 9.9°, -8.0 ± 3.6° vs. -3.6 ± 9.7°, -6.1 ± 9.7° vs. -1.16 ± 12°) at all time points in EC than in CC. The sacrum showed more lateral inclination toward the supporting leg at all time points (14.3 ± 6.1° vs. 11.6 ± 6.4°, 12.1 ± SLHOP pk 9.0° ± 6.1°, 8.9 ± 7.1° vs. 6.7 ± 6.2°) and more erect position at KEMpk in EC (1 ± 10.6°) than at CC (-4.6 ± 10.5°). No significant differences were observed in thoracic inclination angles. No significant interactions were observed among all variables. CONCLUSIONS: Increased GM before and after FC on single-leg landing may have positive effects on frontal and transverse plane hip motion to reduce ACL injury risk. However, excessive GM activation may result in excessive trunk lean toward the supporting leg and more erect position, which increase risk for ACL loading. Thus, appropriate GM activation is necessary to protect the ACL during single-leg landing.

2815 Board #98 June 1 3:30 PM - 5:00 PM
Relationship between Take-Off Force Profiles and Single Leg Hop Distance
Christopher Ballantine, Maria Talarico, Daniel Clifton, Michael McNally, James Onate. The Ohio State University, Columbus, OH. (No relevant relationships reported)

The anterior single leg hop for distance test (SLHOP) is a functional performance task that is often used to assess return to play criteria following ACL reconstruction. Clinicians primarily assess SLHOP distance, but the way an individual completes the task may be important when determining return to play status. Recent research has indicated that non-uniformity in vertical ground reaction force (VGRF) profiles during the descending phase and SLHOP distance. PURPOSE: To determine the relationship between vertical and anterior force variables during the descending phase and SLHOP distance. METHODS: Twenty-three female collegiate soccer players (19.1±1.5 years; 166.9±7.1 cm; 62.6±3.8 kg) performed SLHOP for maximal distance on their dominant limb, taking off a tri-axial force plate. Kinetic data were collected during the descending phase of the SLHOP to identify peak force in the vertical (Fz) and anterior-posterior (Fy) axes and average rate of force development (RFD), the rate of change in the force-time curve. Two start events were used to calculate RFD: 1) RFDneg (peak Academy of maximum center of mass acceleration (subject moving down, acceleration negative) and 2) RFDzero: peak when ground reaction force equals body weight (subject moving down, acceleration zero). The RFD end event was peak force (near the lowest point of descending). Forces were normalized to body weight and SLHOP distances were normalized to leg length. A linear regression with best subset selection method was performed to identify which combination of variables were most related to SLHOP distance with an alpha level set a priori at p<0.05. RESULTS: Peak Fy (R2=0.33, 95%CI=5.48, ±0.40, p>0.03) were significantly related to SLHOP distance (model adjusted R2=0.69). CONCLUSION: Female soccer players who maximized anterior force and minimized vertical RFD during the descending phase of SLHOP achieved greater SLHOP distances. Results suggest maximal SLHOP distance warrants both vertical and anterior force generation. However, these movement strategies may not translate across different jump tasks (i.e. vertical jump, etc.) or different sports. Further research is needed to explore the relationship between other phases within the force-time curve, pathomechanics, and SLHOP distance.
warranted to examine the relationship between force and RFD profiles and other jump tasks. Future studies should examine the effect of sex and sport on the relationship between SLHOP distance and force variables.

**F-57** Free Communication/Poster - Children and Youth

**Friday, June 1, 2018, 1:00 PM - 6:00 PM**

Room: CC-Hall B

**2818 Board #101 June 1 2:00 PM - 3:30 PM**

**Evaluation Of The Implementation Of An Academically-integrated Intervention Targeting Obesity-related Health Behaviors In Preschooler-age Children**

Christine W. St Laurent, Sarah Burkart, Sofiya Alhassan, FACS. **University of Massachusetts Amherst, Amherst, MA.**

(Sponsor: Sofiya Alhassan, FACS)

Obesity related health behaviors [ORHBs; physical activity (PA), diet, and sleep] interventions targeting preschool-age children implemented within childcare centers have shown mixed results. The variability of these findings could be related to process evaluation measures, which are frequently not reported. **PURPOSE:** To describe the process evaluation (feasibility, acceptability, and fidelity) outcomes of a 12-week preschool intervention targeting ORHBs that was integrated into early education learning standards (state mandated policies) in preschools.

**METHODS:**
Two preschools (classrooms, n = 7) were randomized to either the 12-week Physical Activity, Diet and Sleep (PADS) intervention or control condition. The PADS program was led by research staff and teachers and included ORHB lessons and activities implemented on four days/week (three days of morning PA, three days of afternoon PA, one day of diet, and one day of sleep). PADS PA intervention intensity was assessed on one randomly selected weekday morning/week with accelerometers. Other process evaluation outcomes were assessed (daily, weekly, and at 12-weeks) using semi-structured questionnaires completed by research staff and teachers. **RESULTS:** Fifty, 33.3, 77.8, and 100.0% of observed lessons were implemented as planned for diet, sleep, morning PA, and afternoon PA, respectively. Only 44.7 ± 8.6% of the morning PA lessons were spent in moderate-to-vigorous intensity. Among all observed lessons at least 50% of the students participated and the majority of students seemed to enjoy the activities. Teacher encouragement was present in 62.5% (diet) - 72.2% (morning PA) of observed lessons. Greater than 90% of the lessons were perceived as effective and would be used in the future by teachers. **CONCLUSIONS:** This pilot data suggests that integrating ORHBs into education learning standards is feasible and acceptable by preschool teachers and students. PADS PA lessons had the highest levels of implementation, whereas modifications were recommended for some diet and sleep lessons. Implementation of all lessons may also improve with greater teacher encouragement.

**2819 Board #102 June 1 2:00 PM - 3:30 PM**

**Mixed-method Analysis Of An After-school Program To Increase Physical Activity**

Kelly R. Rice1, John Schuna2, Tim Behrens, FACSM. 1Oregon State University, Corvallis, OR. 2Oregon State University, Corvallis, OR. 3Northern Arizona University, Flagstaff, AZ.

(Sponsor: Tim Behrens, FACSM)

Physical activity (PA) is essential for adolescent health and prevention of chronic diseases. After-school programs and time spent outdoors are important for addressing health behaviors, particularly PA. **PURPOSE:** The purpose of this study was to increase PA through an afterschool program that utilized outdoor resources. **METHODS:** Get Outside - After School Activity Program (GO-ASAP), a 20-wk (2d wk. for150-180 mins) PA program designed to increase lifestyle PA. Participants (N = 18) were recruited from a local middle school. The Physical Activity Questionnaire for Children (PAQ-C), as well as accelerometers, was used to assess PA. Assessment of social cognitive (SCT) and self-determination (SDT) constructs were measured on a 5-point Likert scale. All assessments were administered pre- and post-intervention. Focus groups were conducted post-intervention to assess self-confidence and enjoyment. **RESULTS:** Participants (male = 11, female = 7) were 12.9 ± 0.9 years of age. Accelerometer-derived PA indicated an increase in MVPA min/hr (92±0.80 to 3.91±2.4) but was not significant (p=0.28). Self-reported PA increased from baseline (2.10 ± 0.56 to 2.54±0.92; p<0.042). There were no significant changes noted in SCT or SDT constructs. Five themes emerged from focus groups: (1) students liked participating in the GO-ASAP, (2) students learned new skills and activities while exercising outdoors, (3) participation in the GO-ASAP had a positive effect on confidence and self-esteem, (4) Participation in the GO-ASAP had a positive effect on life-long commitments to fitness, and (5) there is a positive interaction between students and GO-ASAP leaders. **CONCLUSIONS:** Results of this pilot project indicated that outdoor-based PA programs might yield small effects in PA. Additional explorations with larger sample sizes are warranted to fully investigate the efficacy of these findings. The need for after school programs involving activities promoting PA into adulthood should be explored.

**2820 Board #103 June 1 2:00 PM - 3:30 PM**

**Changes On Neuroendocrine Parameters (cortisol, Melatonin) And Anxiety Levels After A School-based Exercising And Nutrition Counseling Intervention In School-aged Obese Adolescents From Monterrey Mexico**

Marco A. Enriquez Martinez1, Oswaldo Ceballos Guerro3, Raul Lomas Acosta1, Jose Alberto Valadez Lira.2, Armando Coccra1, Benemérita Escuela Normal Manuel Ávila Camacho., Zacatecas, Mexico. 1Universidad Autónoma de Nuevo León., San Nicolás de los Garza, Nuevo León., Mexico. 2Secretaría de Educación Coahuila., Saltillo, Coahuila, Mexico.

(No relevant relationships reported)

**BACKGROUND.** Recent studies point to high prevalences of obesity in adolescent populations worldwide. Its implications derive in various disorders, among which are inflammatory processes, as well as disorders related to sleep-wake, both processes involved in stressful situations. There are two neuroendocrine parameters (cortisol and melatonin) two hormones associated with the sleep-wake process that lead to a certain level of anxiety in obese subjects. Both cortisol and anxiety have been evidenced in various investigations as obsesogenic factors. For its part, the practice of physical exercise has been indicated as a factor associated with the increase in melatonin levels, which has anti-inflammatory and recovery functions. **PURPOSE:** To assess the changes in the levels of neuroendocrine parameters (cortisol, melatonin) and anxiety after an intervention of nutritional counseling and exercise in school age obese adolescents of Monterrey Mexico.

**METHODS:** Experimental study with a sample of 31 adolescents (13 ± 2) randomly assigned in three work groups who had participation during 4 months. The control group (CG) did not receive any treatment; experimental group 1 (EG1) participated in a health program composed of 4 weekly sessions of 60 minutes of physical activity; Experimental group 2 (EG2) 4 weekly sessions of 60 minutes of physical activity sessions of nutritional guidance and 2 weekly sessions of light therapy of 45 minutes. The values of cortisol and melatonin were taken in saliva and for anxiety the questionnaire of state anxiety (STAI) was used.

**RESULTS:** After comparing initial and final values, the results showed significative changes into EG2 increasing melatonin (p > 0.001). Salivary cortisol showed significant decreases into EG1 (p = 0.004) and also into EG2 (p =0.006). Anxiety state showed a significant increase into CG (p<0.001), and significant decreases into EG1 (p<0.001) and into EG2 (p<0.001)

**CONCLUSIONS:** The School-based Exercising And Nutrition Counseling shows favorable effects in the reduction of cortisol levels y ansiedad, both factors associated with inflammation. The use of light therapy seems to help into the recovery processes increasing secretion of melatonin and recovery after exercise. we suggest analyze sleep variables for further studies.
After controlling for pre-test scores, athletic (F(1,25)= 18.577, r²=0.001, r²=0.151) and scholastic (F(1,25)= 4.462, r²=0.05 , r²=0.462) competency increased for non-minority and deceased for minority participants. There were no significant changes in PA enjoyment. Ego goal orientation decreased among male participants (F(1, 26)= -5.972, p=.05). Weekly physical activity minutes increased from pre to post-test, F(1, 27) =53.115, r²=0.001, r²=0.663. CONCLUSIONS: Participating in the after-school jump rope program did show consistent increases in assessed psychological variables however there were positive trends in goal orientation, weekly PA, and. Participants were involved in multiple after-school programs which may have influenced the data. Accelerometer data shows that the jump rope program elicited 45.3 minutes of MVPA including an average of 9 minutes of very vigorous PA creating an interval training type program. Further examination of how this type of program impacts self-perceptions is needed.

**METHODS**
African American children with ADHD and/or DBD were randomized to a 10-week after-school physical activity program (n=19) or a sedentary control program (n=16). Only 18% had ever received mental health services despite 87% meeting positive or intermediate criteria for ADHD and/or DBD. At posttest, 3 systematic classroom observations were conducted for each student using the BOSS (Shapiro, 2004). For comparison, each BOSS observation also assesses behavior among non-participating classroom peers. ANOVA tested differences in academic engagement and off-task motor (OFF-M) and verbal (OFF-V) behaviors among the physical activity group, control group, and classroom peers. Bivariate correlations tested relationships between program attendance and classroom behavior.

**RESULTS**: Omnibus tests revealed differences in OFF-M (F(2,23)=16.9, r²=.001) and a trend for academic engagement (F(2,23)=2.6, p=.09). Pairwise comparisons revealed that the physical activity and control groups evidenced 52% and 49% more OFF-M (p<.01), 34% and 33% more OFF-V (ns), and 11% and 15% less academic engagement (ns) than classroom peers. No differences were evident between intervention groups. Large non-significant correlations were found between program attendance and academic engagement in both physical activity (r=.45, p=.08) and control (r=.45, p=.11) groups.

**CONCLUSION**: Neither after-school program improved classroom behavior of children with ADHD and/or DBD to levels of classroom peers. Extra-curricular physical activity programs will require greater intentionality to impact classroom behavior in this population.

**CONCLUSIONS**
- Vigorous physical activity, waist circumference, age, and sex but not sedentary time in physical activity, high sedentary time.
- Evidence suggests physical activity influences children’s neurocognitive function and ADHD symptoms. ADHD and Disruptive Behavior Disorder (DBD) are highly comorbid. Extra-curricular physical activity programs may improve academic achievement in ADHD and DBD by increasing academic engagement levels during instruction closer to those of typically developing peers. However, few studies have tested the impact of physical activity on objectively-measured classroom behavior in children with ADHD and/or DBD. **PURPOSE**: To evaluate the impact of physical activity on behavior for children with ADHD and/or DBD using a tool which objectively measures classroom behavior.

**RESULTS**
- Neither after-school program improved classroom behavior of children with ADHD and/or DBD to levels of classroom peers. Extra-curricular physical activity programs will require greater intentionality to impact classroom behavior in this population.

**METHODS**
- Physical activity (PA) and cardiorespiratory fitness (CRF) are independently associated with lower cardiometabolic risk, and may affect risk through different pathways. PA and CRF are two different constructs (behaviour vs trait), and CRF has a genetic component suggesting that some may be predisposed to higher CRF in whom associations between PA and cardiometabolic health might be less pronounced than in those with low CRF. Therefore, CRF might moderate the association between PA and cardiometabolic risk, however, only cross-sectional studies have examined such an influence of CRF on this relationship so far.

**PURPOSE**: To examine if CRF moderate the prospective association between PA and cardiometabolic outcomes in 10-year-old children.

**METHODS**: In total, 718 children (30.3% boys) had valid measures of PA measured by actiometer (GT3X), and CRF assessed by the Andersen intermittent running test, as well as the cardiorespiratory fitness (peak VO2); systolic blood pressure, waist circumference (WC), total cholesterol, high-density lipoprotein, triglycerides, glucose, and insulin. Outcomes were analyzed individually, and as a clustered cardiometabolic risk score (sum of z-scores). PA and cardiometabolic risk factors were measured at baseline and follow-up seven months later. Linear mixed modelling was used to examine the prospective associations between PA exposures and cardiometabolic risk outcomes, including the interaction term (PA × CRF) in the model to assess moderation by CRF.

**RESULTS**: CRF modified the association between baseline PA (counts per minute) and between moderate-to-vigorous PA (MVPA) (miraito) with clustered cardiometabolic risk at follow up (P<.0026). Moreover, CRF modified the association for PA and MVPA with insulin resistance independent of WC (P<.0022). When stratified by CRF level (low-high), PA and MVPA predicted lower insulin resistance [MVPA β=0.119 (95% CI: -0.267, -0.038); P=0.008] and clustered cardiometabolic risk [MVPA β=0.002 (95% CI: -0.166, -0.018); P=0.014] in children with low CRF, but not among their fitter peers (P=0.323). **CONCLUSION**: CRF moderate the prospective association between PA and clustered cardiometabolic risk; this moderation was most pronounced for insulin resistance. Our findings suggest that PA may be especially important in children with low CRF.

**CONCLUSIONS**: This suggests cardiorespiratory fitness is predicted by vigorous physical activity, waist circumference, age, and sex but not sedentary time in children. Strategies aimed to promote and improve cardiorespiratory fitness and health in children should emphasize vigorous physical activity.
can sustain improvements in PA motivation and behavior. This study examined the effectiveness of a 1-week need-supportive summer camp to enhance self-determined PA motivation and behavior at 12 weeks post-camp. METHODS: Adolescent girls [N=42; n overweight or obese girls (OW/OB; >85th percentile); M_{BMI} = 11.7±1.1] attended a one-week (5 days) camp intentional in need-supportiveness and completed follow-up 12 weeks post-camp. Objective PA was measured via accelerometer. Self-determined PA motivation was assessed using Behavioral Regulations in Exercise Questionnaire-3. RESULTS: At baseline, compared to OW/OB, healthy weight girls (HW): a) were similar in PA motivation (18.66±3.52, 19.88±3.9; p>0.05), b) took more steps/day (12,172±2,103 vs. 7,442±3,737; p<0.05), and c) engaged in greater moderate-to-vigorous intensity PA (MVPA) (291.7±46.4 vs. 185.4±90.8; p<0.05). In PA motivation, the repeated measures analysis of variance results showed a significant within-subjects effect (F[1,38]=6.63, p<0.01, η^2=0.17). The within-subjects contrast analyses showed a linear and positive growth pattern for OW/OB but a quadratic inverted U-shape for HW. Similarly, the analysis of covariance determined that the camp had a significant between-group effect on PA (steps: F[1,19]=19.15, p=0.001, η^2=0.51; MVPA: F[1,19]=21.63, p=0.001, η^2=0.52) with OW/OB increasing their PA whereas HW PA remained stable. CONCLUSIONS: These findings suggest that the psychological need-supportive summer camp may be more effective in improving and sustaining PA motivation and behavior in OW/OB compared to their healthy weight counterparts.

### 2826 Board #109 June 1 2:00 PM - 3:30 PM Physical Activity in Latina Caregivers of Children with Developmental Disabilities

Jacqueline Guzman, Sandra Magaña, Judith S. Rocha, Mariana Garcia Torres, Miguel Morales, David X. Marquez, FACSM. University of Illinois at Chicago, IL. University of Texas at Austin, Austin, TX. (Sponsor: David X. Marquez, FACSM)

**CONCLUSIONS: Overall, the average MVPA minutes per day among Chinese school-aged children is low, and families may be considered in the development of PA interventions and policies.**

Latinas caregivers of children with developmental disabilities (DD) have more chronic health conditions and poorer health compared to both White and Latina caregivers of children without DD. It has been well documented that Latinas women, in general, report less than recommended levels of physical activity (PA). A challenge of Latina caregivers is that they focus on caring for the family and the child with DD and take less time to care for themselves which contributes to the low levels of leisure-time PA and exacerbates already existing health disparities in this population. PURPOSE: To describe PA levels of Latina caregivers of children with DD and identify if one educational session led to changes in PA. METHODS: An 8-week caregiver intervention pilot was conducted with 18 caregivers of children with DD. Promotoras de Salud, community health worker (CHW) provided health education. Participants met with CHW in two-hour home visits sessions once a week. One entire session was dedicated to PA, which included the importance and benefits of PA, incorporating PA in everyday routines, and a stretching exercise activity. Participants had a wrist-worn ActiGraph GT3X+ accelerometer for 7 days at baseline and 8 weeks. RESULTS: This analysis included accelerometer data from baseline and post-test of 18 caregivers, M=44.2, all foreign born. The majority of this sample was highly active with a range of 7132 to 19620 steps/day at baseline and 72% and 67% of the participants exceeding 10,000 steps/day at baseline and at post-test, respectively. Participant’s average step count significantly decreased at post-test (M=11902, SD=2705) from baseline (M=12555, SD=3247), t(17)=2.10, p=0.025. CONCLUSIONS: The present study suggests that Latina caregivers of children with DD are physically active. However, we were not able to identify whether this activity was from leisure-time, occupational or caregiving as we were only able to report on step count from wrist-worn accelerometer data. The program was designed to promote and sustain positive health behaviors, and one 2-hour educational session was not enough to promote PA. PA Interventions for Latina caregivers of children with DD should promote leisure-time PA to address the health disparities in this population.

Supported by Midwest Ryalal Center P30 AG0128849

### 2827 Board #110 June 1 2:00 PM - 3:30 PM Weight Status Influences Effectiveness of Need-Supportive Physical Activity Summer Camp in Girls

Megha Vishwanathan, Marlyse Sifre, Sophie Waller, Mika Manninen, Ellen M. Evans, FACSM, Sami Vii-Pipari. University of Georgia, Athens, GA.

**CONCLUSIONS:** Habitual physical activity (PA) is a major factor related to obesity risk. Research has shown PA interventions among adolescents to be moderately successful in the short-term but limited to sustained behavior change. Self-determination theory (SDT) postulates that a psychological need-supportive environment (i.e. one that supports competence, autonomy, and social relatedness) is effective in maintaining volitional motivation which can lead to sustained positive behavioral changes including PA. Although research has supported the central tenets of the SDT, there is limited evidence examining whether a summer camp intervention
youth. When implemented effectively, classroom-based PA interventions may help to reduce these disparities by providing structured PA at school. The purpose of this study was to evaluate the efficacy in implementing the Intervention Preventing Prolonged Sitting with Activity (InPACT), a classroom-based PA intervention, in three economically and racially diverse schools in Southeast Michigan. METHODS: Three elementary schools in Michigan, one suburban (school 1: 90% white; 25% on free/reduced lunch), one rural (school 2: 90% white; 50% on free/reduced lunch) and one urban school (school 3: 59% black; 74% on free/reduced lunch) participated. Prior to the start of the intervention, teachers were trained to incorporate 10, 3-minute moderate-to-vigorous physical activity (MVPA) breaks in their classrooms each day. Throughout the intervention, teachers completed surveys to document the number of MVPA breaks completed per day. Direct observation was also used to assess intervention fidelity. RESULTS: There was a significant difference in the number of MVPA breaks completed in the classroom per week by school (school 1: 82.11 min; school 2: 98.11 min; school 3: 50.13 min; p = 0.04). There was also a significant difference in the percent of students who engaged in MVPA by school (school 1: 92.03%; school 2: 84.03%; school 3: 77.05%; p = 0.02). There was a trend towards a significant difference in the number of activity breaks implemented per day (school 1: 5 breaks; school 2: 6 breaks; school 3: 3 activity breaks; p = 0.06). CONCLUSIONS: Implementation of the InPACT intervention varied by school with school 3, the low-income, ethnically diverse school accumulating significantly fewer minutes of MVPA in the classroom compared to the higher-income, predominantly white schools. Although this intervention was successful in two of our three target schools, tailored intervention strategies are needed to improve implementation in low-income schools to better address disparities in physical activity participation.

**2830** Board #113 June 1 2:00 PM - 3:30 PM
**Effect Of School-based Physical Activity Programs On Hamstring Flexibility: A Meta-analysis**
Sonia Monterro-Briceno, Isaura M. Castillo-Hernandez. University of Costa Rica, San José, Costa Rica. (Sponsor: Ellen M. Evans, FACSM) (No relevant relationships reported)

**PURPOSE:** Flexibility is an often neglected but very important physical fitness component that is gaining attention regarding its role in correct posture and the incidence of chronic injuries, especially among children and adolescents. The aim of the study was to examine the chronic effect of school-based physical activity (PA) programs on hamstring flexibility (HFlex) and to evaluate potential moderators of this effect using a meta-analytic approach.

**METHODS:** A computerized literature search was conducted based on five databases: SPORTDiscus, Google Scholar, PubMed, Dialnet Plus, and MEDLINE. Studies needed to meet the following inclusion criteria to be included in the meta-analysis: 1) a randomized controlled trial design, 2) PA program took place in a school setting 3) published in English or Spanish, and 4) reported descriptive statistics that permitted effect size (ES) calculation. A random-effects model with a within-group design was used to calculate the ES. The moderator effects were analyzed either by one-way analysis of variance of independent groups or by Pearson product-moment correlation coefficients, depending on the variable considered.

**RESULTS:** From 2006 articles, 13 studies representing 18 ES’s and totaling 792 participants (males/females, 10.3 ± 0.5 y) were included in the analysis. The mean quality score for the studies was 3.4 ± 0.7 (on a scale from 1 to 5). A moderate overall ES of 0.38 (p ≤ 0.01; CI 0.22 to 0.58; z = 4.5; p = 0.03; 19.48% power) was found suggesting a low-moderate effect size of the school-based PA programs to enhance HFlex. Neither a) quality of the studies (r = 0.43, p = 0.87), b) number of intervention sessions (r = 0.16, p = 0.52), nor c) minutes per session (r = 0.03, p = 0.93) were significant moderators. Sex could not be included as a moderator because 78% of the studies did not report the effect on HFlex separately by sex. No bias was found according to Egger’s regression analysis (p = 0.80).

**CONCLUSION:** School-based PA programs have a significant positive overall effect on children and adolescents’ Hflex compared with their control peers. Reporting the effect differentiated by gender and including detailed group demographic data (i.e., experimental and control) is recommended for individual studies.

**KEYWORDS:** hamstring flexibility, school-based physical activity

**2831** Board #114 June 1 2:00 PM - 3:30 PM
**Interventions for Increasing Physical Activity in Low-Income, Ethnic Minority Children and Youths: A Meta-analysis**
Kyungun Kim1, Seung Ho Chang2, Ji hyun Lee2, Sukho Lee2, 1University of Central Missouri, Warrensburg, MO; 2San Jose State University, San Jose, CA; 2Texas A&M University-San Antonio, San Antonio, TX. (Sponsor: Minsoo Kang, FACSM) (No relevant relationships reported)

Ethnic minority and economically disadvantaged children and youths often show high levels of risk and vulnerability to physical inactivity and health issues.

**PURPOSE:** To provide a better understanding of and examine the effectiveness of interventions to increase physical activity (PA) in children and youths from low-income families and ethnic minorities (LEIM) through a meta-analysis. **METHODS:** We identified relevant studies through August 2017 from PubMed, Medline, CINAHL Plus, SportDiscuss, ERIC, PsychINFO, Scopus, ProQuest, and The Physical Activity Index. The main outcomes were the general PA levels and moderate-to-vigorous intensity of PA. Inclusion criteria applied were: (a) necessary statistics to compute effect size (ES); (b) PA intervention studies; (c) LEIM participants aged 3-12 years; and (d) full-text articles written in English and published in peer-reviewed journals. A random-effects model was used to estimate the ES. Furthermore, moderator analysis was conducted using five moderators: (1) intervention duration (<13, 13-47, or >47 weeks); (2) participant age (<10, 10-12, or >12 years); (3) intervention delivery (teacher, parents, teacher and parents, or specialists); (4) technology (used or not used); and (5) behavioral modification (used or not used). The ES were calculated using the Comprehensive Meta-Analysis 3.0. The ES were computed using Hedges g with 95% CI, and the group difference was examined using the Q-statistic.

**RESULTS:** The results indicate that there were small to medium effects of PA interventions on PA (Overall ES = .325, 95% CI = .088, 0.561). Moderator analysis did not identify any significant differences across groups. However, ES for groups with less than 13 weeks (ES = .527, 95% CI = .163, .891, p < 0.05), participants aged 10-12 (ES = -.540, 95% CI = .185, .895, p = .003), interventions delivered by specialist (ES = .535, 95% CI = .104, .966, p = .015), interventions without technology (ES = .367, 95% CI = .099, .634, p = .007), and with behavioral modification (ES = .314, 95% CI = .046, .582, p = .022) were significantly different from zero. **CONCLUSION:** The results from this study indicate that interventions targeting increase in PA in LEIM children and youths were somewhat successful with small to medium effects. Movement is very important for the growth and development of children. However, according to NHANES accelerometer data, children aged 6-11 years spend almost half of their day sedentary. Therefore, identifying ways to increase physical activity is important to the health of children. **PURPOSE:** To determine the effect of replacing traditional sitting desks with standing desks on total daily sedentary behavior (SB) and physical activity (PA) in elementary school children. **METHODS:** A 9-week within-classroom, controlled design, with teacher allocation to either a traditional seated desk (CON) or a standing desk (INT) was conducted during the first part of the school year. Baseline (September) and post assessments (December) included five consecutive weekdays of waking hour, hip-worn accelerometer (Actigraph GT3X+) assessments. Wilcoxon Rank Sum and Kruskal-Wallis Tests were used to detect significant between group differences (p < 0.05) in changes in SB, light-intensity PA (LPA), and moderate-to-vigorous-intensity PA (MVPA). **RESULTS:** 22 third (8.5 ± 0.7y), 36 third (9.7 ± 0.5y) and 41 sixth (11.7 ± 0.4y) grade students completed the study and provided complete accelerometer data during the school day. During the intervention week students were exposed to the standing desks in the classrooms (homeroom time) for 19h of the possible 34.4h per week that students attended school. While both groups showed an increase in percent of homeroom time sedentary and a decrease in PA, changes in SB and PA were significantly less in the INT group than the CON group (SB, p = 0.033; LPA, p = 0.004; MVPA, p = 0.003). Specifically, the INT increased SB by 1.9% and decreased MVPA by 0.1% of wear time, while the CON group increase SB by 6.2% and decreased MVPA by 3.1% of homeroom time. Similar trends in PA, but not SB or sitting, were seen when examining the entire school day. **CONCLUSIONS:** As the school year progresses, there is a tendency for student increase sitting and decrease PA. The introduction of the standing desk was shown to positively curtail these trends. Therefore, standing desks may be useful in preventing sedentary activity in elementary school classrooms, especially among younger children.

**2833** Board #116 June 1 2:00 PM - 3:30 PM
**Impact Of Coordinated-bilateral Physical Activities On Attention And Concentration In School-aged Children**
Weiyun Chen, Heidi Harris. University of Michigan, Ann Arbor, MI. (No relevant relationships reported)

**PURPOSE:** This study examined the effects of a 4-week, daily 6-minute coordinated-bilateral physical activity (CBPA) break in classroom on attention and concentration in school-aged children. **METHODS:** 116 fifth graders from two elementary schools were assigned to three groups: two intervention groups (n = 60) and one control group (n = 56). Three groups were pre- and post-tested with the d2 Test of Attention, a cancellation test that measures students’ performance in attention and concentration.
One intervention group (n = 31) participated in six minutes of daily coordinated-bilateral physical activity (CBPA) classroom break for four weeks. Another intervention group (n = 29), the Fisbit Only (Fith-O), wore Fisbits per day. Five school days per week for four weeks without CBPA breaks. Processing Speed, Focused Attention, Concentration Performance, Attention Span, and Accuracy were used as parameters of attention performance for data analysis. The d2 Test had high test-retest reliability coefficients for all parameters, ranging from 0.95 to 0.98. A 2 × 3 ANOVA revealed significant decreases in processing speed (F1, 22 = 6.876, p = .010), attention (F1, 22 = 10.688, p = .002), concentration performance (F1, 22 = 26.46, p = .000), and attention span (F1, 22 = 14.090, p = .000) over the control, but not in accuracy. The CBPA group also showed significant improvement in concentration performance (F1, 22 = 24.162, p = .000) and attention span (F1, 22 = 6.891, p = .011), compared to the Fith-O. No significant changes in all five attention parameters were found between the Fith-O and the control.

CONCLUSIONS: Engaging students in daily, highly-focused, coordinated-bilateral activities is an effective strategy to improve attention and concentration in school-aged children.

PURPOSE: To assess changes in after-school time spent performing sedentary behavior (SB), light-intensity physical activity (LPA), and moderate- to vigorous-intensity physical activity (MVPA) among elementary school children in response to the introduction of stand-biased desks in the classroom. METHODS: Thirty-one 6th grade participants were assigned by their teacher to either a traditional (TD) (n=16) or stand-biased (SBD) (n=15) desk. After-school PA and SB were measured using accelerometry on four consecutive weekdays at baseline (prior to introduction of the stand-biased desks), and again following 9-weeks of exposure to either a TD or SBD in the classroom. After-school sedentary and physical activity periods were recorded during both measurement periods using National Oceanic and Atmospheric Administration (NOAA) data and the Youth Activity Profile Questionnaire (YAP), respectively. Wilcoxon Rank Sum Tests were used to detect significant differences (p<0.10) in changes in after-school SB and PA between groups. RESULTS: No significant between group differences were found during the after-school period in pre-post changes in time spent performing SB (p=0.770), LPA (p=0.740), vigorous-intensity PA (p=0.599), or MVPA (p=0.470). Significant between group differences in the median change in proportion of time spent performing moderate-intensity PA (MPA) (SBD: −1.4%; TD: 0.2%, p=0.093) were detected, with the SBD group experiencing a decrease of 4.5 minutes/after-school period relative to a 0.1 minute increase among TD participants. Coinciding with a change in PA, it was found that the average after-school temperature decreased from 60.0 °F at pre to 11.4 °F at post, while daylight also decreased by 81 minutes during the after-school period. Further, after-school sport participation between groups also changed from pre to post, with TD experiencing an increase of two after-school sport participants, while SB experienced a decrease in after-school sport participation of two participants. CONCLUSION: Stand-biased desks did not have a negative impact on children’s after-school PA and SB. Instead, seasonal variation and the structure of children’s after-school schedule may have a greater influence on after-school activity than a mild classroom-based stand-biased desk intervention.

PURPOSE: The purpose of this study is to evaluate the effects of a 5-week summer golf camp on cardiovascular fitness and flexibility in youth with obesity and/or congenital heart disease.

METHODS: Twenty-six youth, ages 8 to 13, were recruited for the First Tee golf camp sponsored by the Children’s Heart Association. Twenty patients had congenital heart disease and 14 patients were obese. The camp consisted of a 3-day SCRATCH golf training program followed by 5 weeks of golf sessions. Golf sessions were 90 minutes long, offered twice weekly, for a total of 13 sessions. Informed consent/assent was obtained for all participants. Pre and post-camp flexibility measurements were assessed via the back saver sit-and-reach test. Subjects completed the PACER test to assess aerobic capacity before and after the completion of camp.

RESULTS: Mean age of participants was 11 years old. Pre and post-test data from the PACER test was obtained from 22 (85%) participants (14 boys, 8 girls). There were significant improvements in PACER scores from baseline (p < 0.0001). 21 (95%) participants improved PACER scores by the conclusion of camp. PRE PACER lap score was (10.0 ± 5.6). POST PACER lap score was (13.3 ± 7.0). Pre and post-test sit and reach data was obtained from 25 of the 26 (96%) camp participants (17 boys, 8 girls). There were significant improvements in right and left leg sit and reach scores for both girls and boys (right side, p = 0.0001; left side, p < 0.0001). Right side PRE sit and reach was (9.7 ± 2.3) compared to POST = (11.3 ± 2.1). Left side PRE sit and reach was (9.5 ± 2.9) compared to POST = (11.4 ± 2.4).

CONCLUSIONS: Youth with congenital heart disease and/or obesity show significant improvements in flexibility and cardiorespiratory fitness after attending golf camp. Camp appears to offer health benefits in addition to learning about golf and may promote children to be outside and active. There is limited research on the effects of participating in a golf camp in pediatric congenital heart disease and obese populations; further studies may identify additional health benefits.

PURPOSE: To identify the effects of a 5-week summer golf camp on cardiovascular fitness and flexibility in youth with obesity and/or congenital heart disease.

METHODS: Twenty-six youth, ages 8 to 13, were recruited for the First Tee golf camp sponsored by the Children’s Heart Association. Twenty patients had congenital heart disease and 14 patients were obese. The camp consisted of a 3-day SCRATCH golf training program followed by 5 weeks of golf sessions. Golf sessions were 90 minutes long, offered twice weekly, for a total of 13 sessions. Informed consent/assent was obtained for all participants. Pre and post-camp flexibility measurements were assessed via the back saver sit-and-reach test. Subjects completed the PACER test to assess aerobic capacity before and after the completion of camp.

RESULTS: Mean age of participants was 11 years old. Pre and post-test data from the PACER test was obtained from 22 (85%) participants (14 boys, 8 girls). There were significant improvements in PACER scores from baseline (p < 0.0001). 21 (95%) participants improved PACER scores by the conclusion of camp. PRE PACER lap score was (10.0 ± 5.6). POST PACER lap score was (13.3 ± 7.0). Pre and post-test sit and reach data was obtained from 25 of the 26 (96%) camp participants (17 boys, 8 girls). There were significant improvements in right and left leg sit and reach scores for both girls and boys (right side, p = 0.0001; left side, p < 0.0001). Right side PRE sit and reach was (9.7 ± 2.3) compared to POST = (11.3 ± 2.1). Left side PRE sit and reach was (9.5 ± 2.9) compared to POST = (11.4 ± 2.4).

CONCLUSIONS: Youth with congenital heart disease and/or obesity show significant improvements in flexibility and cardiorespiratory fitness after attending golf camp. Camp appears to offer health benefits in addition to learning about golf and may promote children to be outside and active. There is limited research on the effects of participating in a golf camp in pediatric congenital heart disease and obese populations; further studies may identify additional health benefits.

Table 1: Correlation of lipid indicators with other CVD risk factors

<table>
<thead>
<tr>
<th>Lipid Indicator</th>
<th>Body Weight</th>
<th>Body Fat</th>
<th>Waist Circumference</th>
<th>BMI</th>
<th>20-meter Pacer Score</th>
<th>MAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDL</td>
<td>−0.268**</td>
<td>−0.292**</td>
<td>−0.264</td>
<td>−0.239**</td>
<td>0.107</td>
<td>−0.032</td>
</tr>
<tr>
<td>LDL</td>
<td>0.035*</td>
<td>0.303*</td>
<td>0.309</td>
<td>0.334*</td>
<td>−0.151*</td>
<td>0.232**</td>
</tr>
<tr>
<td>Total Cholesterol</td>
<td>0.226**</td>
<td>0.265**</td>
<td>0.241**</td>
<td>0.268**</td>
<td>−0.132*</td>
<td>0.219**</td>
</tr>
<tr>
<td>*<em>p&lt;0.01 <em>p&lt;0.05</em></em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cardiovascular disease (CVD) is the leading cause of death in adults in the United States. A concern in U.S. children is the increasing rates of CVD risk factors (obesity, dyslipidemia and low cardiorespiratory fitness) which tend to track into adulthood and are related to premature morbidity and mortality. Specifically, high levels of low-density lipoprotein (LDL), total cholesterol and blood pressure, alongside low levels of high-density lipoprotein (HDL) and cardiorespiratory fitness, have been identified as risk factors for CVD. PURPOSE: To identify the association of several CVD risk factors from a pediatric population participating in (S)Partners for Health. METHODS: This cross-sectional study included 248 (151 female, 97 male, 9-13 year old students in 2008-2013, from Michigan, who participated in baseline measures for the (S)Partners for Health. Pearson correlations were used to evaluate if LDL, HDL or total cholesterol were directly associated with body weight, percent body fat, waist circumference, body mass index (BMI), mean arterial pressure (MAP) and aerobic performance (20-meter PACER score). RESULTS: There were significant, but weak, correlations among HDL, LDL, total cholesterol and body weight, body fat, waist circumference and BMI (Table 1). CONCLUSION: The weak associations between lipid indicators and CVD risk factors measured in (S)Partners for Health align with previous research. Future studies should investigate the modifiability of these variables and use factor analytic or profiling techniques to address the various measurement properties for this extensive CVD risk assessment battery to improve efficiency.
and body composition in male and female adolescents. METHODS: Thirty-six (6 male, 7 female, age 12.8 ± 0.7 years) adolescents completed an 8 week HIIT training program. HIIT training consisted of two 30 minute sessions a week (5 min warm up, 20 minute stimulus, 5 min cool down). During the stimulus period, subjects completed twenty 30 sec “on”, 30 sec “off” intervals. The initial “on” workload was set to be equivalent to 90% of maximal workload recorded during the VO2 max test, while the “off” workload was set to be equivalent to 50% of maximal workload. Intensities were adjusted during each session so that during the last 5 intervals was equivalent to at least 9 out of 10 on the Borg RPE scale. Enjoyment of physical activity (Physical Activity Enjoyment Scale, PACES), VO2 max and body composition were assessed before and after the training program. RESULTS: Response to the PACES improved 23% following HIIT training (Pre=52.3±3, Post=64.3±3, p=0.01). Similarly, VO2 max (18%) (Pre=26.7±2.0 ml kg⁻¹ min⁻¹, Post=31.6±2.7 ml kg⁻¹ min⁻¹, p=0.002) and maximal workload (5%) (Pre=184.5±14.1, Post=228.1±14.1, p=0.001) increased as a result of HIIT. In contrast, body fat (Pre=46.6±2.5%, Post=44.9±2.4%, p=0.001) was reduced following HIIT. CONCLUSION: The results of this investigation indicate that HIIT training elicits a more positive perception of exercise and beneficial adaptations in cardiovascular fitness and body composition. HIIT training appears to be a good option to develop positive lifelong physical activity habits in adolescents.

**2838 Board #121**

June 1 2:00 PM - 3:30 PM

**Effects Of A Weight Bearing Exercise Program On Bone Mineral Density Of Adolescent Female Athletes**

Kayla Daniel¹, Kelsey Conrad², Jaqueline Buell³, Julie Young¹, Lihong Huang¹, Anastasia Fischer, FACSM¹. ¹Nationwide Children’s Hospital, Columbus, OH. ²Ohio State University, Columbus, OH. (Sponsor: Anastasia Fischer, FACSM) (No relevant relationships reported)

**PURPOSE:** Bone Mineral Density (BMD) is a modifiable target of the Female Athlete Triad for intervention. Low BMD can be screened, prevented, and treated. In female adolescents, low BMD is associated with increased risk of fracture and development of osteoporosis. Weight bearing exercise interventions are proven to elicit a substantial bone mineral accrual advantage in childhood. The purpose of this study was to evaluate for a change in BMD in female adolescent athletes after a weight bearing physical activity intervention designed to optimize BMD and bone architecture.

**METHODS:** A convenience sample of 19 female high school athletes completed a Dual Energy X-Ray Absorptiometry (DEXA) scan and resting metabolic rate (RMR) as well as eating and activity questionnaires. Girls participated in a one hour program designed to improve BMD twice per week completing 16 sessions in 8-12 weeks. Following the program, girls completed a second DEXA scan. 12 months after the program, girls completed a third DEXA scan. Total Body Less Head (TBLH), lumbar spine, and Total Fat Free Mass (TFFM) were recorded. Energy availability (EA) was calculated using estimated energy intake from eating questionnaire and energy needs estimated using the activity questionnaire added to their RMR. Girls were diagnosed with decreased EA if they consumed <30kcal/kg FFM per day. Repeated measures ANOVAs were run to examine differences between BMD between three time points.

**RESULTS:** Average age at the beginning of the study was 16.3±1.19. Fourteen girls were tested immediately after the exercise program and 8 one year after the program. There were no differences in RPE during bar spine or TFFM (p=0.22, p=0.23, p=0.09 respectively) over the program. Girls with decreased EA did not accrue BMD (p=.29 respectively) over the program. There were no differences in TBLH, lumbar spine, or TFFM (p=.22, p=.23, p=.29) respectively) over the program. Girls with decreased EA did not accrue BMD following a weight bearing exercise program.

**CONCLUSIONS:** C had more %MPA during TG (29.4 ± 9.8) than JG (17.4 ± 6.5). [Jumping games]: P had more % VPA in JG (29.4 ± 9.6) when compared to BRISK (00.0 ± 00.0). BWE (13.3 ± 6.3), and TG (4.5 ± 5.3). C had more %VPA during TG (45.9 ± 23.7) than JG (17.4 ± 6.5). [Jumping games]: P had more % VPA in JG (29.4 ± 9.6) when compared to BRISK (00.0 ± 00.0). BWE (13.3 ± 6.3), and TG (4.5 ± 5.3). C had more %VPA during TG (45.9 ± 23.7) than JG (17.4 ± 6.5). [Jumping games]: P had more % VPA in JG (29.4 ± 9.6) when compared to BRISK (00.0 ± 00.0). BWE (13.3 ± 6.3), and TG (4.5 ± 5.3).

**CONCLUSIONS:** C spent significantly more time in VPA during all 5 PAs when compared to P. However, P spent significantly more time in MPA during BRISK, JG, and TG than C. For both P and C, JG had the most VPA when compared to the C. These findings can be used to plan future PA interventions for P and C exercising together.

**2840 Board #123**

June 1 2:00 PM - 3:30 PM

**The Contribution Of A Community-Based Gym And Aquatics Program To Physical Activity In Children**

Mark R. Scudder, Nei P. Sharma, Sharon E. Taunovo Ross, John M. Jakicic, FACSM. University of Pittsburgh, Pittsburgh, PA. (No relevant relationships reported)

**PURPOSE:** To compare physical activity in children accumulated from gym and aquatic instruction during a 2-hour community-based physical activity program. **METHODS:** The community-based program consisted of a summer weekday program and a fall Saturday program, with each program including both a gym and aquatics component. Each program served approximately 60-85 boys and girls 3-13 years of age. Observations were conducted over 10-12 sessions for each program to quantify the amount of physical activity engagement. Observations included use of the System for Observing Fitness Instruction Time (SOFIT) to quantify children’s physical activity (e.g., sedentary vs. ‘very active’) and the context of the program (e.g., skill practice vs. free play). SOFIT observations were made by two trained observers, and the inter-rater reliability was greater than 90%. Physical activity and context variables were subjected to linear mixed model analyses, with type of instruction entered as a fixed factor, and multiple observations of the same age or skill group entered as a repeated factor.

**RESULTS:** Gym and aquatic instruction each contributed approximately 25 min of moderate-to-vigorous physical activity, with the proportion of time spent in moderate-to-vigorous physical activity not statistically different during aquatic vs. gym sessions (53.4% vs. 49.0%, p=0.09). Compared to the gym session, however, the aquatic session resulted in less time sitting (4.8% vs. 17.2%) and more time ‘very active’ (25.1% vs. 13.9%, p=0.001), as well as higher estimated energy expenditure (0.087 vs. 0.07 kcal/min, p<0.001). Compared with the gym, children spent less time in management contexts (i.e., breaks and transitions; 15.9% vs. 30.2%, p<0.001) and more time in free play (10.7% vs. 0.7%, p<0.001) during the aquatic sessions. **CONCLUSIONS:** The results suggest that these types of programs can be effective at engaging children in physical activity during out-of-school time, with the data from the aquatic sessions of particular interest. Additional research is needed to examine whether these results are consistent across different community-based programs and with varying skill level of program instructors, and whether the physical activity achieved with these programs provides health-related benefits in children.

**2841 Board #124**

June 1 2:00 PM - 3:30 PM

**Physical Activity Enjoyment in Different Physical Activities in Parent-Child Dyads When They Exercise Together**

Noelle Merchant¹, Patrick Filanowski¹, Ronald J. Iannotti², Sarah M. Camhi³, Jessica A. Whiteley¹, Laurie Milliken, FACSM¹. ¹University of Massachusetts Boston, Boston, MA. ²CDM Group, Inc., Bethesda, MD. (Sponsor: Laurie Milliken, FACSM) (No relevant relationships reported)

**PURPOSE:** To objectively measure and compare the intensity of 5 physical activities completed by parent-child dyads. **METHODS:** Thirteen parent-child dyads (parents mean age = 37.1 ± 7.5 yrs, children mean age = 6.6 ± 1.8 yrs) participated in physical activity (PA) sessions facilitated by trained research assistants. The 6-point Visual Analog Scale (VAS), with 1 meaning ‘like it very much’ and 6 meaning ‘don’t like it at all’, was used to assess independent t-tests were used to compare PA between P and C. A repeated measures ANOVA was used to compare PA across 5 different PAs, separately for P and C. Alpha was set at p = 0.05.

**RESULTS:** [P versus C]: C had more %VPA than P during BRISK (mean difference: 15.8 ± 23.1), JG (21.2 ± 0.1), D (16.2 ± 12.0), and TG (24.7 ± 7.6). P had more %MPA than C during BRISK (mean difference: 22.2 ± 4.9), JG (10.8 ± 3.1), and TG (12.3 ± 0.5). [Brisk walking]: BRISK (68.1 ± 18.8) resulted in more time spent in %MPA for P when compared to C (28.2 ± 36.6), BWE (31.0 ± 25.8), D (39.7 ± 19.3), and TG (41.7 ± 10.3). C had more %MPA during BRISK (45.9 ± 23.7) than JG (17.4 ± 6.5). [Jumping games]: P had more % VPA in JG (29.4 ± 9.6) when compared to BRISK (00.0 ± 00.0). BWE (13.3 ± 6.3), and TG (4.5 ± 5.3). C had more %VPA during TG (45.9 ± 23.7) than JG (17.4 ± 6.5). [Jumping games]: P had more % VPA in JG (29.4 ± 9.6) when compared to BRISK (00.0 ± 00.0). BWE (13.3 ± 6.3), and TG (4.5 ± 5.3). C had more %VPA during TG (45.9 ± 23.7) than JG (17.4 ± 6.5). [Jumping games]: P had more % VPA in JG (29.4 ± 9.6) when compared to BRISK (00.0 ± 00.0). BWE (13.3 ± 6.3), and TG (4.5 ± 5.3).
participants’ enjoyment of each PA during the PA sessions. Each parent child dyad completed 5 different PA’s together (brisk walking, jumping games, dancing, bodyweight exercises, and tag games) in random order for 8 minutes each. Immediately after completion of each of the 5 PA’s, research assistants provided the VAS to the parent and child, independently, and asked them to indicate their enjoyment rating of the preceding PA. A Mann-Whitney U test was used to compare enjoyment of the 5 different PA’s between parents and children, with a significance level set at p < 0.05. Friedman tests were used to compare the differences in enjoyment of the activities separately for parents and children. Post hoc analyses with Wilcoxon signed-rank tests were conducted with Bonferroni corrections applied, resulting in a significance level set at p < 0.0125 to compensate for multiple comparisons.

RESULTS: Parent’s enjoyment was significantly higher for dancing compared to children’s (parents mean = 4.30 ± 0.87, children’s mean = 3.00 ± 1.58, U = 34.5, p = 0.007). When comparing PA’s performed by parents, parents enjoyed tag games (mean = 1.31 ± 0.48) significantly more than brisk walking (mean = 2.38 ± 1.21, Z = 2.547, p = 0.011) and body-weight exercises (mean = 2.77 ± 1.36, Z = -2.859, p = 0.004). When comparing activities performed by children, children enjoyed tag games (mean = 1.23 ± 0.59) significantly more than dancing (mean = 3.00 ± 1.58, Z = -2.825, p = 0.005).

CONCLUSION: Both parents and children enjoyed tag games the most, when compared to the other 5 PA’s. These results could aid future PA programming and interventions when recommending activities for families to complete together. Future studies should investigate if varying enjoyment levels of parent-child dyads could impact the likelihood that they would exercise together where enjoyment levels are not matched.

2842 Board #125 June 1 2:00 PM - 3:30 PM Effects Of An Educational, Nutritional And Recreational Camp Intervention In Health Parameters In Overweight Children Carmen Silvia Grubert Campbell1, Suliane Beatriz Ruaber2, Henrique Lima Ribeiro1, Isabella Reis Praça1, Joyce Bomfim Vicente1, Geiziane Melo1, Zelia Vargas dos Reis1, Valeria Pedrosa1, Pablo Cidelino1, Daniel Fernandes Barbosa1, Eric Vale1, Alison Luiz Aquino da Silva1, Herbert Gustavo Simões2, 1Catholic University of Brasilia, Brasilia, Brazil. 2Catholic University of Brasilia, Aquiras Claras, Brazil.

(No relevant relationships reported)

PURPOSE: To investigate the impact of a Health Educational Program for Children (HEPchild) composed of 5 days of Camp (KIDS) and 12-weeks of follow-up (FOU) on the Physical Activity Level (PAL), Sedentary Behavior (SB), Anthropometric data and Food Intake (FI) in overweight children. METHODS: Twelve children attended the HEPchild program which consisted of pre-assessments, KIDS and 12 weeks of FOU. The PAL, SB and FI were assessed through questionnaires. RESULTS: The anthropometric were reduced (p<0.05) after KIDS which was maintained at the 12 weeks of FOU. After the FOU, children increased (p<0.05) the mean level of physical activity by 344 METs/week. In addition 25% of the children became more active (>1500 and <3000METs/week) after FOU in comparison to pre KIDS. On the other hand, the amount of sedentary children (>600METs/week) decreased by 15% and the insufficiently active (600 at 1500METs/week) per week) increased by 15%. The PAL leisure time increased significantly throughout the weekdays (26.0%) and the weekends (14.1%) after FOU comparing to pre KIDS. The SB showed a significant reduction in 177.14 and 41.43 minutes along the weekdays and the weekends respectively. Before KIDS, the consumption of sugars and candies were out of control (100% inadequate), and, after the intervention, 58.4% were conducted with Bonferroni corrections applied, resulting in a significance level set at p < 0.05.

2843 Board #126 June 1 2:00 PM - 3:30 PM Six-month Sustained Improvement In Motor Proficiency In Youth After A 24-week Home-based Intervention Daniela A. Rubin, FACSM1, Kathleen S. Wilson1, Debra J. Rose1, Marilyn Dumont-Driscoll2. 1California State University Fullerton, Fullerton, CA. 2University of Florida Gainesville, Gainesville, FL.

(No relevant relationships reported)

PURPOSE: Motor proficiency and physical activity (PA) levels are below average in youth with Prader-Willi syndrome (PWS), a rare neurodevelopmental disorder causing motor, behavioral, and medical challenges. This study aimed to determine if participation in a 24-week parent-led PA intervention led to sustained improvement in gross motor proficiency (MP) in youth with and without PWS.

METHODS: Participants included 107 youth ages 8-16 with or without PWS but categorized as obese, assigned to an intervention group or to a wait-list control group. After serving as controls, the wait-list group received the intervention. Follow-up assessments were then conducted six months post intervention. The home-based PA program included playground and interactive game consoles scheduled 4 days a week. Training and program materials were provided to families at baseline to guide implementation of the program. Gross MP (Bruininks-Oseretsky Test of Motor Proficiency body coordination and strength and agility subtests) was obtained at baseline (pre), after 24 weeks of participating in the intervention (post) and at 6-month FU. Scale scores are reported (Mean ± SE). Intent-to-treat analyses were conducted.

RESULTS: All youth demonstrated improved upper-limb coordination, bilateral coordination, balance, running speed and agility, and muscular strength at post (p<0.004 for all). At FU all youth maintained improvements in bilateral coordination (pre=9.3±0.4, post=12.0±0.5, FU=11.6±0.5), speed and agility (pre=9.2±0.4, post=10.8±1.0, FU=11.4±0.5), p<0.05. At FU all youth maintained improvements in upper-limb coordination (pre=10.7±0.5, post=12.2±0.6, FU=12.1±0.8) balance (pre=8.1±0.3, post=9.3±0.4, FU=9.2±0.5) and strength (pre=8.0±0.3, post=9.0±0.4, FU=9.0±0.5), but the FU scores for these tests showed a slight decrease such that they were no longer significantly different from baseline (p<0.05).

CONCLUSIONS: This parent-led game-based PA program resulted in immediate positive changes in gross MP in youth with and without PWS with improvements maintained for six months post intervention. Participation in a PA routine emphasizing motor skill development at home shows promise in leading to sustained improvements in MP in obese youth and in youth with PWS. Funded by USAMRAA W81XWH-11-1-0765

2844 Board #127 June 1 2:00 PM - 3:30 PM Are Graded Task-based Interventions The New Remedy For Unfit Overweight And Obese Female Adolescents? Emmanuel Bonney, Gillian Ferguson, Bouwien Smits-Engelsman. University of Cape Town, Cape Town, South Africa.

(No relevant relationships reported)

Promotion of physical activity and fitness in adolescent girls who are physically unfit and have less opportunity to practice remains a challenge, particularly in low income communities. It is therefore critical to identify new methods for increasing fitness in this population.

Purpose: To determine the efficacy of two graded task-based interventions in improving neuromotor fitness among adolescent girls.

Methods: Fifty-six female adolescents (14±0.9years) classified as overweight or obesity participated in the study. Participants were randomly allocated to receive either the graded Wii exercises or task-based functional exercise and attended weekly 45min exercise sessions for 14 weeks. During the training period, the participants received supervised exercise training that was systematically graded with simple objects such as sandbags and plastic bottles over 14 sessions. Outcome measures included motor competence, lower extremity muscular strength (both isometric and functional strength), aerobic and anaerobic fitness. Data on enjoyment and ratings of perceived exertion were collected for each session. A repeated measure ANOVA was used to analyse data with significance level set at p<0.05.

Results: At the end of the intervention, it was observed that both groups had significant improvement in motor competence [F(1,54)=4.065, p=0.045], lower extremity muscular strength (isometric strength) [F(1,54)=92.470, p=0.001], lower extremity muscular strength (functional strength) [F(1,54)=15.993, p=0.001], aerobic [F(1,54)=5.586, p=0.022] and anaerobic fitness [F(1,54)=45.792, p=0.001]. Though the two interventions were equally considered to be enjoyable by the participants, there was no difference in outcomes for the two groups.

Conclusions: The two graded task-based interventions may be useful for increasing neuromotor fitness in this population. People working with girls in this age group could implement either of the two depending available resources. We recommend the adoption of these interventions for physical education and/or fitness promotion programmes among girls in low income settings.

Abstracts were prepared by the authors and printed as submitted.
Type II diabetes is a concern in the United States, and risk factors that contribute to this disease are largely mediated by lifestyle interventions. Identification of those at high risk for type II diabetes and implementation of risk reduction behaviors may prevent onset of the disease. PURPOSE: To investigate the effect education on the perceived risk of type II diabetes and intent to adopt healthier lifestyles in traditional-age college students. METHODS: 29 participants provided demographic information, physical activity level, anthropometric measures, and completed the Risk Perception Survey-Developing Diabetes (RPS-DD), perceived risk of diabetes visual-analogue scale (PRD-VAS), and the diabetes risk calculator (DRC), with 17 of these participants also providing information on their intent to change fitness behaviors. RESULTS: RMANOVA's assessed changes across time in the RPS-DD and PRD-VAS. Kendall’s tau-B correlations were conducted to examine relationships between the abovementioned variables. Data analysis showed six participants at high risk for prediabetes and 12 with at least one risk factor for metabolic syndrome. RPS-DD risk and RPS-DD knowledge scores did not change, but analysis of the PRD-VAS indicated a significant change across time (p < 0.01). The DRC did not correlate with prediabetes or metabolic syndrome. Significant interactions between prediabetes status and perceived risk (p = 0.04), but not between prediabetes risk and intent to adopt healthier lifestyle (p = 0.42) were shown, and between metabolic syndrome and prediabetes risk (p = 0.03), as well as criteria for both diseases, excluding HbA1c (p = 0.15). CONCLUSIONS: Students in this study possessed many risk factors for developing type II diabetes. Those at high risk for such diseases demonstrated an understanding of their risk, but did not express an intent to modify their lifestyle behaviors. Further, the noninvasive prediabetes and diabetes risk calculator did not consistently identify these diseases in this population. Research should be dedicated to determining how to change perceived risk of developing type II diabetes, methods of promoting healthier lifestyles, and development of a validated noninvasive instrument for use among traditional-age college students.

PURPOSE: Use of a theoretical framework can offer implications for physical activity (PA) intervention. College students represent a population which might benefit from theoretically-grounded PA interventions. This study investigated the associations among Chinese college students’ Social Cognitive Theory-based beliefs, PA levels, and relevant health outcomes while also examining if sex were present for any outcome. METHODS: In June of 2017, 220 college students (115 females; M = 20.29 ± 2.37) were recruited from a South Central Chinese University. Students’ PA-related Social Cognitive beliefs (i.e., self-efficacy, enjoyment, family support, friends support, and environment) were assessed using a validated questionnaire. One-week PA levels were recorded via ActiGraph Link accelerometers. Finally, body fat percentage and objective health status were evaluated using the InBody 230 Monitor whereas cardiovascular fitness was assessed via the 3-Minute Step Test. RESULTS: Correlation analyses indicated both self-efficacy and environment factors were significantly related to family/friends’ support and enjoyment (r range: 0.11 - 0.48, p = 0.05), and that friends’ support were highly related to family support (p < 0.01). Interestingly, regression analyses revealed self-efficacy to negatively predict average MVPA per day (β = −0.21, p < 0.01) but, as expected, that a lower body fat percentage was predictive of improved objective health (β = 0.17, p < 0.05). Finally, significant sex differences were observed for average MVPA per day, F(1, 213) = 22.2, p < 0.01, η2 = 0.07, PA self-efficacy F(1, 217) = 6.5, p < 0.01, η2 = 0.03, and PA enjoyment F(1, 217) = 3.9, p = 0.05, η2 = 0.02, whereas males demonstrated higher values for all three outcomes. No other sex differences were observed. CONCLUSIONS: Findings suggest that male and female Chinese college students differ with regard to MVPA per day in addition to PA-related self-efficacy and enjoyment. As self-efficacy and enjoyment are predictive of long-term PA participation, PA interventions among college students, particularly females, are needed targeting these Social Cognitive beliefs to improve various health outcomes such as body fat percentage and cardiovascular fitness.
PURPOSE: In previous studies, a variety of scales were used to evaluate physical activity intensity among children, such as the Children’s Effort Rating Table and OMNI Scale of Perceived Exertion scale. However, most of the Perceived Exertion Scales are only applicable to children over six years old. Therefore, it is necessary to design a Perceived Exertion Scale of Physical Activity Intensity for Chinese Preschool Children (PESP). METHODS: The draft scale was designed according to the children’s Perceived Exertion Scales and the Observer Evaluation Scale of Physical Activity Intensity for Preschool Children of our previous research. A Zephyr monitor and an ActiGraph triaxial accelerometer were used to measure physical activity of 116 children. The children completed the PESP. The revision of the scale was based on the heart rate, Count value and children’s feedback. Finally, the reliability and validity of the final scale were analyzed by SPSS Statistics 13.0. RESULTS: The PESP utilizes cartoon images for the items and contains 6 options. Each option includes a children’s cartoon image, a ribbon and description language. Some children questioned the image of gender and minority characteristics. Thus, the revision of the scale was based on that. There was very significant difference between each option index (P<.01). It is indicated that the PESP can reflect the changes of different activity intensity of preschool children. There was a strong correlation between the scale scores in the first test and second test (r=0.82, P<.01), indicating that the scale has high reliability. The scale scores of preschool children had a moderate correlation with heart rate only during high intensity activity. It is indicated that the correlation between scale scores and objective indexes is related to the physical activity intensity. When all the data were analyzed, it was found that there was a strong correlation between the scale scores and heart rate(r=0.60, P<.01), indicating that the scale has good validity. CONCLUSIONS: The PESP utilizes cartoon images for the items and contains 6 options. The PESP has good reliability and validity, which indicates that the scale can be used to evaluate the preschool children’s physical activity intensity. The scale is more applicable to evaluate high intensity physical activity.

PURPOSE: Asthma is the most common chronic respiratory disease among children in the US, and may be a barrier to physical activity due to breathlessness and chest tightness. The purpose of this study was to determine if airway function was influenced by moderate to vigorous physical activity (MVPA) in asthmatic children over one week. It was hypothesized that as minutes of MVPA increased, peak expiratory flow (PEF) would increase. It was also hypothesized that the correlation between chest tightness and MVPA would be stronger when the PA level was lower. RESULTS: The participants included both third (n=45) and fourth grade (n=63) children. In asthmatic patients, PEF has been reported to correlate with forced expiratory volume in 1-sec (FEV1). Objective MVPA was recorded daily with hip-worn Actigraph GT3X accelerometers from 0845-1125 and 1445-1625 at 5s epochs. Minutes of MVPA were calculated using validated child cut-points. Pearson correlations were used to examine relationships between minutes of MVPA and PEF. There was very significant difference between each option index (P<.01). It is indicated that the PESP can reflect the changes of different activity intensity of preschool children. There was a strong correlation between the scale scores in the first test and second test (r=0.82, P<.01), indicating that the scale has high reliability. The scale scores of preschool children had a moderate correlation with heart rate only during high intensity activity. It is indicated that the correlation between scale scores and objective indexes is related to the physical activity intensity. When all the data were analyzed, it was found that there was a strong correlation between the scale scores and heart rate(r=0.60, P<.01), indicating that the scale has good validity. CONCLUSIONS: The PESP utilizes cartoon images for the items and contains 6 options. The PESP has good reliability and validity, which indicates that the scale can be used to evaluate the preschool children’s physical activity intensity. The scale is more applicable to evaluate high intensity physical activity.

PURPOSE: Almost 17% of Latino preschool children are obese, which is far higher than their racial/ethnic counterparts. To address the key behaviors associated with childhood obesity, the 5-2-1-0 message was developed (<= 5 servings of fruits and vegetables [F/V], <= 2 hours of recreational screen time, >= 1 hour of physical activity [PA], and zero sugary drinks per day). In this study, we examined baseline data from ANDALE Pittsburgh, a culturally-tailored obesity prevention program, to determine whether or not Latino preschool children were meeting recommendations from the 5-2-1-0 message. METHODS: N=51 parents (33.5±6.1 years) with preschool-aged children (3.5±1.2 years, 59% female) were recruited from community venues in Southwestern Pennsylvania. Screen time (parent survey; n=51), F/V and sugary beverage consumption (food screener; n=51), and PA (accelerometry; n=22) were assessed. For analysis, we used PA guidelines from the Institute of Medicine (IOM) recommendations for preschool children (<15 min/hour of total daily physical activity). Sociodemographic and home factors related to the 5-2-1-0 message were assessed using a parent survey. A trained researcher measured child height and weight to calculate body mass index and percentiles. We calculated descriptive statistics (mean (SD) and frequencies (n)) in SPSS version 25.0. RESULTS: Most parents were Mexican (63%), stay-at-home caregivers (71%), completed high school or less (55%), and had low acculturation (86%). On average, children consumed 2.25± 1.64 servings/day of F/V, consumed 15.5± 5.26 kcal/day from sugary drinks, accumulated 12.9± 2.9 min/hr of total PA, watched 98.7± 74.2 min/ day of screen time, and 46% were overweight or obese. Only 6% of children met the F/V recommendation, 54% met screen time recommendations, 27% met the IOM PA recommendations, and 38% met the sugary drinks guideline. CONCLUSIONS: In this community sample of Latino preschool children, nearly half were overweight/obese and few were meeting recommendations from the 5-2-1-0 message; this suggests our sample is comparable or worse off than the general U.S. preschool population for these key behaviors. Efforts are needed to effectively intervene and improve 5-2-1-0 behaviors associated with excessive weight gain in Latino preschool children.

A Multi-Level Analysis of the Effects of Epoch Length on Children’s Physical Activity Pattern
Han Chen. Valdosta State University, Valdosta, GA.

PURPOSE: The new generation ActiGraph GT3X+ accelerometer, the study examined the effects of different epoch lengths on children’s moderate to vigorous physical activity (MVPA) generated by the different cut points while monitoring them during activity classes. The study also tested the moderating effects of physical activity (PA) level on the relationship between epoch length and MVPA. METHODS: The participants included both third (n = 28) and fourth grade (n = 25) students. Students in third grade participated in a Sports, Play, and Active Recreation for Kids (SPARK PE) class while the fourth graders were engaged in an active video game (AVG) class. Data were downloaded using 1s, 5s, 10s, 15s, 30s, and 60s epoch lengths. MVPA was determined by five different cut points. Multi-level analyses were conducted to test the effects of level 1 (i.e., epoch length) and level 2 (i.e., gender, body mass index [BMI], and class content) variables on MVPA. The study also examined the moderating effects of level 2 variables on the relationship between epoch length and MVPA. RESULTS: When lower cut points suggested by Freedson (2005), Evenson (2008), and Pulsford (2011) were used, MVPA increased, followed by the increase of epoch lengths. This positive relationship between epoch length and MVPA was stronger when the PA level was higher. When MVPA was determined by higher cut points suggested by Puya (2002) and Mattuckos (2007), epoch length was found to negatively relate to MVPA, and this relationship was stronger when the PA level was lower. Conclusions: Different epoch lengths generate various MVPA levels, and the relationship between epoch length and MVPA is moderated by PA levels.
Traditional real-time direct observation (DO) systems have been used for decades to assess children’s free-living physical activity (PA). Using video-taped DO would overcome several methodological issues and allow for more precise assessments of behaviors. **PURPOSE:** To develop and test a novel video-based DO system for children’s free-play activity.

**METHODS:** Following iterative DO system development (The Observer XT, Noldus), 28 children (age 8-4.1.5 years) participated in a 30-minute indoor free-play session. The participants were recorded using a GoPro camera and wore an accelerometer on the hip (AG-H) and non-dominant wrist (AG-W). Researchers coded videos for the main Whole-Body Movement and four modifiers: 1) Locomotion, 2) Limb Movement, 3) Activity Type, and 4) Intensity value. For interrater reliability, percent agreement was calculated from six randomly selected videos, using duplicate entries by an expert coder one-week apart. For inter-rater reliability, three videos were used to calculate percent agreement between entries from trained, novice coders (n=6) and the expert coder. To assess construct validity, time spent in activity intensity categories from expert-coded DO MET values were compared with accelerometer estimates using Wilcoxon Rank-Sum tests.

**RESULTS:** Percent agreement for in-rater reliability was above 80% except for Locomotion (47%; video 4, 26%; video 3) and Limb Movement, and MET value (19%, 78%, respectively; video 3). Across all variables, percent agreement for interrater reliability ranged widely from 12%-96%, 0-100%, and 36%-97% for videos 1, 2, and 3, respectively. Mean estimated time spent in PA intensity categories from AG-H overestimated sedentary (SED; p=0.008), moderate (MPA; p<0.001), and moderate-to-vigorous PA (MVPA; p=0.017) and underestimated light (LPA; p<0.001). The AG-W underestimated SED (p=0.03) and LPA (p=0.001) but overestimated MPA (p<0.001) and MVPA (p<0.001).

**CONCLUSIONS:** The current DO system is feasible for observing detailed changes in children’s free-play activity. However, refinement to the system must be made to improve reliability before it is adopted as a criterion measure for free-play activity in children. Supported by: University of Massachusetts Amherst Commonwealth Honors College

**2855 Board #138 June 1 2:00 PM - 3:30 PM Teaching Styles in Physical Education: The Effects on Physical Activity Levels of Middle School Students with Different Motivation Types**

**Youngju Hwang**, Jooyeon Jin. **University of Wisconsin-La crosse, Onalaska, WI**. **University of Seoul, Seoul, Korea, Republic of.**

(No relevant relationships reported)

**PURPOSE:** Self-determination theory (SDT) has been widely investigated as a powerful theoretical framework to understand and change an individual’s physical activity behavior in different settings (Deci & Ryan, 1985; De Meyer et al., 2016). However, there is a limited understanding on how entire SDT explains objectively measured moderate to vigorous physical activity (MVPA) levels of adolescents in physical education lessons. To examine if physical educators’ teaching style influences student needs that affect student motivation, which in turn predict objectively measured student MVPA levels (i.e., a serial mediator model).

**METHODS:** A total of 313 students from three middle schools in Wisconsin completed learning Climate Questionnaire modified from Williams and Deci (1998). Psychological Need Scale and Need Frustration Scale adopted from Chen et al. (2015), and Physical Education Questionnaire modified from (Aelterman et al., 2012) to assess perceptions of autonomy-supportive teaching, experience of need satisfaction and need frustration, and motivational outcomes, respectively. After a week of the survey administration, participants’ MVPA levels were recorded using a GT3X+ accelerometer for four consecutive physical education lessons. PROCESS, a regression-based computational procedure program designed for mediation analyses in SPSS, was used to examine the mediating relationships.

**RESULTS:** Bootstrapping with 10000 samples showed that autonomous teaching behavior significantly influence MVPA levels through related satisfaction and intrinsic motivation (β = .79; 95% CI: -.39 - .135), autonomous teaching behavior significantly influence MVPA levels through competence satisfaction and intrinsic motivation (β = 1.17; 95% CI: .69 - 1.77), and autonomous teaching behavior significantly influence MVPA levels through competence satisfaction and identified regulation (β = 1.33; 95% CI: .83 - 1.99). In addition, bootstrapping with 10000 samples revealed that controlling teaching behavior significantly affects MVPA levels through autonomy frustration and amotivation (β = -.49; 95% CI: -1.03 - -.08).

**CONCLUSIONS:** The findings indicates that an autonomy-supportive teaching style may promote MVPA levels of middle school students during physical education lessons.
CONCLUSIONS: This study found statistically significant correlations with GRIT score, age related GRIT score, and breakfast frequency. Results related to physical activity may have been related to social desirability responses. GRIT related to age is likely related to the required academic achievement of Post-Secondary Education Option students. Gender identification was not included in the survey to protect anonymity. Gender identification may change the correlation factors that were found.

2857 Board #140 June 1 2:00 PM - 3:30 PM Changes In Student Perceptions of Interdisciplinary Collaboration After Community Health Fair Volunteer Experiences Mary C. Stenson, Mark Glen, Nicole Lang, Julie Strelow. College of St. Benedict/ St. John’s University, Saint Joseph, MN. (No relevant relationships reported)

PURPOSE: The purpose of this study was to identify student perceptions of interdisciplinary collaboration in healthcare professions before and after community health fair experiences. METHODS: Three community health fairs provided an opportunity to introduce pre-healthcare students to interdisciplinary collaboration. A descriptive, mixed-methods design was used with an interdisciplinary convenience sample of pre-healthcare college students who identified as exercise science, Integrative Health Science, nursing, and nutrition majors. Surveys were conducted before and after the health fairs using a 7 item scale developed by Gallagher et al. (2010) and open-ended questions developed by the researchers that measured the impact of the collaborative experience. RESULTS: A significant increase was observed in knowledge of community agencies that can provide optimum care (Δ=0.67; p<0.01), knowledge of the value of an interdisciplinary healthcare team (Δ=0.85; p<0.000), knowledge of strengths and skills of other disciplines (Δ=0.69; p<0.05; Δ=0.00), and experience working with healthcare teams (Δ=0.97; p=0.003). Students more strongly agreed that other members of the healthcare team are important to their work after the health fair experiences than before (Δ=-2.87; p<0.000). No significant change was found in attitudes towards the importance of communication between team members (Δ=0.73; p=0.01; Δ=-0.32) or learning from other professionals (Δ=0.08; Δ=-1.03; p=0.06). In open ended responses students indicated that they were motivated to learn about other healthcare disciplines to improve patient/client care and they experienced challenges in applying the professional values they perceive as important. CONCLUSION: Students increased their knowledge of the value of an interdisciplinary healthcare team. Students recognized the importance of interdisciplinary collaboration, but engaged in collaboration to varying degrees. The health fairs provided an intentional, foundational experience to support development as future healthcare professionals and effective members of interdisciplinary teams. Using skills in a real-world setting helped students recognize their strengths and areas where their interdisciplinary teamwork skills may need improvement.

2858 Board #141 June 1 2:00 PM - 3:30 PM Who Are the Undergraduate Equestrians in the Intercollegiate Horsecrosses Association, and What Are Their Lifestyle Habits? Jessie Bitler, Helen Battisti, Shelley Yeager, Diane DellaValle. Marywood University, Scranton, PA. (No relevant relationships reported)

Purpose: Given there is little available research on equestrian athletes, and none about the members of the Intercollegiate Horse Shows Association (IHSA), the purpose of this cross-sectional study was to describe demographic characteristics and lifestyle habits of undergraduate student members of the IHSA. Method: Participants included 528 undergraduate student members from the eight zones of the IHSA (Age 20.30 ± 1.43 years, 96 % female, 91.7 % white). Participants completed an online survey including demographic characteristics, academics, years of riding experience, sleep, physical activity, fruit and vegetable intake, and alcohol (ETOH) and tobacco use. Body Mass Index (BMI) was calculated based on self-reported height and weight. Participants were divided into two groups (less experience and more experience) based on the sample means of 12 years of riding experience. Independent-samples t test and Chi-Square test of independence were used to assess differences between years of riding experience for characteristics and lifestyle habits. Results: Participants reported 11.7±4.5 years of riding experience, 55.7 % did not own their own horse and 64.8 % rode English. Mean GPA of participants was 3.48±0.4 and 46.4 % reported majoring in math, science, animal sciences. There were no significant differences found between riding experience groups and BMI (23.2±3.7 kg/m²), alcohol consumption (34.3 reported none, 46.6 % reported <1 serving ETOH per day), cigarette smoking (98.1 % non-smokers), fruit consumption (83.6 % reported 1-3 servings/day), vegetable consumption (82.8 % reported 1-3 servings/day), and hours of sleep per night (84.6 % reported 6-8 hours). There were also no significant differences in physical activity within sport (44.1 % reported 30-60 min/day), vigorous physical activity outside of sport (39.9 % reported 0.30 min/day), and light activity outside of sport (68.4 % reported 15-60 min/day).

Conclusion: There were no differences between riding experience groups and demographics or lifestyle habits in this representative sample of undergraduate members of the IHSA. Given that this study is the first description of nutrition and physical activity habits of this understudied population, it opens the door to further research in this highly-trained group of equestrian athletes.

2859 Board #142 June 1 2:00 PM - 3:30 PM Mid-term Effectiveness Of An Unsupervised Exercise Prescription Program In Breast Cancer Survivors Gabriele Mascherini, Benedetta Tosi, Leonardo Osti, Giorgio Galanti. University of Florence, Florence, Italy. (No relevant relationships reported)

Purpose: The efficacy of physical exercise prescription as therapy in breast cancer survivors is largely documented in literature. Unsupervised exercise produces short-term improvements in physical fitness of breast cancer survivors, but regarding the mid-term effectiveness only few studies are available. The purpose of this study was to assess the effects of an unsupervised exercise prescription program on body composition, physical fitness and Health Related Quality of Life of breast cancer survivors. Methods: Forty-two (average age 52.0±10.1 years) women were enrolled. Assessments performed at baseline and after 6 months of exercise prescription: body composition (anthropometric parameters and bioimpedance analysis), physical fitness: aerobic capacity by Six-Minute Walk Test (6 MWT), limbs strength by Hand Grip Test and Chair Stand Test, flexibility by Sit and Reach Test; TOGLIERE PRESSIONI - Health Related Quality of Life (SF-36). Statistical analysis was conducted by Student’s t-tests and multiple regression. Results: Body composition improvements: BMI (Δ=0.69±1.3; p<0.001), waist circumference (Δ=90.2±18.7; p<0.001), extracellular water (Δ=17.5±1.9; p<0.001), - fat mass (Δ=25.0±8.1; p<0.001), physical fitness improvements: - 6 MWT (Δ=584.8±197.2; p<0.001), - Hand Grip (Δ=24.3±4.8; p<0.001), - Chair Test (Δ=14.5±3.8; p<0.001), - 3-repetitions (Δ=0.001), - Sit and Reach (Δ=2.6±9.3; p<0.001), - 8.5±7.1 cm; p<0.001). Health Related Quality of Life improvements: - Physical Functioning (Δ=0.67±20.4; p<0.001), - Role Physical (Δ=0.67±20.4; p<0.001), - Social Functioning (Δ=69.1±18.9%; p<0.001), - General Health (Δ=0.85; p<0.001), - Mental Health (Δ=63.4±14.8; p<0.001), - Energy and Vitality (Δ=0.85; p<0.001), - Social Functioning (Δ=69.1±18.9%; p<0.001). The percentage change in fat mass has been associated with adjuvant cancer therapy (intercept=-0.016; β=6.829; p<0.005). Conclusions: An unsupervised exercise prescription program improves body composition, physical fitness, and Health Related Quality of Life in breast cancer survivors. Longer term follow-up studies to establish the real capacity of this program to induce long-term changes in lifestyle are needed.
shoulder range of motion (SRM; measured by back scratch test); aerobic endurance (AE; 2-minute step test); and mobility and balance (MB; up and go test), were assessed at baseline and 12 months for cancer survival patients. RESULTS: Baseline t-tests revealed no significant differences in HCL, HLDL, HDL, and CRF from pre- to post-test (all p > 0.05). However, significant changes in CRF were observed (p < 0.05, Cohen’s d = 0.38) at 12-months. Moreover, functional fitness (LBF) (p = 0.05, Cohen’s d = 0.55) and MB (p = 0.01, Cohen’s d = 0.67) significantly improved after the intervention. Notably, patients’ AE (M = 92.26, p = 0.01, Cohen’s d = 1.26) demonstrated the greatest improvements among all outcomes.

CONCLUSIONS: A 12-month smart watch-based PA intervention may promote improved biomarkers and functional fitness among Chinese BCS. Such innovative PA intervention has important implications in promoting disease prevention and management in this population. Larger samples with randomized clinical trials are warranted.

---

**2861 Board #144 June 1 2:00 PM - 3:30 PM Changes in Sedentary Time and Physical Activity of Cancer Survivors Participating in an Exercise Program**

Sarah Greterman. Concordia College, Moorhead, MN.

*No relevant relationships reported*

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

**Methods:** Forty-seven cancer survivors volunteered to wear armband activity monitors for seven consecutive days over three different time points of the group exercise program: weeks 1, 6 (midpoint), and 12 (endpoint). A repeated measures ANOVA with mixed model time frame and timing variables compared time spent in SED, LBF, MOD, and VIG between weeks 1, 6, and 12 was used to analyze the data.

**Results:** Of the 47 recruited participants (mean age 53.63±13.85) completed week 1 (Group A), 19 participants (age = 52.17±11.71) completed weeks 1 and 6 (Group B), and 12 participants (age = 53.08±11.01) completed weeks 1, 6, and 12 (Group C).

Participants averaged >17 hr•day of non-sleep activity monitor wear time with no significant differences in wear time (p = 0.05, F = 4.48). Minimal VIG PA resulted in combining MOD and VIG activity into one moderate-vigorous PA group (MVP). Group C engaged in more PA compared to Groups A and B, but there were no statistically significant differences between Groups A and C (p = 0.24, F = 1.47) during week 1 or between groups B and C during both week 1 (p = 0.54, F = 0.39) and week 6 (p = 0.33, F = 0.98). For Group C, total PA based on wear time increased significantly from weeks 1 to 6 and decreased from weeks 6 to 12, but there were no statistically significant changes over all three time points (p = 0.12, F = 1.83). All three groups averaged more than 40 min•day of MVP. Group C engaged in less SED time compared to Groups A and B, but there were no statistically significant differences between Groups A and C (p = 0.64, F = 0.22) or between groups B and C (p = 0.42, F = 0.67).

For Group C, SED time was lower at both week 6 and week 12 compared to week 1, but week 12 was slightly higher than week 6. There was a statistically significant difference in change in SED time from weeks 1 to 6 (p = 0.03, r = 2.79) and weeks 6 to 12 (p = 0.03, r = 2.85), but not weeks 1 to 12 (r = 0.9997, p = 0.003).

**Conclusion:** The fact that participants exceeded the 150 min•week recommendation of PA and SED time declined from week 1 to week 12 is promising.

---

**2862 Board #145 June 1 2:00 PM - 3:30 PM Effect Of Self-control Exercise Practice Done On Lymphocyte Subsets Of Lung Cancer Patients**

Jibing Wang1, Weimo Zhu, FACSMP, Renwei Wang1, Jiaying Lan1, Ruirui Xing1, Shuhao Quan2, Tongji University, Shanghai, China. 1University of Illinois at Urbana-Champaign, Urbana, IL. 2Shanghai University of Sport, Shanghai, China.

*No relevant relationships reported*

**PURPOSE:** Self-Control Exercise (SCE), known also as Quoilin Qigong, is a mind-body exercise being used in China for cancer survival for more than 40 years. This study was to examine the dose of SCE on lymphocyte subsets of lung cancer patients and the possible mechanisms.

**METHODS:** 33 lung cancer patients (9 males & 24 females, M±SD: Age in yr: 60.24±16.14; Cancer survival yr: 1.67±0.69) were recruited from the Shanghai Cancer Club. All the patients were diagnosed pathologically. The patients began to learn SCE for 3 weeks and then performed 24-week SCE at their will. Cancer history was surveyed, physical activity including SCE was recorded during the intervention. The lymphocyte surface antigen CD3/CD4/CD8/CD28/CD16/56+CD19/CD4/CD25 were examined by direct immunofluorescence staining and flow cytometry. Pearson correlation coefficient were computed to determine the correlations between the change of lymphocyte surface antigen and the SCE duration (minutes) per week.

**RESULTS:** The mean SCE practice was 80.91±44.68 minutes per day with a range from 30 to 180minutes per day. It was found that CD4+ increased significantly (p<0.01), CD4+CD25 declined significantly (p<0.05) respectively after 24 weeks.

---

**2863 Board #146 June 1 2:00 PM - 3:30 PM An Investigation Of Physical Activity And Cardiorespiratory Fitness In Childhood Cancer Survivors**

David Mizrachi1, Claire E. Wakefield1, Joanna E. Fardell2, David Simar1, Ann Maguire2, Gill Hubbard1, James McBride3, Penelope Field4, Richard J. Cohn1, 1University of New South Wales, Sydney, Australia. 2The Children’s Hospital at Westmead, Sydney, Australia. 3University of Stirling, Inverness, United Kingdom. 4Sydney Children’s Hospital, Sydney, Australia.

*No relevant relationships reported*

**Purpose:** Survivors of childhood cancer experience an increasing incidence of late sequelae with age, with the effect on health likely compounded by limited physical activity and low cardiorespiratory fitness (CRF). This study aimed to determine survivors’ physical activity levels and to objectively measure CRF, compared with controls.

**Methods:** Stage 1: We collected physical activity data from parents of survivors aged 7–18 years, ≥2 years after diagnosis, from 11 Australian and New Zealand hospitals as well as from age-matched controls using the International Physical Activity Questionnaire (IPAQ). We compared moderate-vigorous physical activity levels with American Cancer Society guidelines (≥300 min/week). Stage 2: We then assessed CRF in survivors aged 8–18 years, ≥1 year after treatment completion, by cardiopulmonary exercise test using the Bruce Protocol, 6-minute walk test (6MWT), and self-reported fitness (International Fitness Scale).

**Results:** Stage 1: 192 parents of survivors (mean age–12.9±2.3 years) and 111 parents of control children (mean age–12.3±2.7 years) participated. Parents reported child survivors to participate in more physical activity than controls (248.4±217.6 vs 184.8±213.6 min/week, p = 0.036), with 31% of child survivors meeting physical activity guidelines, compared with 22.7% of controls (p = 0.011). Stage 2: To date, 11/42 survivors (mean age–10.7±6.2 years) and 10/42 controls (mean age–10.6±1.1 years) have completed comprehensive CRF assessments. Survivors appear to have similar CRF compared with controls in terms of VO2max (43.1 vs 46.8ml/kg/min, p = 0.31; 47% vs 60 percentile, p = 0.41) and 6MWT distance (737m vs 690m, p = 0.07; 85% vs 78 percentile, p = 0.43). Preliminary data suggest little difference in self-reported CRF (p = 0.98) and overall fitness (p = 0.07).

**Conclusion:** Only one-third of young survivors of childhood cancer are meeting American Cancer Society’s physical activity guidelines. Preliminary data indicate similar fitness levels between survivors and age-matched controls. However, considering the increasing risk of late-effects during aging in survivors, regularly assessing physical activity and CRF provides clinicians with vital information to monitor and encourage survivors to mitigate risks by adopting a healthy lifestyle long-term.

---

**2864 Board #147 June 1 2:00 PM - 3:30 PM Association Between Cancer Screening and Physical Activity in Cancer Survivors**

Katlyn M. Mathis. Pennsylvania State University, State College, PA.

*No relevant relationships reported*

**PURPOSE:** To determine if cancer survivors who adhere to cancer screening guidelines are more likely to be physically active.

**METHODS:** A Health Risk Factor Questionnaire was mailed to cancer survivors in Central Pennsylvania who were identified by the PA Cancer Registry in 2017. The survey addressed physical activity levels and participation in regular cancer screenings for breast, cervical, and colorectal cancers. Physical activity levels were categorized as meeting ACSM guidelines for aerobic training, resistance training, or both. Adherence to cancer screening guidelines was determined for colorectal, cervical, and breast cancer as put forth by the American Cancer Society, which included a colonoscopy, PAP smear, and mammogram, respectively. Odds ratios were calculated for aerobic, resistance, and combined physical activity levels in people who adhered to cancer screening guideline or not.

**RESULTS:** Among cancer survivors in Central PA, those who met colorectal cancer screening guidelines are more likely to meet aerobic training guidelines (OR=0.369; 95% CI=0.165 to 0.826) and those that met cervical cancer were more likely to meet aerobic and resistance training guidelines combined (OR=0.255; 95% CI=0.094 to 0.691). No other results were significant.

**CONCLUSIONS:** Cancer survivors who adhere to colorectal cancer screening guidelines are more likely to meet ACSM guidelines for aerobic exercise and those that adhere to cervical cancer screening are more likely to meet ACSM guidelines for
both aerobic and resistance exercise. Physical activity is an important part of cancer prevention and should be further addressed in a high risk population such as cancer survivors in Central PA.

2865 Board #148 June 1 2:00 PM - 3:30 PM
Neuropathy And Fine-motor-function In Survivors Of Childhood Acute Lymphoblastic Leukemia: A Report From St. Jude Life

Purpose: To investigate associations between peripheral neuropathy, fine motor skills, and quality of life (QOL). These relationships have not been investigated in long-term survivors of childhood ALL.

Methods: Adult survivors of childhood ALL (N=365, 52% male; median age 8.8 ± 4.5 years at diagnosis and 28.6 ± 5.9 years at evaluation) were evaluated using the modified total neuropathy score (mTNS); functional performance test (PFT), and Medical Outcomes Study Short Form Survey (SF-36). Neuropathy was defined as a total score ≥4 on the mTNS. Participants were identified as having fine motor impairments according to timed writing and eating PPT tasks (> 10 seconds). Vincristine and cranial radiation doses from childhood cancer treatment, abstracted from medical records, were included as covariates in logistic regression models. Results: 39.7% of ALL survivors had neuropathy (N=145) and 44.1% had fine motor impairments (N=161). Survivors with neuropathy received a mean cumulative dose of vincristine of 47.4 ± 42.6 mg/m²; survivors without neuropathy had a mean cumulative dose of 31.5 ± 22.1 mg/m² (p<0.001). Neuropathy was significantly associated with fine motor impairments (Odds ratio (OR): 1.5, 95% confidence interval (CI): 1.01-2.39, after controlling for current age, sex, and cranial radiation. Fine motor impairments were associated with a 2.20-fold (95% CI: 1.07-4.52) risk of a physical component summary T-score <40 on the SF-36. CONCLUSIONS: Adult survivors of childhood ALL with neuropathy are at higher risk for fine motor impairment. In addition, survivors with fine motor impairment are at increased risk for reporting poor quality of life. Interventions designed to address loss of fine motor function may improve quality of life in this vulnerable population.

2866 Board #149 June 1 2:00 PM - 3:30 PM
Analysis of Cancer Survivor’s Accessibility to Exclusively Tailored Exercise Programs in Nebraska
Ava T. Coughlin, Roderrick T. Bartee, Kate A. Heelan, FACSM, Paul R. Burger. University of Nebraska at Kearney, Kearney, NE.

Purpose: The purpose of this investigation is to examine cancer survivors’ accessibility to exercise facilities (EF) and exercise programs designed exclusively for cancer survivors (EPCS) in Nebraska, USA.

Methods: Geographic Information Science (GIS) was utilized to construct a spatial database consisting of cancer patient survivors, EF, and identified EPCS, all geocoded from street addresses. Network analyses were performed to assess distance and travel time to both the nearest EF and EPCS. The U.S. Census Bureau’s Core Based Statistical Area (CBSA) definitions for 2013 were used to categorize counties as part of a Metropolitan Statistical Area (MSA) or Micropolitan Statistical Area (mSA) and the balance, rural.

Results: Multi-level geocoding of cancer survivors achieved a 99.9% match rate with 90.6% successfully geocoded to either a point or street address. Fifty-nine percent of survivors reside in a county classified as an MSA, 19% are in an mSA, and 22% are rural. Survivors living in an MSA had a mean distance of 3.2 ± 5.4 miles (2.0 ± 4.1 minutes) away from the nearest EF and a mean distance of 15.9 ± 22.4 minutes (10.9 ± 22.4 miles) away from the nearest EPCS. Survivors living in an mSA had a mean distance of 6.5 ± 8.6 miles (4.4 ± 6.4 minutes) from the nearest EF and a mean distance of 157.2 ± 122.4 miles (114.9 ± 91.9 minutes) to the nearest EPCS. Similar to mSA, rural survivors had a mean distance of 25.8 ± 20.1 miles (19.3 ± 15.4 minutes) from the nearest exercise facility while having a mean distance of 168.4 ± 124.5 miles (118.8 ± 84.5 minutes) from an EPCS. Conclusion: Exercise facilities are accessible to cancer survivors throughout Nebraska; however, EPCS are not located within a reasonable distance to rural survivors to facilitate participation. On-line and prescribed EPCS programs and trainings should be developed and shared with rural and mSA exercise facilities to increase accessibility.

2867 Board #150 June 1 2:00 PM - 3:30 PM
Adherence To Lifestyle Recommendations Regarding Physical Activity, Diet, Smoking And BMI In Cancer Survivors
Renate M. Winkels1, Wayne Foo1, Joachim Wiskemann1, Joel E. Segel1, Scherezade Mama2, Kathryn H. Schmitz, FACSM3. 1Penn State Cancer Institute, Hershey, PA. 2Penn State University, State College, PA. (Sponsor: Kathryn Schmitz, FACSM)

Purpose: Assess adherence to lifestyle recommendations for physical activity, diet, smoking and BMI in cancer survivors in Central Pennsylvania.

Methods: A survey on health-related lifestyle factors was sent to cancer survivors in Central Pennsylvania (PA) facilitated by the PA Cancer Registry in 2017. The survey included questions on current BMI, smoking status, physical activity level, and diet. From this, we assessed adherence to the WCRF/AICR recommendations for cancer prevention, as they are also recommended for cancer survivors. Respondents were assigned 1 point for each of the following recommendation they adhered to: BMI between 20-25 kg/m², currently not smoking, consumption of 5 or more servings of fruits/vegetables per day and being physically active at least 30 minutes/day (maximum score 4 points).

Results: The response rate to the survey was ~27%, and varied from 23% (lung) to 30% (breast). The average age of the respondents was 66 years. The overall score for adherence was 1.6 points which was largely driven by the high adherence to the recommendation not to smoke; adherence to the other guidelines was significantly lower. Survivors who adhered to the recommendation on physical activity had a similar score for the other lifestyle recommendations (1.1 of 4 out of 3) compared to 1.0 of 3 for survivors who did not adhere to the recommendation on physical activity.

Conclusion: In this survey among cancer survivors in central PA, adherence to lifestyle recommendations was low for all types of cancer. Response rate was 27%; possibly, cancer survivors who were higher educated and more health-conscious were more likely to respond. Thus, the adherence to lifestyle recommendations among cancer survivors in central PA may even be lower than what is presented here.

2868 Board #151 June 1 2:00 PM - 3:30 PM
Cardiorespiratory Fitness and Cancer In Women
Baruch Vainshelboim1, Stephen M. LoRusso1, Ivan Mulligan, Stephen Baker2, Patricia Fitzgerald, Krishofer Wisniewski1, Jonathan Myers, FACSM3, Saint Francis University, Loretto, PA. 1VA Palo Alto Health Care System/ Stanford University, Palo Alto, CA.

Purpose: To evaluate associations between cardiorespiratory fitness (CRF) in cancer patients and cancer incidence and mortality. Methods: Geographical Information Science (GIS) was utilized to construct a spatial database consisting of cancer patient survivors, EF, and identified EPCS, all geocoded from street addresses. Network analyses were performed to assess distance and travel time to both the nearest EF and EPCS. The U.S. Census Bureau’s Core Based Statistical Area (CBSA) definitions for 2013 were used to categorize counties as part of a Metropolitan Statistical Area (MSA) or Micropolitan Statistical Area (mSA) and the balance, rural.

Results: Multi-level geocoding of cancer survivors achieved a 99.9% match rate with 90.6% successfully geocoded to either a point or street address. Fifty-nine percent of survivors reside in a county classified as an MSA, 19% are in an mSA, and 22% are rural. Survivors living in an MSA had a mean distance of 3.2 ± 5.4 miles (2.0 ± 4.1 minutes) away from the nearest EF and a mean distance of 15.9 ± 22.4 minutes (10.9 ± 22.4 miles) away from the nearest EPCS. Survivors living in an mSA had a mean distance of 6.5 ± 8.6 miles (4.4 ± 6.4 minutes) from the nearest EF and a mean distance of 157.2 ± 122.4 miles (114.9 ± 91.9 minutes) to the nearest EPCS. Similar to mSA, rural survivors had a mean distance of 25.8 ± 20.1 miles (19.3 ± 15.4 minutes) from the nearest exercise facility while having a mean distance of 168.4 ± 124.5 miles (118.8 ± 84.5 minutes) from an EPCS. Conclusion: Exercise facilities are accessible to cancer survivors throughout Nebraska; however, EPCS are not located within a reasonable distance to rural survivors to facilitate participation. On-line and prescribed EPCS programs and trainings should be developed and shared with rural and mSA exercise facilities to increase accessibility.
Radiation therapy was first attempted as a treatment for cancer in 1896. Since then, it has become a common modality, and the survival rate among diagnosed patients has increased drastically. While radiation can prolong life expectancy, it can be deleterious to the patients’ health. Exercise has consistently demonstrated improvement in anthropometric, cardiometabolic, and functional capacities of cancer survivors, but data concerning the effect of radiation on exercise outcomes are limited. PURPOSE: To evaluate the effect of radiation therapy on exercise outcomes in cancer survivors.

METHODS: Patients participated in a 10-week exercise intervention involving aerobic, resistance, and flexibility training. There were 59 patients who had never used radiation (NR), 63 who had complete radiotherapy (HR), 18 currently undergoing treatment (CR), and 17 who failed to report their status. We analyzed differences among the three radiation exposure groups (NR, HR, and CR) in baseline characteristics, exercise adherence, and improvement in several parameters of health and function using chi-square and multivariate tests; post-hoc analyses tested specific group differences.

RESULTS: There were no baseline differences between groups in age, health history, body composition, cardiovascular parameters, fatigue, insomnia, or depression. Patients in the NR group performed better on the five times sit-to-stand test than HR patients (p = 0.013) and better on sit-and-reach (p = 0.037) and functional reach (p = 0.039) than CR patients. There were no differences in program completion based on use of radiation (p = 0.404). Although there were no baseline differences in the six-minute walk (p = 0.987), CR patients improved more than HR patients (p = 0.038) and NR patients (p = 0.051). There were no baseline differences in systolic blood pressure (p = 0.957) but CR patients experienced greater reductions than patients in the HR group (p = 0.011) and NR group (p = 0.035).

CONCLUSION: Exercise may be an effective way to mitigate some of the health consequences associated with radiation therapy. In our sample, exercise improved blood pressure and six minute walk more in patients who were currently undergoing treatment; however, our low retention rate may create potential bias and fail to accurately characterize expected results.

Advancements in treatment, such as chemotherapy, have improved survival rates among cancer patients. Today, approximately 67% of patients are at least five-year survivors; however, the combination of cancer and its care often affects the quality of those years. Patients commonly experience psychological symptoms, losses in physical function, and deterioration of cardiovascular health. Exercise ameliorates many of these consequences, but the effect of chemotherapy on exercise outcomes requires further exploration. PURPOSE: To evaluate the effects of chemotherapy on exercising cancer survivors. METHODS: We enrolled cancer survivors in a comprehensive 10-week exercise program; 40 patients had never received chemotherapy (NC), 80 had a history of chemotherapy (HC), and 24 were currently undergoing treatment (CC), and 13 failed to report status. During a pre-exercise evaluation, we gathered demographic, morphological, psychological, cardiovascular, and functional data. Following the intervention, we repeated all assessments. We compared baseline data and analyzed pre-to-post differences in the three exposure groups (NC, HC, and CC) using chi-square and multivariate tests; post-hoc analyses tested specific group differences.

RESULTS: Patients in the NC group were older (p = 0.013), weighed more (p = 0.054), and had a higher body mass index (p = 0.067); obesity affected 56.7% of NC patients, 39.1% of HC patients, and 19.0% of CC patients (p = 0.026). The NC group also had a higher incidence of hyperlipidemia (p = 0.055) and worse performances in the six-minute walk (p = 0.019), timed up-and-go (p = 0.002), chair stand (p = 0.043), and epic lift (p = 0.029). There were no group differences in exercise adherence (p = 0.414). NC patients improved the least in arm curls (p = 0.022) and improved the most in VO₂ max (p = 0.037) and systolic blood pressure (p = 0.064).

CONCLUSION: Patients who had used chemotherapy in the past or were currently undergoing treatment were younger than those with no history of use; age may explain the differences noted. Our results indicate chemotherapy is not a barrier for exercise participation; as long as it is tolerated, exercise should be encouraged throughout cancer survivorship. While chemotherapy did not affect attrition, our low retention rate overall limits the strength of these findings.
Cancer survivors experience several disabling long-term side effects promoted by the cancer treatment and the pathology. Although the American College of Sports Medicine recommend the practice of strength training to cancer survivors similarly to healthy subjects, these recommendations are based on a restricted literature. Cancer survivors may require a longer recovery between sessions due to physiological impairments.

**PURPOSE:** To assess the time-course of muscle performance recovery after a resistance exercise session in Hodgkin’s Lymphoma survivors. **METHODS:** Four Hodgkin’s Lymphoma survivors (age: 28.00 ± 8.16; height: 1.71 ± 0.06m; weight: 68.38 ± 9.83kg) participated in this study. The volunteers attended to the laboratory in four consecutive days. On the first visit, the isokinetic knee extension production capacity 24 hours after a resistance exercise session and do not require any other tests.

**RESULTS:** Data are presented as mean (SD); * indicates significant change from baseline (p<0.05).

**CONCLUSIONS:** Hodgkin’s Lymphoma survivors recover muscle strength production capacity 24 hours after a resistance exercise session and do not require any other tests.

**Discussion:** This study contributes to the understanding of the time-course of muscle performance recovery after resistance exercise sessions in cancer survivors and highlights the importance of regular muscle-strengthening exercises for this population.

---

**Objectively Quantified Doses of Activity and Inactivity and Subjective well-being in Breast Cancer Survivors**

**Amanda Hickey**, Richard Viskochil, Patty Freedson, FACSM, Barry Braun, FACSM, Keene State College, Keene, NH, University of Massachusetts, Amherst, MA, Colorado State University, Fort Collins, CO.

No relevant relationships reported.

**Introduction:** Physically active breast cancer (BC) survivors have higher quality of life (QOL) compared to those who are sedentary. However, exercise programs may introduce compensatory responses to total daily physical activity (PA) and sedentary time (ST) that could undermine the expected benefits of exercise training.

The primary aim of this study was to evaluate changes in daily PA and ST following the implementation of an exercise training program in BC survivors. A secondary aim was to examine the relationship between PA/ST and fatigue/QOL.

**Methods:** 12 postmenopausal BC survivors wore an ActiGraph GT3X monitor on the right hip for 7 consecutive days and completed the EORTC QOL questionnaire and Piper Fatigue Scale prior to and during the final week of a supervised 12-wk exercise training program (45-60 min/day, 2-4 days/wk). The activity data were categorized using the Freedson 1998 cut-points and are presented as a percentage of wear-time.

**Results:** The table presents PA, ST, perceived fatigue, and QOL scores.

<table>
<thead>
<tr>
<th>ST (%)</th>
<th>Light (%)</th>
<th>MVPA (%)</th>
<th>Piper Fatigue Score</th>
<th>EORTC QOL Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline</strong></td>
<td>47.7 (6.41)</td>
<td>17.6 (4.95)</td>
<td>5.2 (3.94)</td>
<td>80.6 (40.40)</td>
</tr>
<tr>
<td><strong>Post-Intervention</strong></td>
<td>71.8* (8.38)</td>
<td>22.7* (6.75)</td>
<td>5.5 (3.29)</td>
<td>66.1* (31.87)</td>
</tr>
</tbody>
</table>

**Note:** Data are presented as mean (SD); * indicates significant change from baseline (p<0.05).

By post-intervention these women replaced ST with light intensity activity. The EORTC score was significantly correlated with ST at baseline (R=0.33, p=0.05), but this relationship was not significant at post-intervention. There were no significant relationships found between the Piper Fatigue Score and ST.

**Discussion:** These findings suggest participants did not reduce PA or increase ST during the exercise program. It has been reported that exercise training may lead to compensatory declines in habitual PA and increases in ST but our results do not support this. It is possible that as BC survivors increase purposeful exercise, they are able to substitute low levels of PA for ST. The relationship found between QOL and ST suggests that reductions in ST could be a potential target for interventions that aim to improve QOL in BC survivors.
Androgen deprivation therapy (ADT) is a foundation of treatment for men with prostate cancer (PCa). However, ADT is accompanied by adverse effects that increase risk of functional decline. Although some clinical observations suggest that ADT may have a greater impact upon functional status among aged men, empirical evidence addressing age-related differences in the trajectory of adverse effects of prolonged ADT remains limited. PURPOSE: The purpose of the present pilot study was to explore differences in change in mobility performance and physical activity (PA) over 6 months among 3 different age cohorts of PCa patients undergoing ADT.

METHODS: A total of 44 PCa patients undergoing prolonged ADT (> 6 months of treatment) were classified into 1 of 3 age cohorts: 55-64 (n=13); 65-74 (n=19); and 75+ years of age (n=12). Measures of mobility performance (400M Walk) and objectively-determined PA were obtained from men at baseline and 6 month follow-up assessments. RESULTS: Results of 3 (Age) x 2 (Time) Repeated Measures ANOVA analysis demonstrated a significant Age main effect for mobility performance (p < .05) while the Age main effect for PA approached significance (p = .06). Post hoc analysis revealed that patients in the youngest group had more favorable mobility performance relative to the middle (d = -.71) or oldest (d = -1.04) age groups and patients in the oldest group were accruing less objectively-determined PA relative to the middle (d = .45) or youngest (d = .92) age groups. However, the Age x Time interaction was not significant for mobility performance (p = .38) or PA (p = .28) indicating no differences in the trajectory of change were observed for either outcome as a function of age across time. CONCLUSIONS: This study provides some of the first preliminary evidence examining potential age-related differences in the trajectory of change in physical function and PA in PCa patients on ADT. Findings revealed that although well-established, anticipated age differences in mobility performance and PA were observed, no age-related differences in the trajectory of change in functional decline or PA emerged among PCa patients undergoing prolonged ADT.

Aquatic Exercise Training Program Outcomes on Quality Of Life and Lower Limb Lymphedema: Pilot Study

Andrée Dionne1, Tarik Azlal1, Sandra Morales2, Serge Goulet1, Mario Leontiec1, Alain Steve Comtois1. 1University of Quebec in Montreal, Montreal, QC, Canada. 2University of Sherbrooke, Montreal, QC, Canada. 3University of Quebec in Chicoutimi, Chicoutimi, QC, Canada.

CONCLUSIONS: No relevant relationships reported

Lower limb lymphedema (LLL) has a negative impact on many aspects of daily living, including household chores, physical activity, and psychological well-being. Patients with LLL that are not properly managed may become progressively worse and lead to an increase in impairments in physical capacity and decline in the quality of life. PURPOSE: To determine whether patients with LLL can benefit from water immersion exercise to improve quality of life and control-diminish limb volume. METHODS: A total of 7 female participants affected by bilateral (n=4) or unilateral (n=3) LLL were included in this pilot study. Participants had primary or secondary LLL as complications of melanoma or gynecological cancers. Water immersion interval training exercise was conducted over a 6-week period (12 sessions of 45 minutes) and consisted of yoga exercises, aqua-jogging, pedaling on a water treadmill. The distance covered in the 6 min walk test (458.4 ± 117.0 vs 520.0 ± 126.0 meter, p = .04) and the sum of right and left handgrip strength (32.6 ± 5.6 vs 38.0 ± 10.8 kg, p = .003) were significantly improved and so did the emotion score (2.1 ± 0.7 vs 1.6 ± 0.6, p = .03) and overall quality of life (7.09 ± 1.8 vs 8.1 ± .8, p = .05). CONCLUSIONS: Water immersion exercise training allowed patients with lower limb lymphedema to lower the extent of LLL, improve physical function, and quality of life outcomes.

The Importance of Adiposity to the Cancer Patient

Alexia Amo1, Cynthia Villalobos1, Justin C. Brown2, Paul D. Voutil3, Courtney D. Jensen1. 1University of the Pacific, Stockton, CA. 2Harvard University, Cambridge, MA. 3St. Joseph’s Hospital, Stockton, CA. (Sponsor: Kathryn H. Schmitz, FACSM)

INTRO: Cancer stage reflects the severity and extent of the disease, with stage IV reflecting advanced cancer and poorer prognosis. Exercise has been shown to improve a number of psychological and physiological variables in cancer survivors, such as cancer-related fatigue (CRF) and cardiovascular fitness (VO2peak). However, the effect of stage on these improvements is unknown. PURPOSE: To examine whether diagnosed cancer stage affects or modifies improvements in CRF and VO2peak among cancer survivors. METHODS: A total of 384 cancer survivors (57 ± 12 years of age) completed initial assessments of CRF and VO2peak via the Fener Fatigue Scale and the University of the Pacific Cancer Rehabilitation Institute’s cancer-specific treadmill protocol, respectively. Participants were divided into four groups based on diagnosed cancer stage (I, II, III, and IV). Survivors completed supervised, one-on-one exercise sessions three days per week, 60 minutes per day for 12 weeks. The intervention consisted of individualized and progressive cardiovascular, whole-body strength, balance, and flexibility training. Participants’ CRF and VO2peak were reassessed following the intervention. RESULTS: Collectively, pre-to-post assessments demonstrated significant overall improvements in CRF (-25%) and VO2peak (11%) across all stages (p < .01). No significant differences in CRF (p = .092) or VO2peak (p = .44) improvements occurred between the stages. When evaluating individual cancer stage CRF improvements were observed with each stage (I, II, III, and IV). Significant differences existed in VO2peak (p < .01) across any cancer stage (I, II, III, and IV). CONCLUSION: Exercise-based cancer rehabilitation during and following cancer treatment has been shown to have positive effects on CRF and VO2peak, but the effect of stage on these improvements has not been understood. Our findings reiterate the importance of exercise to the cancer survivor, regardless of body composition, but there is potential for bias owing to the high dropout rate found in our study.

Exercise-based cancer rehabilitation during and following cancer treatment has been shown to have positive effects on CRF and VO2peak, but the effect of stage on these improvements has not been understood. Our findings reiterate the importance of exercise to the cancer survivor, regardless of body composition, but there is potential for bias owing to the high dropout rate found in our study.
Increased demand for sedentary behavior reduction in workplace environments has led to the planning of landmark interventions implemented at the group level in the form of cluster randomized controlled trials (RCTs). To date, limited evidence is available regarding cluster RCT recruitment strategies. **PURPOSE:** The purpose of this paper is to provide a review of recruitment strategies employed in a large cluster RCT targeting a reduction in workplace sedentary behavior. **METHODS:** Recruitment yields (N enrolled/N screened) x 100 were calculated. Mean (SD) and median workforce sizes were calculated at each recruitment step. The percentage of participants who progressed to each recruitment step (of the total N screened per worksite) was calculated to determine the mean percentage of a worksite successfully randomized. Recruitment barriers and modifications were recorded by the research team. A survey was completed by a subset of non-participants (N = 57) and thematic analyses conducted to examine reasons for non-participation, positive impacts and negative experiences. **RESULTS:** Cluster recruitment yield was 43% (24 worksites enrolled/56 screened). Individual recruitment yield was 49% (641 employees enrolled/1317 screened). On average, 52 ± 16% of the worksite was successfully randomized. Eighteen modifications were developed to overcome participant-related, context-related and research-related barriers. **CONCLUSIONS:** Researchers should plan to screen at least 200% of the intended number of worksites and they should target worksites that are approximately double the size of the intended cluster size to avoid loss of statistical power or timeline extensions. Acknowledging temporal fluctuations in worksite-specific workloads, providing options throughout the recruitment process, and adopting a participant-centered approach may facilitate cluster RCT success.

Orthopedic trauma can be a catalyst for substantially reduced physical activity and increased sedentary behavior that can persist post-recovery. While objective measures (e.g. accelerometer) provide rigorous approaches to assessing physical activity and sedentary behavior, they may be inappropriate for studies with some patient groups. Self-report measures provide potential alternatives, however, their validity must be established. **PURPOSE:** To determine, in orthopedic trauma patients, the agreement and concordance of physical activity and sedentary behavior data from two self-report measures, the International Physical Activity Questionnaire (IPAQ) and the domain-specific sitting questions from the Australian Diabetes, Obesity and Lifestyle General Questionnaire 3 (AusDiab3), with data derived from objective measures. **METHODS:** Sixty patients with isolated upper- or lower-limb fractures were two activity monitors (ActiGraph, ActiPAL) for 10 days, from 2-weeks post-surgery. Participants then completed the IPAQ and AusDiab3 questionnaires relating to the previous 7 days of objective monitoring. **RESULTS:** The IPAQ overestimated objectively-observed overall physical activity (median METTmins: 550 vs.0.0) and underestimated median daily sitting time (8.00 vs.10.59 hrs). The AusDiab3 questionnaire underestimated median daily sitting time to a lesser degree than the IPAQ (9.21 vs. 10.53/hr). There was moderate concordance between IPAQ-reported and objectively-derived overall physical activity (p=0.431, p<0.001), weak concordance between IPAQ-reported and objectively derived sitting time (p=0.384, p<0.001) and moderate concordance between AusDiab3-reported and objectively measured sitting time (p=0.51, p<0.001).

**CONCLUSIONS:** There was disagreement and discordance between the IPAQ and AusDiab3 questionnaire and objectively derived data, suggesting that these measures cannot be used interchangeably in orthopedic trauma patients. Modifications could be made in order to more specifically address the activity characteristics of this population.
subjective sleep quality (lower scores = better sleep quality). Mixed-effects regression models adjusted for worksite clustering and age, gender, race, job type, body mass index (BMI), and MVPA.

RESULTS: Participants spent 333.1 ± 78.0 min/8hr workday and 30.7 ± 14.8 min/8hr workday in sedentary and LPA behaviors at baseline, respectively. Overall, sedentary time was reduced by 33.6 ± 13.6 min/8hr workday and LPA was increased by 0.1 ± 0.9 min/8hr workday. Increases in LPA were associated with 3-month improvements in PSQI sleep latency (β = 0.009 [20], p = .05). No other changes in sedentary or LPA behaviors were associated with PSQI changes.

CONCLUSION: Worksite interventions targeting sedentary behavior may be effective for improving sleep onset, but not other aspects of sleep quality. Future interventions should examine longer term follow-up periods, assess sleep objectively, and incorporate interventions that target sedentary time and LPA both during and outside of work hours.

Previous research indicates that women become more sedentary during pregnancy. However, very few studies have objectively measured sedentary behaviors in this population. PURPOSE: To quantify objectively measured sedentary behaviors, including patterns of sedentary behaviors, in a sample of pregnant women.

METHODS: Participants included pregnant women enrolled in a behavioral nutrition and physical activity intervention. Participants wore an Actigraph accelerometer during all waking hours for seven consecutive days. The total volume of sedentary behaviors was quantified (% of day), as was the amount of time spent sedentary according to type of day (morning [6am-12pm], afternoon [12pm-6pm], evening [6pm-12am]) and type of day (weekday, weekend). Surveys were administered to assess demographic characteristics. Descriptive statistics calculated the percentage of time spent in sedentary, in addition to the percentage of type and time of day spent sedentary. RESULTS: On average, the participants (n=41) were 28.0±4.4 years of age, 17.8±2.3 weeks gestation, and had a pre-pregnancy body mass index of 27.0±7.5. The majority of the sample were Caucasian (82.5%), married (68.3%), and had some college education (72.3%). Overall, participants spent 59.1% of waking hours sedentary. When looking at type of day, participants were sedentary 60.2% of the day on weekdays, and 55.6% of the day on weekend days. When looking at type of day, participants were sedentary 57.7% of time during morning hours, 58.6% during afternoon hours, and 61.3% during evening hours. CONCLUSION: Results indicate that pregnant women spend a majority of their day engaged in sedentary behaviors. When looking at type and time of day, the data indicate that our sample was more sedentary on weekdays and during evening hours. Given the benefits of regular physical activity during pregnancy for both the mother and baby, and the high rates of sedentary behaviors, interventions aimed at decreasing sedentary time during pregnancy are needed. Replacing sedentary behaviors with even light activity may be a first step in successfully decreasing the total volume of sedentary behavior.

The project was supported by the SVSU Allen Foundation Grant, the SVSU Ted & Ruth Braun Fellowship, and the SVSU Faculty-led Research Grant.

Sedentary behavior is negatively associated with individual metabolic syndrome (MetS) risk factors in young adults but little research has investigated these associations using a clustered risk score. PURPOSE: To determine whether sedentary behavior is associated with a clustered MetS score independent of moderate-to-vigorous physical activity (MVPA) and cardiorespiratory fitness (VO2peak) in young adults.

METHODS: 146 participants (age 22.0±3.7 years, BMI 25.0±3.9 kg/m², VO2peak 43.0±9.5 ml min/m² kg). The study total minutes and bouts of sedentary behavior (<150 counts/minute) and MVPA (>2,600 counts/minute) were measured by an accelerometer worn during waking hours for 7 consecutive days. MetS risk factors measured were waist circumference, blood pressure, and fasting glucose, triglycerides and high-density lipoprotein cholesterol. VO2peak was measured using an incremental treadmill metabolic exhausion analysis. Confirmatory factor analysis (CFA) was used to construct a model for MetS and individual indicator variables. Structural equation modeling (SEM) was used to determine the associations among sedentary behavior, VO2peak, MVPA and MetS. Goodness-of-fit indices were used to assess model fit for CFA and standardized estimates with an alpha level of 0.05 were used for SEM models.

RESULTS: The clustered score was a valid model of MetS (χ²=12.9, p=.12; CFI=.93; RMSEA=.07). On average, participants engaged in 503.4±87.4 minutes/week of sedentary behavior and 190.9±145.2 minutes/week of MVPA in 10-minute bouts. Total sedentary behavior was significantly and positively associated with MetS (β=.24, p=.03). This association was independent of MVPA (β=.23, p=.04) but mediated by relative VO2peak (β=.25, p=.29). Similarly, sedentary behavior in bouts of 10, 20, 30, and 60-minutes or longer were all significantly and positively associated with MetS independent of MVPA (β ranged .23 to .29, p<.05) but not VO2peak (β range .16 to .25, p<.05). CONCLUSIONS: Our findings suggest sedentary behavior is associated with clustered metabolic risk in young adults, independent of MVPA, and that bouts of 20 minutes or longer may have the greatest impact on MetS risk. Additionally, fitness may play an important role in attenuating the effects of sedentary behavior on MetS in this population.
spent on average 530.4 ± 101.4 minutes (78% of the day) in sedentary behavior, which is a 3.24% reduction (p<.001). There was no effect of MPVT on VO2peak (p = .421), however, participants who lost fat mass over the course of the study spent significantly more time (p=.008) in MPVT outside of the study. CONCLUSIONS: Overall, participants did not compensate following an exercise intervention by increasing their sedentary behavior. However, differences in MPVT outside of the study affected changes in fat mass.

Based on self-reported data, minority populations are often found to be less active compared to whites, which may contribute to overall health disparities. The Houston Travel Related Activity in Neighborhoods (TRAIN) Study provides an opportunity to examine differences in accelerometer-determined (PA) levels among a majority-minority sample of adults.

PURPOSE: To describe and examine differences in accelerometer-determined PA and sedentary behavior among TRAIN participants at baseline, by race/ethnicity groups and sex.

METHODS: Study participants were part of an ongoing natural experiment of transportation-related PA. At baseline, a group of participants self-selected to wear an Actigraph wGT3X-IT monitor for 7 consecutive days during waking hours. Participants with ≥4 days with ≥ 10 hours/day were included in analysis. Freedson cut-points were used to quantify time spent sedentary (min/d) and in light- and moderate-vigorous-intensity physical activity (MVPA) (min/d). Vector magnitude (VM) estimates are also reported. Krukal-Wallis tests were used to compare accelerometer based estimates by 1) race/ethnicity, and 2) sex and race/ethnicity groups.

RESULTS: 365 TRAIN participants had valid accelerometer data, 62.1% were female and 28.7% and 37.8% were black and Hispanic, respectively. There was a significant difference in VM (counts/min/day) across race/ethnicity groups with blacks and Hispanics having the highest and lowest median values, respectively (p<.001). There were also differences for intensity-specific estimates. Median sedentary time (min/d) was highest in whites (591.0) and lowest in blacks (533.3), light intensity PA (min/d) was highest in blacks (256.2) and lowest in Hispanics (211.4), and MVPA (min/d) was highest in whites (17.9) and lowest in Hispanics (10.8) (p<.005). Race/ethnicity differences were further stratified by sex. Among Hispanics, VM estimates were higher among men (461.5) than women (390.9) (p<.005), which was also reflected in MVPA (min/d). In blacks, MVPA was higher among men (21.3) than women (11.3) (p<.005). No other significant differences were noted.

CONCLUSIONS: For blacks, findings conflict with results typically found with self-reported data. Yet, findings for Hispanics align with existing literature, with the majority of disparity shown in women.

It is estimated that occupational energy expenditure has decreased by 100 kcal·d⁻¹. Analogous to sitting, too much standing that is static with little movement poses health risks. Innovative technologies such as balance boards have been developed for use within an office setting to replace sitting and encourage movement while standing, yet little is known whether physiological benefits exist or if productivity is affected.

PURPOSE: To investigate differences in energy expenditure (EE), heart rate (HR), productivity, fatigue, and pain while performing desk work while sitting (SIT), standing (STAND), and standing on a balance board (BOARD).

METHODS: Thirty healthy adults (60% female; age 39.7 ± 11.8 y; BMI 26.7 ± 5.0 kg·m⁻²) employed in sedentary-based jobs volunteered for this randomized crossover trial. Participants performed typing work in three different positions: SIT, STAND, and BOARD, each condition lasting 30 min. Oxygen consumption (VO2) was measured via indirect calorimetry and EE was calculated using respiratory quotient and corresponding caloric equivalent values. Productivity was quantified by measuring words typed per min, accuracy, and typing mistakes. Overall feelings of fatigue and

Abstracts were prepared by the authors and printed as submitted.
pain were self-reported three times during each position using validated 10-cm visual analog scales. Repeated measures ANOVA were used to assess differences in outcome variables across conditions.

RESULTS: VO₂ was significantly different among all conditions regardless of current standing desk use (SIT 3.13 ± 0.53; STAND 3.77 ± 0.48; BOARD 3.92 ± 0.54 mL/kg \textsuperscript{1}min\textsuperscript{-1}; p<0.001). EE (kcal/min\textsuperscript{-1}) also differed (p<0.001) among SIT (1.27 ± 0.22), STAND (1.42 ± 0.26) and BOARD (1.48 ± 0.29). Compared to sitting (67 ± 9 bpm), HR was higher in STAND (76 ± 11 bpm) and BOARD (76 ± 11 bpm; p<0.001). Measures of productivity were similar across conditions (p=0.05). Mean self-reported fatigue and pain levels were similar across conditions (p<0.05). Fatigue progressively increased over each 30 min condition (p<0.001) whereas pain in SIT and BOARD increased from min 10 to 20, then leveled off between min 20 to 30. For STAND, pain continued to increase over time.

CONCLUSION: Compared with sitting, a balance board may be effective for increasing EE without interfering with productivity in an occupational setting.

2893 Board #176 June 1 2:00 PM - 3:30 PM Intervention Targeting Reductions In Sedentary Time In Older Cancer Survivors: Characteristics Of Responders Versus Non-responders

Elizabeth Harding, Amy Tarnower, Charles Wiggins, Emily Williams, Matthew Schwartz, David Medrano, Anita Y. Kinney, Cindy K. Blair. University of New Mexico, ALBUQUERQUE, NM.

(No relevant relationships reported)

PURPOSE: We conducted a 16-week randomized controlled trial among older cancer survivors to disrupt sedentary time with short bouts of standing and stepping using prompts from a Jawbone UP2 tracker and smartphone app. Technical support was provided via 5 telephone calls. Primary analyses revealed limited change between intervention and control groups regarding reduction and breaks in sedentary time, and time spent stepping. The purpose of this secondary analysis is to provide insight as to the characteristics and behaviors of the participants that improved during the intervention (responders) versus those who did not improve (non-responders).

METHODS: Sedentary behavior and physical activity were measured in 26 older cancer survivors (mean age 69±3.1 years), using an ActiPAC activity monitor for 7 days pre- and post-intervention. The intervention group was divided into non-responders (n=12) and responders (n=14) based on improvement defined as: a decrease in daily sedentary time of 30 minutes or more, or an increase in daily light-intensity activity (LPA) of 30 minutes or more, or an increase in moderate-intensity physical activity (MPA) of 10 minutes or more. Independent sample t-tests were used to evaluate differences between groups regarding baseline demographic factors (age, sex, BMI), health characteristics (pain interference, fatigue, self-reported physical function, physical performance), sedentary behavior (sedentary minutes, breaks from sitting), and physical activity (LPA, MPA).

RESULTS: There were no significant differences in demographic factors (p-values 0.13 to 0.89) or baseline health characteristics (p-values 0.44 to 0.75) between responders and non-responders. Responders had more sedentary minutes/hour (42.4±4.3 vs. 36.1±8.1; p=0.03) and less LPA minutes/hour (standing + stepping: 14.3±3.4 vs. 20.3±7.8; p=0.03) at baseline compared to non-responders. The average duration since transplant was 27.2 months (SD=21.5). Participants wore their accelerometer for 6.5 days (SD=6.5). Participants recorded 9.4 (SD=4.1) hours per day of total sedentary time and averaged 3.7 bouts (SD=1.7) of sedentary time per day accumulated in at least 10 minute bouts, for a total of 2.9 hours (SD=1.5). For active behaviors, participants recorded 20.7 minutes of total MPA per day and 5.7 minutes per day of MVPA accumulated in at least 10 minute bouts. Participants <60 years of age reported significantly more minutes of MVPA than participants ≥60 years of age (Mean 35.4±15.8 min/day; CI: 9.7 to 22, p<0.001). MVPA and sedentary time were not significantly associated with gender, BMI, or months since transplant.

CONCLUSION: Accelerometer assessment of daily activity patterns indicated kidney transplant recipients showed high volumes of sedentary time, and low volumes of health-enhancing physical activity. Further research on effective interventions to favorably change this ratio and improve health outcomes of these patients is needed.

2894 Board #177 June 1 2:00 PM - 3:30 PM Effects of a 16-Week Treadmill Exercise on Physical Activity and Sedentary Time in Older Women

Joshua R. Sparks, Charity B. Breneman, Ryan R. Porter, Steven N. Blair, FACSM, Xuewen F. Wang. University of South Carolina- Columbia, Columbia, SC. (Sponsor: Steven N. Blair, FACSM) (No relevant relationships reported)

Aging is often accompanied by a decrease in physical activity (PA) and increase in sedentary time. Low PA and excessive sedentary time have been linked to adverse health outcomes. Less is known about whether exercise training influences sedentary time and PA in various intensities, and whether body weight and cardiorespiratory fitness (CRF) play a role in any of the associations. PURPOSE: To examine the influence of a 16-week treadmill walking protocol on time spent being sedentary and time spent performing light PA (LPA) and moderate-to-vigorous PA (MVPA), in older women, and to examine the influence of body weight and CRF. METHODS: Older women (n=61; age=65.5±4.3 years) participated in a 16-week moderate-intensity treadmill walking program (35-65 minutes/session, 3 days/week). Women wore a SenseWear Mini Armband consecutively for 14 days, except during water activities, at baseline and at the end of the intervention. The software provided by the manufacturer was used to estimate the metabolic equivalents (METs), and to classify PA into LPA (< 3.0 METS) and MVPA (> 3.0 METS). Sedentary time was calculated by subtracting time asleep from time with METs < 1.5. Body weight and CRF (by a graded exercise test) were recorded at baseline and end of intervention. Paired t-tests and regression analyses were used to compare between baseline and end-intervention in the time being sedentary and performing PA. Body weight and CRF were used as time-varying covariates. RESULTS: Time being sedentary significantly reduced from baseline to end-intervention by approximately 38 minutes (p<0.001). Contrary to sedentary time, LPA significantly increased by approximately 17 minutes (p=0.002), and MVPA significantly increased by 20 minutes (p<0.001). Body weight was associated positively with sedentary time (p=0.007), and negatively with LPA (p=0.001) across the intervention, but not with MVPA (p=0.24). CRF was associated negatively with sedentary time (p=0.002), and positively with both LPA (p=0.04) and MVPA (p=0.0001) across the intervention. CONCLUSION: A 16-week moderate-intensity treadmill-based intervention decreased sedentary time, and increased time spent performing LPA and MVPA. Interestingly, MVPA time was associated with CRF, but not body weight.
examine the accuracy of activPAL and ActiGraph (AG) devices in differentiating sitting on a physio-ball, standing still, and sitting in a chair during a lecture-based classroom setting. METHODS: A total of 28 males and females, aged 18-25 years, from two classes of the same 50-minute course participated in the study. Each participant wore activPAL3 on non-dominant thigh and AG GT3X-bt on right hip in three conditions, which were randomly ordered: 1) sitting on a physio-ball, 2) standing, or 3) sitting in a chair. For the purpose of this study, the first five minutes of the analyses, the first and the last 5 minutes were excluded from the analyses, thus, comparison of sitting and standing (min) between activPAL and AG devices was made during the mid-40 minutes of each class. RESULTS: One participant missed a day of physio-ball, analyses involving values obtained during physio-ball consisted of 27 participants. During physio-ball sitting, activPAL detected the behavior as 38.33 ± 4.40 min of sitting and 1.35 ± 3.56 min of standing, while AG detected the behavior as 29.14 ± 14.30 min of sitting and 0.24 ± 0.48 min of standing. During standing, activPAL detected 3.84 ± 7.53 min of standing, while AG detecting 3.12 ± 0.28 min of standing. During sitting in a chair, activPAL measured 39.26 ± 1.44 min of sitting vs. AG measured 17.42 ± 15.50 min of sitting. Paired samples t-tests indicated significant differences in sitting on physio-ball, standing, and sitting in a chair between the two devices (p<0.001, p<0.020, and p<0.001, respectively). CONCLUSIONS: The activPAL devices were more accurate in identifying the three classroom postures. Further examination of the accuracy of AG worn on other body parts (e.g., wrist and thigh) in differentiating sitting vs. standing in a classroom or occupational setting is warranted.

2897 Board #180 June 1 2:00 PM - 3:30 PM
Sedentary Time And Steps Across Methods For Determining End Of Daytime During 24-hour ActiPal Monitoring
Bethany Barone Gibbs, Melissa A. Jones, Tyler D. Quinn, Subhashan Perera, Christopher E. Kline. University of Pittsburgh, Pittsburgh, PA.

PURPOSE: Best practices to identify daytime end during 24-hour activPAL monitoring are not clear. METHODS: This study included 25 overweight/obese adults (64% male, mean [SD] age: 42 [12] yrs) from a randomized crossover study. Posture, activity (activPAL) and sleep (Activwatch) were monitored for 24 hours on two simulated workdays (with/without use of a sit-stand desk) followed by free-living evening behavior. Average time spent sedentary and steps were calculated using four methods to determine daytime end: 1) criterion method using actigraphy and a standardized scoring algorithm to indicate bedtime, 2) standard 10PM bedtime, 3) participant diary-reported bedtime, or 4) hybrid approach combining activPAL data with participant diary. Validity between criterion and alternative methods was evaluated by calculating average magnitude of error, Pearson’s correlations, and Bland-Altman plots. RESULTS: Criterion method (SD, %) sedentary time was 11.5 ± 1.3, 72.1% hr/day with 3.106 (t129) step/day. Absolute estimates of sedentary time differed from criterion by 1.2 hr/day (10%) using a 10PM bedtime, 0.4 hr/day (3%) using the hybrid method, and 0.2 hr/day (2%) using the diary only. When normalized to wear time, sedentary time errors were small (10PM: 1.4%; hybrid: 0.6%; diary: 0.4%). Correlations between alternative and criterion estimates of absolute sedentary time were lowest for the 10PM bedtime (r=0.57, p=0.003), then hybrid (r=0.83, p<0.001), then diary (r=0.97, p<0.001), but all were highly correlated after normalizing for wear time (r≥0.95, p<0.001). Bland-Altman plots showed no pattern of error and limits of agreement (hr/day) that decreased from 10PM (-1.1, 3.3), to hybrid (-1.3, 1.8), to diary (-0.8, 0.5). Differences from criterion steps/day were highest using the 10PM method (329, 11%) and similar for the hybrid or diary methods (39, 1%). Steps were highly correlated comparing all alternative methods to criterion (r≥0.96, p<0.001). CONCLUSIONS: Using a standard 10PM bedtime resulted in the highest error in sedentary time and steps, though correlations to the criterion were ≥0.95 for all methods after normalizing to wear time. In this population, using participant diary is preferred to accurately quantify absolute sedentary time, though all methods were acceptable with wear time normalization.

2898 Board #181 June 1 2:00 PM - 3:30 PM
The Relationship Between Cell Phone Use, Physical Activity, and Sedentary Behavior in Adults Aged 18-80
Curtis Fennell1, Jacob E. Barkley2, Andrew Lepp2. 1University of Montevallo, Montevallo, AL. 2Kent State University, Kent, OH.

(Sponsor: Ellen Glikson, FACSM)

(no relevant relationships reported)

Previous research, using multiple samples of undergraduate college students, suggests cell phone use is primarily a leisure behavior which most often occurs while sitting. This same research has identified a positive relationship between cell phone use and sedentary behavior, but not physical activity. PURPOSE: To examine these relationships among individuals older than traditional college students. METHODS:

An online survey was completed (N = 421; n = 255 females, 40 ± 16 years old) which assessed, using validated measures, total cell phone use, situational cell phone use (i.e. is the cell phone being used for leisure or work purposes and while sitting, standing, or during physical activity), sedentary behavior (i.e., sitting time), and physical activity behavior. A tertile split was then performed and participants were placed into the following groups based upon their cell total phone use: high (n = 131, 474 ± 268 min/d), moderate (n = 138, 190 ± 36 min/d), or low (n = 152, 81 ± 33 min/d) users. RESULTS: Mean cell phone use for the entire sample was 239 ± 224 min/d. Participants reported that, on average, 61% of their cell phone use was for leisure purposes and 80% of their cell phone use occurs while seated. Linear regression found that cell use was positively associated with sedentary behavior (β = 0.157, p = 0.002), negatively associated with age (β = -0.128, p = 0.015), and not related to physical activity (β = 0.091, p = 0.086) or sex (β = 0.023, p = 0.038). Analysis of variance revealed that the behavior of high cell phone use group (521 ± 266 min/d) was in significantly more (p = 0.006) sedentary behavior than low users (442 ± 214 min/d) with no differences (p ≥ 0.1) between the moderate users (471 ± 253 min/d) and either the low or high use groups. CONCLUSION: Cell phone use in this sample of adults which on average were older than college age was similar to previous studies of college students. Participants reported that cell phones were primarily leisure devices and their use was positively associated with sedentary behavior but not physical activity. Specifically, high cell phone users reported 79 min/day or 15% greater sitting than low users. These associations were also independent of age and sex within this sample.

2899 Board #182 June 1 2:00 PM - 3:30 PM
Impact Of Sit-stand Workstation Progressions On Stress, Focus, And Productivity In University Staff Members
Mark A. Schafer, K. Jason Crandall, T. Scott Lyons, FACSM, Kolbi Edens, Lydia Blankenship, Nuha Shaker, Robert Vondy, Western Kentucky University, Bowling Green, KY.

(Sponsor: Scott Lyons, FACSM)

(no relevant relationships reported)

PURPOSE: The purpose of this study was to determine the impact of utilizing sit-stand workstations (Ergotron) throughout the workday on stress, focus, and productivity when following sit-stand progression protocols for 10 weeks. METHODS: Participants (N=60) were randomly assigned to one of three groups. Group 1 and 2 followed a prescribed protocol to progress up to 50 minutes of standing per hour, respectively. The protocol consisted of reminder emails delivered to participants each hour to reinforce prescribed standing times. Group 3 was instructed to stand according to their preference throughout the day. Stress, focus, and productivity during standing and sitting time were measured using the visual analogue scale (VAS) at the end of each day. Data were analyzed using mixed-design repeated measures ANOVA with significance set at p < 0.05. RESULTS: For each group, stress was significantly lower and focus and productivity were significantly higher during standing compared to sitting (p < 0.01) over the 10 weeks. CONCLUSIONS: The results indicate that there is an increase in focus and productivity, along with reductions in stress, when standing compared to sitting throughout the workday. Furthermore, there was no influence of standing time progression throughout the 10 weeks or total standing time per hour. Future investigations should examine the long-term utilization and compliance of the sit-stand workstations and the potential impact on overall health.

2900 Board #183 June 1 2:00 PM - 3:30 PM
The Physical And Psychological Effects Of Standing Desks In Office Workers
Hannah E. Dohn, Dale D. Brown, FACSM, Kristen M. Lagally, FACSM, Kelly R. Launor, Illinois State University, Normal, IL.

(Sponsor: Drs. Dale D. Brown and Kristen M. Lagally, FACSM)

(no relevant relationships reported)

The present study demonstrates differences between energy expenditure in typical office workers and whether or not sit-stand desk options are beneficial. PURPOSE: The purpose of the study was to determine differences in energy expenditure between sitting and standing in typically sedentary office workers. A secondary purpose of this study was to determine mindset differences with regards to job boredom, job stress, and job satisfaction. METHODS: Participants (N = 26, 4 males and 22 females) were from two medium-sized moderately sedentary communities in the Midwest that had standing desk options available to them. Data was collected using BodyMedia SenseWear armbands for energy expenditure and self-reported Likert-scale surveys for psychological data. Data was collected during four sessions; two sitting sessions where participants were asked to not use their standing desk option, and two standing sessions where participants were allowed to stand as they desired. Data was analyzed using paired-samples t-tests to determine mean differences between energy expenditure and survey data. RESULTS: Results of the t-test for energy expenditure indicated the standing condition expended an average of 7.25 kcal more per hour than the sitting condition (t(24) = -3.352, p = 0.003). No differences were found between average total survey data.

Abstracts were prepared by the authors and printed as submitted.
Sedentary time is ubiquitous and inversely associated with health and wellbeing. Full 24-hour objective monitoring is rare, yet necessary, to understand interrelationships between time spent asleep, sedentary and active and their influences on wellbeing. PURPOSE: Our purpose was to use isotemporal substitution to examine the effects of replacing sedentary time (total and prolonged (>30 min) bouts) with shorter sedentary bouts (<30 min), activity, or sleep on mood and stress at baseline and changes in mood/stress over one year. METHODS: Healthy young adults (age: 20-35; n=423 baseline; n=270 at one year; 48% women) wore a Sensewear Armband (SWA) 24 hours/day for 10 days and completed the Profile of Mood States (POMS) and the Perceived Stress Scale (PSS) at baseline and one year. Minute-by-minute differences in sedentary, in light activity or MVPA, and sleeping were assessed with the SWA. Isotemporal substitution was performed separately for replacing one hour of a) total sedentary time and b) time in prolonged bouts with one hour of shorter sedentary bouts, light activity (1.5-3.0 METs), MVPA (>3.0 METs) or sleep, on mood and stress at baseline and changes across one year. RESULTS: At baseline: substituting 60 mins into MVPA from total sedentary time (standardized beta [95% CI]; -1.07 [-0.199, -0.014]) or time in prolonged bouts (-0.119 [-0.212, -0.025]) improved mood, as did swapping prolonged for shorter bouts (+0.106 [+0.211, 0.000]). Substituting time in prolonged bouts with sleep decreased current stress (-0.132 [-0.255, -0.099]) and improved mood (-0.136 [-0.257, -0.015]). When predicting changes in wellbeing at one year: substituting total sedentary time with light activity improved the change in mood at one year (-1.141 [-0.280, 0.002]), while substituting prolonging bouts with light activity non-significantly improved changes in mood (-1.138 [-0.282, 0.006]). CONCLUSIONS: These results suggest that replacing one hour of sedentary time (especially that accumulated in prolonged bouts) with either more sleep or light activity could be effective for improving current and future mental wellbeing in healthy young adults. Longitudinal studies including objective 24-hour monitoring such as this are integral for informing future interventions targeting this set of behaviors.

Retirement is a major life transition and it may influence health behaviors and time use. PURPOSE: To examine changes in leisure sedentary behavior across retirement transition. In addition, we examined which and how pre-retirement characteristics predicted these changes. METHODS: The study population consisted of 1,354 participants from the Finnish Retirement and Aging Study (FIREA). Repeated postal survey including questions on sedentary behavior domains (television viewing, computer use at home, sitting in a vehicle and other sitting) were conducted once a year across retirement transition, covering on average three study waves. RESULTS: Total sedentary time increased by 67 (95% CI 58-75) minutes/day during retirement transition and continued to increase by 27 minutes/day two years after retirement transition (period*time interaction p<0.001). Of the domain-specific sedentary behaviors, television viewing time increased by 25 (95% CI 21-29), computer use at home by 19 (95% CI 16-22), and other sitting time by 36 (95% CI 31-41) minutes/day, while time sitting in a vehicle decreased by 6 (95% CI 3-10) minutes/day during retirement transition. Women (69 vs. 50 minutes/day, sex*time interaction p=0.04) and persons who had high occupational sitting time, sleep difficulties, mental disorders or poor self-reported health before retirement were most likely to increase in sedentary behavior during retirement transition. CONCLUSIONS: Total leisure-related sedentary time and especially television viewing time increased across retirement transition. As both total sedentary behavior and television viewing are associated with adverse health outcomes and mortality among older adults, more attention should be paid to reducing time spent on sedentary behaviors among recent retired adults. Supported by Academy of Finland Grants 268294 and 294154, Finnish Ministry of Education and Culture and Juho Vainio Foundation.

Sedentary behavior (SB) is an emerging health risk. While behavior patterns are often established during young adulthood, little is known regarding the accumulation of SB in this population and its association with mental wellbeing.

METHODS: Participants were recruited as part of a larger study evaluating feedback mechanisms for lessening SB. Baseline assessments of objectively-measured SB were collected with an inclinometer (actiPAL) worn for seven days. Participants subsequently self-reported sedentary time (IPAO), health-related quality of life (SF-36), and mood (POMS). Descriptive statistics and Pearson’s correlation coefficients were used to characterize SB and the cross-sectional relationship between SB and mental wellbeing constructs, including fatigue, pain, anxiety, depression, anger, vigor, and confusion.

Results: Thirty-five participants (age = 19.4 ±1.1 (mean±SD); 64% male) wore the actiPAL for 6.9 ± 0.5 days. Per the actiPAL, subjects accumulated 602.6± 82.4 minutes/day of sedentary time, with 343.5 ± 77.3 min/day accumulated in bouts of > 30 minutes. They had 48.8 ± 12.8 breaks in SB per day, averaging 5.1 ± 1.4 minute/break. Per the IPAQ, SB was significantly lower at 406.59 ± 117.94 min/day (p<0.001). Further, objectively-measured total SB was not significantly correlated with self-reported SB (r = -0.04, p = 0.81), though bouts of SB in ≤30 min was (r=0.36, p=0.04). There were no significant differences in objectively-measured SB, number of breaks in talking on the phone and while watching television (Blacks = 73 and 131, Whites = 26 and 86 min/day). Total time spent sitting on the weekend was higher among Blacks than both Hispanics and Whites (Blacks = 541, Whites = 346, Hispanics = 306 min/day). However, both Blacks and Whites had higher median minutes spent in total sedentary time during the weekday than Hispanics. CONCLUSION: According to these data, racial and ethnic differences exist between various types of SB. Healthcare professionals should consider these differences when designing culturally tailored interventions designed to curve sedentary behavior. Supported by NIH Grants K01CA158000, R03NR010291, and CA016672.
SB, or average break rate by gender or BMI category (p<0.05 for all). SB (objectively- measured or self-reported) was not significantly associated with any of the mental wellbeing outcomes (p>0.05 for all).

Conclusions: College-aged men and women engage in large amounts of SB. The discrepancy between self-report and objective measures suggests they may be unaware of this important health behavior, and may be especially unaware of incidental SB accumulated in shorter bouts. Though SB was unrelated to mental wellbeing in this young healthy population, the development of sedentary habits during young adulthood may be problematic for future health outcomes.

2905 Board #188 June 1 2:00 PM - 3:30 PM
Determinants Of Sedentary Behavior In Adults: Who Is At Risk Of High Sedentary Time?
Esmée A. Bakker1, Duck-chul Lee, FACSM2, Maria TE Hopman, FACSM2, André LM Verbeek, FACSM2, Thijs MH Eijsvogels1, Radboud university medical centre, Nijmegen, Netherlands. 1Iowa State University, Nijmegen, IA. 2Liverpool John Moores University, Liverpool, United Kingdom. (Sponsor: Prof. Dr. Maria Hopman, FACSM) (No relevant relationships reported)

Sedentariness is associated with increased risks for cardiovascular diseases, cancer, type 2 diabetes, and mortality. In order to target sedentary behavior efficiently, we need to identify determinants of sedentary behavior.

PURPOSE: To identify subject- and lifestyle-related determinants for the domains of sedentary behavior (transportation, occupation, leisure-time).

METHODS: Subject characteristics (age, sex, weight, height, marital status, education level, employment, medical history) and lifestyle factors (sleep, smoking, alcohol consumption, physical activity) were collected via an online questionnaire. Sedentary time was assessed using the Sedentary Behavior Questionnaire and estimated for 9 different activities during weekdays and weekend days. Logistic regression calculated odds ratios and 95% confidence intervals (OR [95% CI]) of being sedentary during transportation, occupation and leisure time dichotomized at the 75th percentile (60 minutes/day, 275 minutes/day and 410 minutes/day, respectively).

RESULTS: This study included 7,648 participants (median age 55, 55% men). Being sedentary during transportation and work was associated with younger age (0.99 per year [0.98-0.99], 0.97 per year [0.96-0.97], respectively), men (1.97 [1.76-2.20], 1.58 [1.41-1.78], respectively) and employment (1.68 [1.45-1.93], 7.07 [5.54-9.03], respectively). Also BMI was associated with sedentary time (1.05 per kg/m2 [1.04-1.07]) during transportation. Being sedentary during work was linked with a higher education level (5.29 [3.64-7.67]), and inversely related to former smoking (0.71 [0.54-0.93]) and being a cancer survivor (0.73 [0.56-0.96]). In contrast, higher amounts of sedentary time during leisure-time were associated with older age (1.03 per year [1.02-1.03]), unemployment (1.58 [1.38-1.81]), BMI (1.04 per kg/m2 [1.02-1.06]), being unmarried (1.36 [1.18-1.56]) and worse health status (1.12 per grade [1.03-1.23]).

CONCLUSION: Several subject and lifestyle-factors relate to a sedentary lifestyle, but characteristics markedly differ between different domains of sedentary time. Domain specific determinants should be included when designing new interventions to reduce sedentary behavior.

2906 Board #189 June 1 2:00 PM - 3:30 PM
Sedentary Time and Cumulative Risk of Preserved and Reduced Ejection Fraction Heart Failure: MESA
Brandi S. Rariden1, Michael R. Richardson1, Tammie M. Johnson2, Clinton A. Brawner, FACSM2, Sherry O. Pinkstaff1, James R. Churilla, FACSM3, 1University of North Florida, Jacksonville, FL. 2Henry Ford Hospital, Detroit, MI. (Sponsor: James R. Churilla, FACSM3) (No relevant relationships reported)

Purpose: Examine the relationship between self-reported sedentary time and cumulative risk of preserved ejection fraction heart failure (HFpEF) and reduced ejection fraction heart failure (HFrEF) and sedentary time.

Methods: Using data from the Multi-Ethnic Study of Atherosclerosis (MESA), we identified 6,814 subjects (52.9% female). All were free of baseline cardiovascular disease. Cox regression was used to calculate the hazard ratio (HR) (MESA) was borderline significant (p=0.050). Differences were mostly small-to-moderate (approximately 0.2 to 0.5 SD) with the greatest differences (≥0.5 SD) being for obesity and diabetes status. METHODS: Data were from a subsample of 727 AusDiab study (2011-12) wave 3 participants who wore the activPAL3 device for 24 days. A break (any upright event following sitting) was categorized as a HEB if it contained ≥5 minutes upright time (upright HEB) or ≥2 minutes stepping time (ambulatory HEB). Linearized variance estimation corrected for the multistage design and significance was set at p<0.05. SUMMARY OF RESULTS: On average (mean ± SD), per day, there were 53.1 ± 14.8 breaks in total, but only 19.7 ± 4.8 HEBs; 18.4 ± 4.5 upright HEBs and 13.6 ± 4.5 ambulatory HEBs, with many HEBs meeting both criteria. Older age, higher BMI and having diabetes were all significantly associated with fewer breaks of all types. After mutual adjustment, these associations remained significant except for the association between total breaks and diabetes, which was heavily attenuated (p=0.573). Women differed significantly from men only in having more upright HEBs; following adjustment, this association was borderline significant (p=0.050). Differences were mostly small-to-moderate (approximately 0.2 to 0.5 SD) with the greatest differences (≥0.5 SD) being for obesity and diabetes status. DISCUSSION: These findings in the free-living environment, using accurate accumulation measures, indicate that very few breaks from sitting are needed for heart health benefits. These findings are consistent with the American Heart Association recommendations for time spent sitting.
Previous studies have shown that supplementation with Cissus Quadrangularis (CQ) can positively alter body composition in sedentary adults. However, it is unknown if this same effect is observed in active adults. PURPOSE: The purpose of this study was to determine the effects of 6 wk of supplementation with CQ on body composition and exercise performance in healthy adults enrolled in a crossfit class. METHODS: A total of 18 adults (9 males, 9 females, 40.2±8.3 y; mean±SD) completed this study. All subjects had been enrolled in crossfit classes prior to the study. Baseline body composition was assessed by whole body densitometry using air displacement plethysmography, and exercise performance was assessed using a time to completion 1000 m rowing test and a 3 repetition max for the standing press and back squat. Following baseline testing, subjects were randomly assigned in a double-blind manner into one of two groups: 3.2 g of CQ; or 3.2 g of a maltodextrin placebo (PL). Subjects consumed half of the daily dose of CQ or the placebo at the beginning of each day. All testing was completed following 7 days of treatment. Pre to post differences were analyzed using a treatment by time repeated measures ANOVA. RESULTS: After 6 wk of treatment, there were no significant differences observed between the CQ or PL group for change in body weight (CQ= -0.2±0.8 kg, PL= -0.7±1.5 kg; p=0.77), fat mass (CQ= -1.1±0.7 kg, PL= -1.1±1.9 kg; p=0.96), fat free mass (CQ= +0.8±0.7 kg, PL= -0.7±1.5 kg; p=0.89), body fat % (CQ= -1.2±0.7 % body fat, PL= -1.1±1.9 % body fat, p=0.94), 3 rep max back squats (CQ= +17.6±11.5 lbs, PL= +16.7±13.2 lbs, p=0.10), 3 rep standing press (CQ= +8.3±6.1 lbs, PL= +7.3±5.6 lbs, p=0.08), or 1000 m rowing test (CQ= -3.0±6.0, PL= -3.9±3.6, p=0.81). CONCLUSION: Compared to the placebo, 6 wk of supplementation with CQ did not alter the body composition or exercise performance adaptations to crossfit training in experienced crossfitters.

Exercise-induced muscle damage (EIMD) symptoms may be attenuated through dietary polyphenol consumption by reducing acute inflammation and oxidative stress, protein degradation, and soreness. However, it is unclear if long-term supplementation of a multi-ingredient resveratrol-based polyphenolic compound mitigates EIMD symptoms and facilitates performance recovery. PURPOSE: To investigate the effects of a resveratrol-based polyphenolic supplement on indices of EIMD. METHODS: Male and female subjects completed a muscle damaging exercise protocol consisting of eccentric-loaded resistance exercise (ECRE) followed by 4 weeks of resveratrol-polyphenol (RES) (n=10) or placebo (CTL) (n=12) supplementation. Perceived soreness, pain threshold and tolerance, range of motion, body composition, nutritional intake, maximal voluntary contraction (MVC), oxygen consumption, subjective fatigue, and serum carbonylated protein were measured in pre- and post-intervention. RESULTS: Lean body mass was significantly increased in both groups (p < 0.05). Intakes of astaxanthin, β-carotene, and resveratrol were significantly increased in the A group (p < 0.01). Although MVC (kg) of leg extension was significantly higher in post-intervention (C: 26.2 ± 1.7, A: 31.1 ± 2.1) than in pre-intervention (C: 24.2 ± 2.0, A: 25.3 ± 2.4) (C: p < 0.04, A: p < 0.005) in both groups, the degree of change was higher in the A group (C: 2.0 ± 0.8, A: 5.7 ± 1.5) (p = 0.065). Oxygen consumption (ml/kg/min) was significantly higher in post-intervention (3.6 ± 0.1) than in pre-intervention (3.4 ± 0.1) (p = 0.049) in the A group, but not changed in the C group. The degree of subjective fatigue was significantly lower in post-intervention (2.0 ± 0.4) than in pre-intervention (3.1 ± 0.6) (p = 0.028) in the A group, but not changed in the C group. In addition, serum carbonylated protein (nmol/mg) was significantly lower in post-exercise (0.12 ± 0.01) than in pre-exercise (0.15 ± 0.01) (p = 0.026) in post-intervention of the A group only. CONCLUSIONS: Intakes of astaxanthin, β-carotene, and resveratrol may promote recovery following exercise-induced muscle adaptation by reducing fatigue and oxidative stress, leading to higher muscle strength.

Blackcurrant is high in anthocyanin content. We have shown enhanced whole-body fat oxidation and increased time trial performance during cycling, in addition to increased femoral artery diameter during an sustained submaximal isometric contraction of the m.quadriceps with intake of New Zealand blackcurrant (NZBC) extract in normobaric normoxia (Cook et al., 2015, 2017). The effect of blackcurrant on metabolic and physiological responses and performance during cycling in normobaric hypoxia are not known. PURPOSE: To examine the effect of NZBC extract on intensity-dependent physiological and metabolic responses and 16.1-km time trial performance in trained cyclists in normobaric hypoxia. METHODS: The study used a double-blind randomized cross-over design. Eleven healthy men from cycling and triathlon clubs with at least 3 yrs experience and cycling 8-10 hr week−1 (age: 38±11 yrs, height: 179±4 cm, body mass: 76±8 kg, VO2max: 47±5 mL·kg−1·min−1, maximum power: 398±38 W, mean±SD) ingested NZBC extract (600 mg·day−1) containing 220 mg anthocyanins) or placebo (PL) for 7 days (washout 14 days). Participants performed bouts of 10 min at 45.5, 55 and 65% VO2max using indirect calorimetry and blood sampling, followed by a 16.1 km-time trial on a SRM ergometer (SRM International, Germany). Participants were familiarized for the time trial. All testing took place in a temperature controlled (15°C) normobaric hypoxic chamber set at an altitude of ~2500 m (15% FiO2) (TIS Services, Medstead, UK) in morning sessions. Data was analysed using paired t-tests. RESULTS: At each intensity, NZBC extract had no effect on metabolic and physiological responses (e.g. at 65% VO2peak, heart rate - PL: 133±12, NZBC: 132±12 beats min−1); fat oxidation - PL: 0.24±0.12, NZBC: 0.20±0.16 g min−1; carbohydrate oxidation - PL: 2.34±0.42, NZBC: 2.48±0.35 g min−1; lactate - PL: 1.37±0.45, NZBC: 1.56±0.57 mmol L−1). No improvements in 16.1 km time-trial performance were observed (PL: 16:85±92, NZBC: 16:58±99 sec). CONCLUSION: Seven day intake of New Zealand blackcurrant extract does not change whole-body fat oxidation and 16.1
km time-trial performance during cycling in normobaric hypoxia. Supplements were provided by Health Currancy Ltd (UK). Blackcurrants New Zealand Inc (NZ) provided funding for conference attendance.

2913 Board #196 June 1 3:30 PM - 5:00 PM
Effects Of Montmorency Tart Cherry (L. Prunus Cerasus) Consumption On Nitric Oxide Biomarkers And Exercise Performance.
Karen M. Keane1, Stephen J. Bailey1, Anni Vanhatalo, FACSM2, Andrew Jones, FACSM2, Glyn Howatson, FACSM1.
1 Northumbria University, Newcastle Upon Tyne, United Kingdom. 2 Loughborough University, Loughborough, United Kingdom. (Sponsor: Professor Glyn Howatson, FACSM)

Montmorency tart cherries contain numerous polyphenols that have been shown to improve blood flow and blood pressure. These effects might be linked to increased nitric oxide (NO) synthesis and contribute to improved exercise performance, but this has yet to be investigated. PURPOSE: To investigate the effects of supplementation with Montmorency tart cherry juice (MC) on plasma nitrite concentration ([NO2]p), a sensitive NO biomarker, vascular function and exercise performance in trained cyclists. METHODS: In a randomized, double blind, placebo-controlled, crossover study, 10 physically active males (mean ± SD age: 28 ± 7 years, stature: 1.83 ± 0.06 m, body mass: 78.0 ± 8.5 kg and VO2max: 59.0 ± 7.0 ml/kg/min) acutely ingested 30 ml of either MC or Placebo (Pla) and completed a 6 min moderate- and severe-intensity cycling bout at 1.5 h post ingestion on two occasions for each experimental condition. The severe-intensity cycling test was continued to exhaustion on one occasion and immediately followed by a 60 s all-out sprint on the other occasion. Blood pressure, pulse wave measures, tissue oxygenation index and plasma [NO2]p were assessed pre and 1.5 h post MC and Pla ingestion.

RESULTS: Time to exhaustion was not different between conditions (P > 0.05), but peak power over the first 20 s (363 ± 42 vs. 330 ± 26 W) and total work completed during the 60 s all-out sprint (21 ± 3 vs. 19 ± 3 kJ) were 10% higher in the MC trial compared to the Pla trial (P < 0.05). Systolic blood pressure was 5 ± 2 mmHg lower 1.5 h post MC supplementation compared to Pla supplementation (P < 0.05). There were no differences in pulse wave measures, plasma nitrite concentration or tissue oxygenation index between the MC and Pla trials (P > 0.05).

CONCLUSIONS: These results suggest that acute supplementation with MC can lower blood pressure and improve some aspects of exercise performance, specifically end-sprint performance, in trained endurance cyclists. These data reveal a practical, non-pharmacological, dietary intervention that may have implications for enhancing vascular health and exercise performance in trained cyclists.

2914 Board #197 June 1 3:30 PM - 5:00 PM
Effects Of Blackcurrant Extract On Peripheral Blood Flow And Muscular Endurance
Matthew J. Barnes1, Blake G. Perry2, Roger D. Hurst1, Dominic Lomives1. 1 Massey University, Palmerston North, New Zealand. 2 Plant and Food Research, Palmerston North, New Zealand.

The consumption of blackcurrants has previously been shown to increase blood flow to the hands and eyes in humans at rest via vasodilatory mechanisms attributed to polyphenolics. While an increase in blood flow to the hands at rest may have health benefits, the potential health benefits of increased blood flow during exercise may, in theory, delay the onset of fatigue by improving oxygen and nutrient delivery to the muscle.

PURPOSE: To investigate the effects of New Zealand blackcurrant extract on peripheral (forearm) blood flow and muscular performance.

METHODS: Ten healthy males participated in two trials during which they ingested either blackcurrant extract (BC), delivering 1.87 mg anthocyanins/kg bodyweight, or a placebo powder (PP) containing equivalent amounts of glucose, fructose and sucrose to BC; treatment allocation was randomly allocated in a balanced fashion and participants were blinded to the treatments. Participants sat at rest and measures of forearm blood flow (FBF), using venous occlusion plethysmography, heart rate (HR), systolic (SBP) and diastolic blood pressure (DBP) were recorded immediately post and every 30 min during the 60 min treatment ingestion, for 2 h. After 2 h participants completed intermittent isometric handgrip exercise to volitional fatigue. Differences within and between trials for all criterion measures were analysed using two-way repeated measures ANOVA.

RESULTS: A treatment effect (p < 0.014), time effect (p < 0.05) and a treatment x time interaction (p = 0.005) were observed for FBF. FBF decreased over the 2 h period with PP only (90 min = 35.8 ± 28.8 %, p < 0.047; 120 min = 39.4 ± 29.1 %, p < 0.028), no change was observed with BC. HR, SBP and DBP changed over time (all p < 0.001) however no difference between treatments was found. The number of repetitions completed during hand grip exercise did not differ between treatments (BC = 73.6 ± 28.8 repetitions vs PP = 77.2 ± 44.5 repetitions).

CONCLUSIONS: New Zealand blackcurrant extract maintains peripheral blood flow during a period of prolonged sitting, however this effect does not alter fatiguing hand grip performance.

2915 Board #198 June 1 3:30 PM - 5:00 PM
Effects Of Acute Golden Root Extract (rhodiola Rosea) Supplementation On Anaerobic Exercise Capacity
Christopher G. Ballmann, Shelby Maze, Abby Wells, Mallory Marshall, John Petrella, FACSM, Rebecca Rogers. Sanford University, Birmingham, AL. (Sponsor: John Petrella, FACSM)

PURPOSE: The purpose of this study was to examine the effects of acute golden root extract (GRE) supplementation on repeated Wingate exercise performance.

METHODS: College aged female participants (age = 19.0 yrs ± 0.63, height= 66.3 ± 1.8, weight= 152.8 lbs ± 19.9) were recruited for this study. In a within groups counterbalanced study design, participants were supplemented with either 1,500 mg/day GRE or placebo (gluten-free cornstarch) for 3 days. Participants also took an additional 500 mg dose of corresponding treatment 30 minutes prior to testing of each trial. During each exercise trial, participants completed 3x 15 second Wingate cycle tests separated by 2 minute recovery periods. Each exercise trial was separated by a 1 week washout period. RESULTS: Over the 3x 15 second Wingate cycle tests, mean watts (p = 0.01), mean anaerobic capacity (p = 0.025), and total work (p = 0.018) were higher in the GRE treatment trial versus placebo. However, mean anaerobic power (p = 0.185), mean peak watts (p = 0.078), and fatigue index (p = 0.186) were unaffected regardless of treatment. CONCLUSIONS: This study suggests that acute GRE supplementation improves repeated Wingate performance suggesting a role for GRE as an ergogenic aid.

2916 Board #199 June 1 3:30 PM - 5:00 PM
Nutritional Analysis of Ginger (Zingiber Officinale) Drink: Potentials for Sport Performance
Muhammed A. Muhammed1, Olufunmilola L. Dominic1, Iliasu Y. Seidina1, Emmanuel O. Sarpong1, Adetayo E. Talabi1. 1 University of Ilorin, Ilorin, Nigeria. 2 University of Education, Winneba, Winneba, Ghana.

PURPOSE: Sport and energy drinks for performance enhancement is a common practice among athletes. These supplements reportedly increases endurance; dehydration, anxiety, headache, sleep disturbances, caffeine intoxication, withdrawal syndrome, dependence and over working of body systems leading to exploration of alternative traditional herbal supplements like ginger which has both dietary and medicinal values. The purpose of this study is to determine nutritional values of ginger drink and ascertain their potentials for enhancing sport performance.

METHODS: Experimental research design was adopted to analyse two versions of ginger drinks prepared using ginger rhizomes (Botanical Identification: U1/001/1083) was obtained from an open market in Ilorin, Nigeria. Ethical clearance was obtained from the University of Ilorin Ethical Review Committee. The ginger rhizomes was used to prepare 2ml/98ml (H2O) and 3ml/97ml (H2O) of ginger concentration. Six samples; (i) 2ml & (ii) 3ml with 1 cube of sugar (1CS) each (iii) 2ml & (iv) 3ml with 2 cubes of sugar (2CS) each (v) 2ml & (vi) 3ml each with no sugar (NS) were prepared and subjected to proximate analysis at the Department of Industrial Chemistry, University of Ilorin, Nigeria. Statistical analysis was descriptive and nutritional components were reported as percentage per 100ml. RESULTS: Nutritional values of the ginger drinks were similar; all six samples contained protein, fat, carbohydrate, vitamins and essential minerals; the energy value was 168 kJ/100ml, which was richer than most energy/sport drinks commonly consumed in Nigeria. These indicated ginger drink might effectively enhance glucose supply for ATP synthesis, delay fatigue, reduce exercise induced oxidative stress, boost recovery and augment performance. Ginger drink containing 1CS had increased pH/100ml: 3.50% for both 2ml/98ml (H2O) and 3ml/97ml (H2O) of ginger concentration. Six samples; (i) 2ml & (ii) 3ml with 1 cube of sugar (1CS) each (iii) 2ml & (iv) 3ml with 2 cubes of sugar (2CS) each (v) 2ml & (vi) 3ml each with no sugar (NS) were prepared and subjected to proximate analysis at the Department of Industrial Chemistry, University of Ilorin, Nigeria. Statistical analysis was descriptive and nutritional components were reported as percentage per 100ml. RESULTS: Nutritional values of the ginger drinks were similar; all six samples contained protein, fat, carbohydrate, vitamins and essential minerals; the energy value was 168 kJ/100ml, which was richer than most energy/sport drinks commonly consumed in Nigeria. These indicated ginger drink might effectively enhance glucose supply for ATP synthesis, delay fatigue, reduce exercise induced oxidative stress, boost recovery and augment performance.
2917  Board #200  June 1 3:30 PM - 5:00 PM
The Effect of Curcumin on Inflammation and Exercise Induced Muscle Damage in Healthy Adults
Alexa Gerchrman,1 Angela Hillman2, Erin O’Hora1. 1Marywood University, Scranton, PA. 2Ohio University, Athens, OH. (No relevant relationships reported)

Curcumin has become a popular nutraceutical product used to decrease inflammation and recently in recovery from exercise. PURPOSE: To determine the effect of curcumin on inflammation and exercise induced muscle damage after plyometric exercise. METHODS: Participants (n=22; Age: 21.48 ± 1.63 years, Height: 176.37 ± 8.12 cm, Weight: 79.16 ± 11.30 kg) were given either curcumin (500 mg with 95% total curcuminoids) or placebo (maltodextrin) supplements twice daily for 9 days (5 days pre exercise, day of exercise and 3 days post exercise. Participants completed 5 sets of 20 drop jumps on day 6. Blood sampling and recovery tests were assessed at pre-supplementation, 24-hours pre-exercise, and 0, 24, 48 and 72hrs post-exercise. Blood markers included creatinine (CK) and erythrocyte sedimentation rate (ESR). Muscle damage symptoms were measured via thigh circumference, vertical jump and subjective measurement of pain (VAS) during a squat and a squat jump. RESULTS: Both groups experienced symptoms of muscle damage in the 24 hours post exercise with elevated CK (403 ± 39 ul), increased VAS pain scores with squatting (37 ± 30 mm), and pain with squat jump (36 ± 31 mm). Vertical jump also decreased over time in the placebo group (19.8 ± 4.8 inches vs. 21.4 ± 3.2 inches, placebo vs. curcumin; p = 0.04). There was no significant change over time or between groups in thigh circumference. CK was not significantly different between groups despite being ≥200 ul greater 24 hr post exercise in placebo vs. curcumin (528 ± 573 ul vs. 325 ± 178 ul, respectively). ESR was significantly greater immediately post exercise in the placebo vs. curcumin group (6.3 ± 5.6 vs. 3.4 ± 2.6 mm/hr), however these were within the normal range limit for this test. CONCLUSION: These data suggest curcumin may aid in pain reduction and potentially inflammation following plyometric exercise. However, future studies need to confirm the efficacy of curcumin for relieving signs and symptoms of exercise-induced muscle damage. Potential targets for future research include dosing protocols and strategies (i.e., daily dosage and required length to provide benefit). Study was supported by the Academy of Nutrition and Dietetics Foundation-McCormick Science Institute Research Award.

2918  Board #201  June 1 3:30 PM - 5:00 PM
The Effects of Blueberry Supplementation on Exercise-Induced Muscle Damage
Lyndsay J. Lee, Paul C. Miller, FACSM, Takudzwa A. Madzima. Elon University, Elon, NC. (No relevant relationships reported)

Blueberries have been reported to possess several anti-inflammatory properties. Previous studies examining the anti-inflammatory effect of blueberries on acute inflammation caused by exercise-induced muscle damage are largely inconclusive. This may be due to the dose used in these studies not accounting for an individual’s lean mass (LM), the compartment directly involved during exercise, when determining appropriate blueberry dosage. PURPOSE: To examine the effect of blueberry supplementation (BB) at a dose relative to LM on delayed onset muscle soreness (DOMS) and recovery. METHODS: Fourteen recreationally active women (age: 21±1yr; body fat: 24.8±5.4%) participated in this double blind, matched-pairs study. Participants were matched by LM and randomly assigned to either a BB or a placebo (PLA) group. Leg strength was assessed via one-repetition maximum (1RM) on a leg press. Participants consumed a daily dose of freeze-dried BB powder (1.6g BB/kilo LM) or a PLA (1.6g PLA/kilo LM) for 7 days prior to induction of DOMS. Participants completed 6 sets of 10 repetitions at 70% 1RM on the leg press to induce DOMS. Perceived soreness (questionnaire), pressure-pain threshold (dolorimeter), and average power (AP; Biodex™) of the right thigh muscles were assessed immediately before (Pre) and after (POST), 24, 48, and 72hrs post induction of DOMS. Reported measures ANOVAs were used for analyses. Significance was set at p<0.05. RESULTS: There were no group x time interactions for perceived soreness, pressure-pain threshold, and AP, however, significant time effects were observed for these variables. When comparing pre to post 24hr (p<0.001), 48hr (p<0.001), and 72hr (p<0.011) perceived soreness of the right thigh muscles significantly increased. Pressure-pain threshold of the right thigh muscles decreased significantly from pre to post 24hr (p<0.023), 48hr (p<0.001), and 72hr (p<0.024). Isokinetic leg extension AP decreased from pre to post 24hr (BB: 83.17 ± 17.62±22Nm; PLA: 85.21 ± 79.20±26Nm; p<0.02). CONCLUSION: Consumption of BB for 7 days prior to DOMS induction on a leg press does not affect rating of perceived soreness, pain threshold, nor attenuate decreases in performance compared to a PLA in recreationally active women.

2919  Board #202  June 1 3:30 PM - 5:00 PM
The Effects Of Rhodiola Rosea Supplementation On Time To Fatigue And Recovery After Exercise In Rats
Gerseli Angeli1, Turbicio Barros Neto2, Donald Kirkendall, FACSM1. 1São Paulo Federal University, São Paulo, Brazil. 2Duke University, Durham, NC. (Sponsor: Donald Kirkendall, FACSM) (No relevant relationships reported)

Rhodiola rosea is one of the most popular adaptogens claimed to promote physical/ cognitive vitality, with ability to reduce the effects of prolonged and minor physical exhaustion that results in fatigue. PURPOSE: To determine the effects of Rhodiola rosea standardized extract supplementation on exercise tolerance and muscular recovery in rats submitted to a 8 weeks swimming training protocol. The study was designed to evaluate the interaction between the Rhodiola rosea supplementation and a physical training program in the variables of the enzymatic adaptations and their gene expressions related to the glycogen resynthesis after exercise. METHODS The study was conducted with 30 rats: Control group (n=10) Exercise group (n=10) and Rhodiola/exercise group (n=10). The training and supplementation protocol consisted in a 8 weeks period. In the Rhodiola/exercise group the animals received 50 mg/kg/day of the product by gavage (intragastric administration). The training protocol consisted in a swimming time of approximately 2h/day 5 days/week. The animals were also submitted to a  fatigue evaluation test pre and post the 8 weeks program. The analyzed variables were: plasma glucose, muscle and hepatic glycogen, gene expression of glycogen synthase and time to fatigue. RESULTS: Post exercise muscular glycogen content was lower in the Rhodiola+Exercise group (0.13±0.01 mg/100mg of tissue) compared with the exercise group (0.64±0.02 mg/100mg of tissue). Post exercise liver glycogen content was also lower in the Rhodiola+Exercise group (0.89±0.01 mg/100mg of tissue) compared with the exercise group (1.77±0.16 mg/100mg of tissue). Gene expression (mRNA) of glycogen synthase was higher in the Rhodiola+Exercise group (1.29±0.43) compared with the exercise group (1.05±0.32). The time to exhaustion was higher in the Rhodiola+Exercise group (93.0±0.34 minutes) compared with the exercise group (71.8±0.43 minutes). CONCLUSION: 8 weeks of Rhodiola rosea supplementation improved the muscle and glycogen mobilization, increasing the time to fatigue. The Rhodiola rosea also increased the gene expression of the glycogen synthase which suggests its benefits on the recovery time after an intense exercise.

2920  Board #203  June 1 3:30 PM - 5:00 PM
Curcuma Longa Extract Reduces Muscle Soreness And Myoglobin Following A Half-marathon: A Double-blind, Placebo-controlled, Randomized
João Felipe Mota1, Flávia Rasmussen Faría1, Aline Corado Gomes1,1 Kennia Rocha Rezende1, Gustavo Duarte Pimentel1, Camila Lemos Pinto1, Marcelo Saldaña Aoki1. 1Federal University of Goias, Goiânia, Brazil. 2University of Alberta, Edmonton, AB, Canada. 3University of São Paulo, São Paulo, Brazil. (No relevant relationships reported)

Strenuous exercise result in muscle damage. Oral curcumin appears to reduce pain associated with delayed onset muscle soreness and enhance recovery of muscle performance. PURPOSE: The purpose of this study was to examine the chronic effect of curcuma intake after a half-marathon run on indirect markers of muscle damage. METHODS: Twenty-eight men completed a double-blind randomized-controlled trial. Curcuma Longa L. extract (SG - 1,5g/ day) or placebo (PG - microcrystalline cellulose) was taken twice daily (two capsules during the lunch and one capsule during the dinner) for 4 weeks, then three capsules immediately before the half marathon. Measurements were made at baseline (M0), 20 days after supplementation (M1), immediately before (Pre), after the half marathon (Post), two hours after the half marathon (2 h post), 24 hours after the half marathon (24 h post), and 48 hours after the half marathon (48 h post), comprising: CK, LDH, ALT, AST, myoglobin and muscle soreness. RESULTS: SG decreased muscle soreness in palpation of biceps femoris 48-h after half-marathon run (P < 0.05). No difference between groups was observed in ALT, AST, CK, LDH. Myoglobin concentrations were lower after 2 h post competition in SG when compared to PG (62.1 ± 8.26 vs. 107.9 ± 18.5 mg/ mL; P < 0.05). CONCLUSIONS: Curcuma Longa extract reduces muscle soreness and myoglobin concentration after a half-marathon run. Supported by CNPq Grant 484023/2013-6.
Echinacea supplements were examined for variation among 76 commercial capsule/tablet and 17 tincture products. Hierarchical clustering analysis indicated that the composition of Echinacea supplements differs tremendously with respect to species, plant material type, extraction method, and standardization. The plant material type explained a large amount of variation in composition among the supplements with 68% of the variation explained by the type of plant material used (raw or extracted). In contrast, 22% of the variation in composition was explained by the combination of species and plant material types. The analysis revealed that the majority of supplements (98%) contained Echinacea purpurea, and 20% were standardized for total Echinacea alkaloids.

F-61 Free Communication/Poster - Ergogenic Aids V - Food, Herbal Supplements & Health
Friday, June 1, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

David S. Senchina. Drake University, Des Moines, IA.

Dimethylallyl disulfide (DIM) is present in cruciferous vegetables and further produced after ingestion of crucifers. DIM has been studied for numerous potential health benefits. PURPOSE: To determine if 12 weeks of curcumin supplementation decreases homocysteine in overweight and obese young men. METHODS: Thirty-two young men (mean ± standard deviation: 27 ± 4 years of age; mean ± standard deviation: 101 ± 15 kg of body weight) were matched based on BMI and randomized into the intervention (curcumin formulated 1560 mg/day) and control (placebo) groups. Participants were given DIM (150mg) or placebo twice daily for seven days before returning to the lab, providing blood and urine samples for analysis, undergoing a resting metabolic rate (RMR) assessment and exercising for 20 minutes at a moderate intensity (50% VO2 peak). Prior to crossing over to the other treatment, subjects had a 7 day washout period. RESULTS: Paired samples T-test did not reveal differences for total cholesterol (t=0.49, p=0.62) DIM 149mg/dL±19.2, placebo 161mg/dL±16.7), triglycerides (t=0.29, p=0.77) DIM 137.6mg/dL±31.2, placebo 149mg/dL±19.5), Fasting Glucose (t=0.03, p=0.97) DIM 98mg/dL±10.6, placebo 99mg/dL±12.9), RMR (t=0.37, p=0.71) DIM 2576.4 kcal/24hr±161.4), Additionally, there were no significant differences found for exercise respiratory exchange ratio (RER), glucose or lactate between treatments (t=0.86, p=0.40). Urine sample were analyzed for 2-hydroxysterone (20HE1) and 16a-hydroxysterone (16a-OH-E1) levels using a commercially available immunoassay. Analysis of results did not reveal differences for 20HE1 (t=0.23, p=0.63) DIM 4.58 ng/ml±4.28 placebo 3.80 ng/ml±3.18) or 16a-OH-E1 (t=0.94, p=0.35) DIM 13.34 ng/ml±14.24 placebo 13.87 ng/ml±12.83). When examined as a ratio 20HE1/16a-OH-E1 Anova did reveal a significant increase associated with DIM ingestion (F=2.28, p=0.04, ES=0.67). CONCLUSION: Based upon the data from the present study supplemental DIM does not appear to alter metabolism at rest or exercise in overweight young men. The higher 20HE1 to 16-OH-E1 warrants further investigation as this ratio may be associated with positive health outcomes.
Although exercise has been shown as effective in lowering postprandial hyperglycemia in patients with type 2 diabetes, alternative approaches for those patients who face substantial barriers to physical activity remain less explored.

**PURPOSE:** The aim of this study is to compare the effects of bitter melon intake versus exercise on postprandial glucose responses in type 2 diabetic patients who receive hypoglycemic agents.

**METHODS:** Using a 2 x 2 randomized cross-over design, 33 female participants (age=52±2 y; stature=157±6 cm; body mass=69.9±11.3 kg; body mass index=27.8±3.29 kg/m²; Control [CON] n=7, supplement [SUP] n=9, aerobic training [AT] n=9, supplement-aerobic training n=8 [SAT]) participated in the study. Primary outcomes were total antioxidant capacity (TAC), superoxide dismutase (SOD), glutathione (GSH), and glutathione peroxidase (GPx) which were measured at baseline and at week 6. All participants were asked to maintain their normal dietary intake during the study period. Participants in both AT and SAT groups were required to follow six weeks of aerobic exercise training program, three sessions a week for at least 45 minutes per session. Those involved in the SUP and SAT groups had a daily oral ingestion of 100 ml of bitter melon juice before the 75-g oral glucose load. All participants completed 2-hour oral glucose tolerance test after bitter melon or exercise interventions. Linear mixed models were used to test the effects of treatment, time, and treatment x time interaction on postprandial glucose values after adjustment for covariates. General linear model was used to test incremental area under curve (iAUC) difference between bitter melon and exercise groups after adjustment for covariates.

**RESULTS:** The baseline glucose levels between bitter melon and walking conditions were similar (6.6±0.9 vs. 6.8±0.7 mmol/L; P=0.57). There were no statistical differences for the mean glucose during the 2-h postprandial period (13.7±2.8 vs. 13.0±2.4 mmol/L; P=.56) and 2-h postprandial glucose iAUC (12.6±4.8 vs. 10.7±3.6 mmol/L; h P=0.38) between the bitter melon and walking conditions. There was no treatment x time interaction on glucose values (P=0.56). When comparing the glucose levels between the two conditions at each time point, there was also no statistical difference in glucose values at 30 minutes (12.4±2.1 vs. 10.5±2.1 mmol/L; P=0.086), at 60 minutes (14.5±2.8 vs. 13.6±2.7 mmol/L; P=0.56), 90 minutes (14.7±3.7 vs. 14.4±3.3 mmol/L; P=0.88), or 120 minutes (13.5±4.6 vs. 13.4±3.9 mmol/L; P=0.95), respectively, between bitter melon and walking conditions.

**CONCLUSIONS:** Our findings suggest that, among patients with type 2 diabetes, the intake of 100 ml of bitter melon juice can elicit similar postprandial glucose responses, as compared with performing 30 minutes of walking at moderate-intensity.

**S602 VOL. 49 NO. 5 SUPPLEMENT**

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

**2925 Board #208 June 1 3:30 PM - 5:00 PM Bitter Melon Intake Versus Exercise For Postprandial Glucose Among Patients With Type 2 Diabetes**

Tongyu Ma, Chong-Do Lee, FACSM. Arizona State University, Phoenix, AZ.

(NO relevant relationships reported)

**PURPOSE:** The aim of this study was to examine the effects of long-term aerobic exercise training and ingesting pomegranate juice on selected plasma oxidative stress markers in middle-aged women with type II diabetes.

**METHODS:** In a randomized, placebo-controlled design, 33 female participants (age=52±2 y; stature=157±6 cm; body mass=69.9±11.3 kg; body mass index=27.8±3.29 kg/m²; Control [CON] n=7, supplement [SUP] n=9, aerobic training [AT] n=9, supplement-aerobic training n=8 [SAT]) participated in the study. Primary outcomes were total antioxidant capacity (TAC), superoxide dismutase (SOD), glutathione (GSH), and glutathione peroxidase (GPx) which were measured at baseline and at week 6. All participants were asked to maintain their normal dietary intake during the study period. Participants in both AT and SAT groups were required to follow six weeks of aerobic exercise training program, three sessions a week for at least 45 minutes per session. Those involved in the SUP and SAT groups had a daily oral ingestion of pomegranate juice (150 ml) for a 6-weeks period [SUP; evening; SAT, an hour after exercise]. The CON group did not receive any intervention. Data were analyzed by GLM and presented as mean (SD).

**RESULTS:** We observed a significant increase in plasma TAC and GPx only in SAT (p=0.001). There was a significant increase in plasma SOD in the SUP, AT, and SAT, but not in the CON (p=0.001). There was a significant improvement in plasma GSH in the SAT compared to the CON and SUP (0.034).

**CONCLUSIONS:** Our results indicate that combining aerobic exercise training and pomegranate juice supplementation can have beneficial impact on the antioxidant defense system of the body and reduce oxidative stress in middle-aged women with type II diabetes.

**FRI, JUNE 1, 2018**

**2926 Board #209 June 1 3:30 PM - 5:00 PM Curcumin Supplementation Mitigates NASH Development and Progression in Female Wistar Rats**

Mary Moore1, Rory Cunningham1, Angelique N. Moore1, James C. Healy1, Michael D. Roberts2, Scott Rector, FACSM1, Jeffrey S. Martin1. 1University of Missouri & Truman VA; Columbia, MO. 2Auburn University, Auburn, AL. (Sponsor: Scott Rector, FACSM)

(NO relevant relationships reported)

**PURPOSE:** Nonalcoholic steatohepatitis (NASH) is independently associated with mortality risk and currently there are no proven pharmacological therapies for treatment. Limited existing evidence suggests that curcumin, a naturally occurring plant polyphenolic compound known to exert anti-inflammatory and antioxidant effects, may have beneficial effects on attenuating NASH development. Here we sought to determine whether curcumin supplementation could be used in both the prevention and treatment of NASH with fibrosis and was particularly effective in attenuating hepatic inflammation. Further study is warranted to examine the anti-inflammatory properties of curcumin in the treatment of NASH.

**METHODS:** Female Wistar rats (n=48) were fed a ‘western diet’ (WD) high in fat (43% kcal) and cholesterol, and administered CCl4 injections (0.5 ml/kg) at weeks 1, 2, 4 and 6 to induce a NASH with fibrosis phenotype. Rats were randomized to 4 groups (n=12/group): Fed WD for 8 weeks (WD8), fed WD enriched with curcumin (WD+C; 0.2% curcumin, BCM-95, Dolcas Biotech), fed WD for 12 weeks (WD12) or fed WD for 8 weeks followed by 4 weeks WD+C (WD12-C).

**RESULTS:** Dietary curcumin supplementation (WD+C) significantly attenuated (p<0.05) histological liver inflammation, molecular markers of fibrosis (Col1a1 mRNA) and serum markers of liver injury (AST) compared with WD8. In addition, curcumin supplementation (WD12-C) also partially reversed WD+C induced NASH, including reduced (p<0.05) hepatocellular inflammation, steatosis and NAFLD Activity Scores (NAS). Furthermore, 4 weeks of curcumin supplementation also reduced molecular markers of hepatic fibrosis (Col1a1 mRNA) and inflammation (TNF-α, FABP4, SPP1 mRNA), as well as serum measures of macrophage infiltration (CCL5, IL-17a) and liver injury (AST, ALP). These witnessed changes were independent of differences in body mass or adiposity and were not related to changes in markers of hepatic total macrophages/Kupffer cells (F4/80, CD68).

**CONCLUSIONS:** Here we report that curcumin supplementation was partially effective at both preventing and also treating NASH in WD+CCl4 challenged Wistar rats. These beneficial effects were more prominent in the reversal of NASH with fibrosis and was particularly effective in attenuating hepatic inflammation. Further study is warranted to examine the anti-inflammatory properties of curcumin in the treatment of NASH.

**2927 Board #210 June 1 3:30 PM - 5:00 PM Effects of Aerobic Training and Pomegranate Juice on Oxidative Stress Markers in Women with Type-II Diabetes**

Majid S. Koozehchian1, Ahmad Abdii2, Javad Mehraban1,

Maryam Kaveh B3, Amin Daneshfar4, Gholamali Owlia5, Jeff Chandler6. 1Jacksonville State University, Jacksonville, AL. 2Azad University, Amol, Iran, Islamic Republic of. 3University of Guilan, Raath, Iran, Islamic Republic of. 4Karnataka College of Pharmacy, Bangalore, India. 5University of Canterbury, Christchurch, New Zealand. 6Texas Southern University, Houston, TX.

(NO relevant relationships reported)

**PURPOSE:** The aim of this study was to examine the effects of long-term aerobic exercise training and ingesting pomegranate juice on selected plasma oxidative stress markers in middle-aged women with type II diabetes.

**METHODS:** In a randomized, place-controlled design, 33 female participants (age=52±2 y; stature=157±6 cm; body mass=69.9±11.3 kg; body mass index=27.8±3.29 kg/m²; Control [CON] n=7, supplement [SUP] n=9, aerobic training [AT] n=9, supplement-aerobic training n=8 [SAT]) participated in the study. Primary outcomes were total antioxidant capacity (TAC), superoxide dismutase (SOD), glutathione (GSH), and glutathione peroxidase (GPx) which were measured at baseline and at week 6. All participants were asked to maintain their normal dietary intake during the study period. Participants in both AT and SAT groups were required to follow six weeks of aerobic exercise training program, three sessions a week for at least 45 minutes per session. Those involved in the SUP and SAT groups had a daily oral ingestion of pomegranate juice (150 ml) for a 6-weeks period [SUP; evening; SAT, an hour after exercise]. The CON group did not receive any intervention. Data were analyzed by GLM and presented as mean (SD).

**RESULTS:** We observed a significant increase in plasma TAC and GPx only in SAT (p=0.001). There was a significant increase in plasma SOD in the SUP, AT, and SAT, but not in the CON (p=0.001). There was a significant improvement in plasma GSH in the SAT compared to the CON and SUP (0.034).

**CONCLUSIONS:** Our results indicate that combining aerobic exercise training and pomegranate juice supplementation can have beneficial impact on the antioxidant defense system of the body and reduce oxidative stress in middle-aged women with type II diabetes.
applied immediately after the TBI in mice, provides beneficial effects on inflammatory processes, while promoting the expressions of plasticity proteins and therefore, could be a candidate molecule for future clinical studies in human patients.

F-62  Free Communication/Poster - Ergogenic Aids VI - Other

Friday, June 1, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

2929 Board #212 June 1 3:30 PM - 5:00 PM
Carbohydrate Mouth Rinse Improves Peak Treadmill Speed and Time to Exhaustion in Overweight Adults
Moath F. Bataineh1, Ayesha S. Al Dhaheri2, Hashemite University, Zarqa, Jordan. 1United Arab Emirates University, Al Ain, United Arab Emirates.

(No relevant relationships reported)

Mouth rinsing a carbohydrate solution improves exercise performance in athletes, but whether it benefits exercise performance in overweight adults is unknown. PURPOSE: This study determined the effect of carbohydrate mouth rinse on running performance and energy intake in overweight participants. METHODS: In a counterbalanced and placebo controlled design, 21 males (Age: 21.0 ± 1.8; BMI: 27.6 ± 1.1) with depleted glycogen stores, completed a graded treadmill exercise test to exhaustion following a 10-mg mouth rinse ingestion of either 7.5% carbohydrate (CHO), placebo (PLA), or a no rinse (CON), followed by standardized meal. Anthropometrics, 24-hour energy intake, heart rate (HR), oxygen consumption (VO2), and rating of perceived exertion (RPE) were measured. RESULTS: All participants completed the trials. Mean time to exhaustion in seconds per treatment was greater for CHO (1048.7 ± 91.8) versus PLA (1034.4 ± 83.6, p = 0.02), and CON (1012.2 ± 75.7, p = 0.001)(CHO: p = 0.430). Peak treadmill speed (km/h) was greater for CHO (11.5 ± 0.8) versus PLA (11.3 ± 0.7, p = 0.011), and (11.2 ± 0.6, p = 0.003)(p = 0.354). Subsequent trial energy intake (Kcal) was lower for CHO (577.5 ± 50.3) versus PLA (622.8 ± 78.3, p < 0.001), and CON (615.2 ± 69.4, p < 0.001)(p = 0.530). The 24-hour energy intake, HR, VO2 and RPE did not change (P > 0.05). CONCLUSION: Carbohydrate mouth rinse improves both running duration and speed in overweight adults with deplete glycogen stores.

2930 Board #213 June 1 3:30 PM - 5:00 PM
Short-term DHEA Intake And Hormonal Responses In Young Recreationally Trained Athletes
Katia Collom1, Corinne Buisson2, Nicolas Gravisse3, Soraya Belgherb1, Zakaria Lab3y, Manh-Cuong Do4, Olivier Gagey5, Sophie Dufay6, Nancy Vibarel-Remot1, Michel Audran7. 1University of Orleans, Orleans, France. 2AFLD, Chatenay-Malabry, France. 3University of Paris Sud, Orsay, France. 4AgEPs, Paris, France.

(No relevant relationships reported)

PURPOSE: Dehydroepiandrosterone (DHEA) figures on the World Anti-Doping Agency (WADA) list of prohibited substances in sport because it is assumed that athletes expect a significant increase in testosterone through DHEA administration. The literature on the hormonal effects of DHEA intake nevertheless appears to be very scant in healthy young subjects, especially women. We therefore propose to examine the effects of DHEA on adrenal and gonadal hormones in healthy young male and female recreationally trained volunteers. METHODS: The study followed a double-blind, randomized-order crossover design. 11 healthy young men (n=10) and women (n=11), with all women using oral contraceptives, were treated daily with 100 mg of DHEA and placebo for 4 weeks. DHEA, DHEA-sulfate (DHEA-S), androstenedione, total testosterone (Ttx), free testosterone (Tfes), dihydrotestosterone (DHT), SHBG, estrone, and cortisol were measured before, in the middle and at the end of each treatment, as were blood glucose, liver transaminases and lipid status. RESULTS: As classically reported, the young male volunteers had significantly higher basal Ttx, Tfes, DHT (P<0.01) concentrations and a significantly lower SHBG concentration (P<0.05) than the young female volunteers before treatment. Women had higher cortisol and cholesterol values (P<0.05) than men. No significant change was observed for the other parameters. In the middle and at the end of DHEA treatment, we observed a significant increase in DHEA, DHEA-S, androstenedione, Ttx, Tfes, DHT and estrone in both men and women, but the increases in Ttx and Ftes were more marked in women (p<0.001) than men (p<0.05). No changes were found in the other parameters, irrespective of gender.

2931 Board #214 June 1 3:30 PM - 5:00 PM
Neuroprotective Effect of Omega-3 Fatty Acids on Head Trauma in American Football Athletes
K. Michele Kirk1, David A. Gable2, Jason D. Stone3, Anthony J. Anzalone4, Stephanie M. Turner2, Andy T. Askol, Joel A. Lueck5, Andrew Jagim3, Margaret T. Jones, FACSM6, Jonathan M. Oliver7. 1Texas Christian University, Fort Worth, TX. 2University of Wisconsin - La Crosse, La Crosse, TX. 3Lindewood University, St. Charles, MO. 4Georgia Mason University, Fairfax, VA. (Sponsor: Margaret Jones, FACSM)

(No relevant relationships reported)

Repetitive head impacts sustained over the course of an American football season, even in the absence of a concussion diagnosis, results in a quantifiable pathophysiological response. Further, long-term exposure to repetitive head impacts may lead to neurological impairment, including the development of neurodegenerative disease. Prophylactic treatment with the omega 3 fatty acids (n-3FA) eicosapentaenoic (EPA) and docosahexaenoic (DHA) attenuates the pathophysiological response to head trauma in rodent models. PURPOSE: The purpose of this study was to examine the effects of n-3FA supplementation on a blood biomarker of head trauma over the course of an American football season. METHODS: Two National Collegiate Athletic Association American football teams volunteered for the study. Thirty-one athletes (n = 31) on one team ingested a highly bioavailable, proprietary formulation (Mindset®), containing n-3FA, including DHA (2,000 mg), EPA (560 mg), and 320mg docosapentaenoic acid (MS-Ω), over the course of an entire season. Thirty-three athletes (n = 33) from the other team served as the control. Neurofilament light (Nf-L), a biomarker of axonal injury, was measured in blood samples obtained prior to the start of the season (T1), at the end of pre-season camp (T2), and over the course of the season (T3 - T6). Standardized magnitude based inference was used to define outcomes of interest. RESULTS: Relative to the control group (12.4 ± 5.3 pg/mL), MS-Ω very likely attenuated Nf-L measured at the conclusion of Fall camp (8.9 ± 4.5 pg/mL) (mean; ±90% confidence limits; 1.5; ±1.2 fold), a period of significant contact. Further, the attenuation relative to placebo was likely maintained at T3 (1.3; ±1.2 fold), T4 (1.3; ±1.2 fold), T5 (1.3; ±1.3 fold), and T6 (1.2; ±1.3 fold) corresponding to sampling time points during the competitive season. CONCLUSION: These data indicate that over the course of the season the head trauma sustained by American football athletes does result in a quantifiable pathophysiological response as measured by a biomarker of axonal injury. Further, administration of MS-Ω may impart neuroprotective qualities as evidenced by lower levels of Nf-L. FUNDING: This study was funded in part by STRUCT Nutrition, Missoula, MT, USA.

2932 Board #215 June 1 3:30 PM - 5:00 PM
A Pre-Workout Supplement Does Not Improve 400 M Sprint Running or Bicycle Wingate Test Performance in Recreationally Trained Individuals
Gregory A. Brown, FACSM1, Brianna Jackson2, Brian Szekely3, Trevor Schramm3, Brandon S. Shaw2, Ina Shaw1, 1The University of Nebraska at Kearney, Kearney, NE. 2AT Still University, Mesa, AZ. 3Georgia Southern University, Statesboro, GA. 4Southern College of Optometry, Memphis, TN. 5University of Zululand, Kwazulu-Natal, South Africa.

(No relevant relationships reported)

Pre-workout supplements are often consumed as a drink and are purported to delay the onset of fatigue, increase exercise performance, and are marketed to recreational and competitive athletes. Pre-workout supplements typically contain caffeine and other ingredients that are supposed to act as stimulants. However, previous research has been inconclusive on the effects of pre-workout nutritional supplements on exercise performance. PURPOSE: The purpose of this project was to evaluate the effects of a commonly used pre-workout supplement on 400 m sprint running and bicycle ergometer Wingate test performance in recreationally trained college age participants. METHODS: For the Wingate testing, 60 minutes after consuming a pre-workout supplement or a similarly flavoured placebo eight recreationally trained college aged males engaged in a 30-second bicycle Wingate ergometer test. For the 400 m sprint running, 60 minutes after consuming a pre-workout supplement or a similarly flavoured placebo 16 college aged participants (9 male and 7 female) engaged in two 400 m running sprints on an indoor track with the sprints separated by 10 minutes of passive rest. RESULTS: During the Wingate testing there were no significant differences in peak power (848.85 ± 210.26 W, 866.92 ± 212.99 W), decline in power (48.68 ± 12.2%, 45.0 ± 11.3%), or change in blood lactate concentrations (8.9 ± 5.4 mmol/L, 8.4 ±

Abstracts were prepared by the authors and printed as submitted.
2933 Board #216 June 1 3:30 PM - 5:00 PM
Acute Effects Of A Multi-Ingredient Pre-workout Supplement On 5-km Running Performance In Recreationally-trained Athletes
Taylor Mussjerd, Nora Johnston, Andrew Jagim, Clayton Carnicic. 1University of Wisconsin-La Crosse; La Crosse, WI. 2University of Northern Colorado, Greeley, CO. 3Linwooden University, St. Charles, MO. 4Northern Illinois University, DeKalb, IL. (Sponsor: John Porcari, FACSM)

PURPOSE: The purpose of the present study was to examine the effects of an acute dose of a multi-ingredient, thermogenic, pre-workout supplement on 5-km running performance and subjective measures of fatigue.

METHODS: Twenty aerobically-trained, college-aged males (n = 10, mean ± SD = 80.8 ± 6.1 kg) and females (n = 10, 64.5 ± 6.6 kg) completed two 5-km running races for each session. During the first session, the subjects were randomly assigned to ingest the supplement or placebo 30 minutes prior to running a 5-km race as fast as possible. The supplement contained multiple ingredients including caffeine anhydrous (150 mg), beta alanine (1.6 g), arginine AKG (1.0 g), 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 matched for flavor and consistency. Subjects completed a 5-point Likert scale (1 = low, 5 = high) questionnaire to determine feelings of fatigue immediately prior to ingesting the substance (baseline), 30 minutes post-ingestion (immediately pre-race), and 5 minutes post-race. For the second session, subjects ingested the opposite substance (supplement or placebo) and underwent the same testing procedures (including time of day) as the first session. Race times were compared between the supplement and placebo conditions using a paired-samples t-test. In addition, a two-way ANOVA with repeated measures was used to compare the feelings of fatigue among the conditions (supplement vs. placebo) at the common time points (baseline, pre-race, post-race).

RESULTS: The results indicated there was no significant (P > 0.05) difference in 5-km race time between the supplement (23.62 ± 2.08 min) and placebo (23.51 ± 1.97 min) conditions. For the feelings of fatigue, there was no significant 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 fatigue were significantly (P < 0.05) greater post-race (3.3 ± 0.8) than at baseline (2.3 ± 0.7) and pre-race (2.4 ± 0.7).

CONCLUSIONS: The findings of the present investigation indicated that the pre-workout supplement provided no ergogenic effect on 5-km race time or feelings of fatigue when administered on an acute basis in recreationally-active males and females.

2934 Board #217 June 1 3:30 PM - 5:00 PM
Effects of Multi-Ingredient Ergogenic Supplement Consumption on Performance Adaptations to High-Volume Resistance Training
Michael Wong, Dean Directo, Adam Osmond, Edward Jo. Cal Poly Pomona, Pomona, CA.

Consumption of various nutritive supplements in isolation have shown to enhance resistance training (RT) adaptations. What remains unclear is the efficacy by which consumption of a multi-ingredient ergogenic supplement (MIES) comprised of branched-chain amino acids, beta-alanine, creatine, glutamine, and black pepper fruit extract facilitates improvements in skeletal muscle performance during RT. PURPOSE: To investigate the effects of a MIES containing the above ingredients on performance adaptations to high-volume periodized RT. METHODS: Thirty-nine recreationally trained males and females were recruited for this randomized, double-blind, placebo-controlled investigation. Subjects were assigned to either a placebo (PLA) (n=16) or experimental MIES group (MIES=23). PLA=0; MIES=23) in a counterbalanced manner. All subjects completed a 6-week periodized resistance training program consisting of 3 sessions per week with 48 hours of rest between each session. MIES and PLA consumed one serving of the MIES and placebo, respectively, immediately post-workout and before sleep on training days, and two servings during rest days. Subjects underwent laboratory assessments for maximum upper and lower body strength and power. A 2 (condition: MIES vs. PLA) x 2 (time: pre- vs. post-training) x 2 (time of day: 9:00 am or 6:00 pm) mixed-effects ANOVA was used to detect main effects and/or interaction. A Tukey’s post hoc test was used for pairwise comparisons. Significant was set at p<0.05. RESULTS: IRM for each exercise improved pre-post training in both MIES (Back Squat= +26.0%, p<0.001; Bench Press= +20.4%, p<0.001; Deadlift= +26.3%, p<0.001) and PLA (Back Squat= +27.1%, p<0.001; Bench Press= +15.6%, p<0.001; Deadlift= +18.4%, p<0.001), but no group x time interactions were found. There was also a significant improvement pre-post training for all dynamic lower body power output measures in both groups with no significant group x time interaction. There were no between-group differences for average daily training volume each week and across the entire training period. CONCLUSION: Supplementation of the experimental MIES in conjunction with high-volume RT failed to improve RT-induced performance adaptations when compared to a placebo group.

2935 Board #218 June 1 3:30 PM - 5:00 PM
The Effects Of A Multi-Ingredient Ergogenic Supplement On Body Composition Following High-volume Resistance Training
Dean Directo, Michael Wong, Adam Osmond, Edward Jo. Cal Poly Pomona, Pomona, CA.

(Purpose: No relevant relationships reported)

In addition to resistance training (RT) methodology, nutrient intake remains a critical factor for the support of skeletal muscle metabolism, performance, and adaptation. Despite the traditional debate regarding the ideal type, timing, and quality of nutrients for recovery and/or performance, the consumption of exogenous substances like branched-chain amino acids (BCAA), beta-alanine, creatine, glutamine and various plant-based compounds, like pipeline have previously shown to support performance, recovery, or metabolic adaptations in skeletal muscle. This has largely enabled the use of multi-ingredient ergogenic supplements (MIES) that incorporate a single blend of these substances with the intent of obtaining a synergistic ergogenic effect. What remains unclear is the efficacy by which a MIES blend of such ingredients facilitates the adaptive changes in body composition during a high-volume RT regimen.

METHODS: To investigate the effects of a proprietary MIES comprised of BCAA, beta-alanine, creatine hydrochloride, glutamine, and black pepper fruit extract on body composition during 6 weeks of high-volume RT. METHODS: Male and female subjects completed a 6 week RT program 3 days a week with 48 hours of rest between each session. EXP (n=16) and Placebo (PLA) (n=23) groups consumed one serving of the experimental MIES or placebo, respectively immediately post-workout and before sleep on training days, and two servings during rest days. Body composition was measured pre- and post-training via Dual Energy X-Ray Absorptiometry. RESULTS: EXP= 12.7 ± 3.2 kg, p<0.001 and PLA= 11.4 ± 3.1 kg, p<0.001 demonstrated a decrease in body total mass. EXP demonstrated a greater increase in lean mass than PLA (EXP= +8.1 ± 0.9 kg, p<0.001 vs. PLA= +6.1 ± 0.7 kg, p<0.001). Fat mass was significantly greater in PLA (EXP= +4.0 ± 2.9 kg vs. PLA= +2.1 ± 0.2 kg, p=0.02). EXP exhibited a decrease in body fat percentage (1.2 ± 0.3 % units) (p<0.01) while PLA showed no change. Post-training body fat percentage was lower in EXP than PLA. There were no between-group differences for average daily training volume each week. CONCLUSION: Supplementation of MIES comprised of BCAA, beta-alanine, creatine hydrochloride, glutamine, and black pepper fruit extract may enhance body composition changes during high-volume RT.

2936 Board #219 June 1 3:30 PM - 5:00 PM
Cannabis Use Habits In Relation To Timing Of Physical Activity

(Purpose: No relevant relationships reported)

PURPOSE: To describe cannabis use in individuals who use the drug relative to when they participate in physical activity (PA). METHODS: Physically active individuals (N=72; males n= 42; females n= 30; average age of 27 years), recruited using the snowball technique, completed a series of self-report questions through Qualtrics designed to describe participants use of cannabis products in relation to their PA. Cannabis use questions were based on the Daily Sessions, Frequency, Age of Onset, and Quantity of Cannabis Use Inventory (DFAQ-CU). RESULTS: A total of 72 participants (54 males, 18 females) were recruited and completed the DFAQ-CU. Participants reported 417 ± 451 minutes of PA per week, with 74.5% of respondents using cannabis products in relation to their PA. Cannabis use was common among participants on the Daily Sessions, Frequency, Age of Onset, and Quantity of Cannabis Use Inventory (DFAQ-CU). Consumption of cannabis most often during PA. Almost 70% of respondents reported using cannabis during PA of beginning PA, and 45% reported using most often within 1-hour after finishing PA. Only 4% of respondents used cannabis most often during PA. Most common activities most commonly included hiking, running, resistance training, yoga, and cycling. Half of participants (51%) reported using cannabis within 1-hour of beginning PA, and 45% reported using most often within 1-hour after finishing PA. Almost half (47%) of participants that reported using cannabis products before or during PA were using the Cannabis Sativa strain, while 39% of respondents that reported using cannabis...
Firefighter personnel are trained to respond to emergencies and are essential to community safety. Though dietary supplementation use can improve overall health and performance, limited information exists on supplement use among firefighters. Understanding supplement use may aid in health and physical performance.

**PURPOSE:** To explore supplement use in volunteer firefighters.

**METHODS:** A national sample of 363 volunteer firefighters (aged 18-77, 38.1 ± 12.5 years, 79.3% male, 95% Caucasian) in a wellness program were surveyed on their frequency and reasons for supplement use over the past six months. Questions asked about supplements such as multivitamins/minerals, individual vitamins (e.g. Vitamin C, Vitamin D), individual minerals (calcium, iron), performance enhancers (glutamine, CoQ10), sports bars/gels, and energy drinks. Stata version 15 was used for data analysis.

**RESULTS:** Of those reporting supplement use, 78 reported using only one supplement, while 277 reported using multiple supplements. Performance enhancers were used by 31 participants (8.5%) at least twice a week; reasons for consumption included increased physical performance, improved overall health, and to prevent health problems. Multivitamin/mineral supplements were consumed by 132 firefighters (36.4%) at least twice a week; reasons for consumption included improved overall health, prevent health problems, and increase heart health (cholesterol/blood pressure). Sports bars/gels were used by 86 firefighters (23.7%) at least twice a week; reasons for sports included increased physical performance, improved overall health, and to lose weight. Energy drinks were consumed by 124 firefighters (34.2%) at least twice a week; reasons for consumption included increased physical performance, cognitive function, and relaxation/stress/mental health.

**CONCLUSIONS:** Overall, most firefighters who reported supplement use did so for improvements in overall health and to prevent health problems. Interestingly, firefighters in this study reported higher overall supplement usage than other tactical adult populations (i.e. military personnel: 55-61%). Future investigations should examine the usage and effectiveness of performance-enhancing supplements on health and occupational performance in firefighters.

*Firefighter personnel are trained to respond to emergencies and are essential to community safety. Though dietary supplementation use can improve overall health and performance, limited information exists on supplement use among firefighters. Understanding supplement use may aid in health and physical performance.*

It is generally accepted that the combination of resistance exercise and protein supplementation increases fat free mass (FFM) and leads to a reduction in fat mass (FM). However, the question of the optimal type and amount of protein is still under discussion. It was recently demonstrated that bioactive collagen peptide (BCP) intake significantly improves the body composition of sarcopenic men (Zdzieblik et al. 2015, *Br J Nutr*).

**PURPOSE:** To determine the efficacy of a collagen peptide supplementation in combination with resistance training on the body composition in untrained subjects.

**METHODS:** The effect of post-exercise supplementation of specific BCP (BODYBALANCE®) on FFM and FM was tested on 182 untrained women and men aged 46 ± 9 years. The study participants underwent 60 minutes of resistance training three times per week, and were daily treated with 15 g BCP or a placebo over a period of 12 weeks. Changes in FFM and FM were measured by DEXA scans and by BIA at the beginning of the study and after 12 weeks. Changes between the study groups in FFM and FM were tested using the unpaired Student’s t-test. The studies were conducted with the approval of the Ethics Committee of the Medical Faculty of the University of Freiburg, Germany. All participants gave written informed consent. RESULTS: The results revealed a significant (p=0.002) increase in FFM after BCP compared to placebo. FFM gain was more than doubled (2.00 ± 0.25 kg) than in individuals who only did the training exercise (0.99 ± 0.19 kg). In addition, FM was significantly (p=0.035) reduced after BCP supplementation by -3.0 ± 0.37 kg compared to placebo (-2.0 ± 0.32 kg). Moreover, study participants who received BCP showed a significant increase in muscle strength of 5.4% compared to placebo treatment. CONCLUSIONS: Bioactive collagen peptides appear to offer an interesting option for optimized sports nutrition. The results demonstrated that the intake of BCP supports the effect of resistance training, as indicated by a more improved body composition and an increase in muscle strength.

*It is generally accepted that the combination of resistance exercise and protein supplementation increases fat free mass (FFM) and leads to a reduction in fat mass (FM). However, the question of the optimal type and amount of protein is still under discussion. It was recently demonstrated that bioactive collagen peptide (BCP) intake significantly improves the body composition of sarcopenic men (Zdzieblik et al. 2015, *Br J Nutr*). In this study, the efficacy of a collagen peptide supplementation in combination with resistance training on the body composition in untrained subjects was investigated.*

Prolonged strenuous exercise cause an acute increase in leukocytes, including lymphocytes, neutrophils and monocytes. Evidences have suggested that probiotics can enhance athletes’ immunity. **PURPOSE:** Investigate the effect of a probiotic supplementation on white blood cells count after a marathon race. METHODS: Eight male athletes that participated in a marathon race were randomly assigned to either a probiotic group (PR=43.7±3.5; 8 yr, 89.2±14.5Kg, time trial 4:04 hrs ±2:3min) or placebo (PL=43.6±3.8; 5 yr, 81.8±9.5Kg, time trial 4:53 hrs±7:5min) in a double-blind design. PR was supplemented with sachet containing Lactobacillus Acidophilus and Bifidobacterium Lactis (10x10^9 UFC/d) during 30 days while PL received sachet with maltodextrin (5g/d). It was collected blood samples before the supplementation period (baseline), one day before the marathon (BM), one hour after the race (ARR), and 7 days after the marathon(7a)after for white blood cells differential count. The data was analyzed using ANOVA with repeated measures and a Bonferroni’s post-hoc; p< 0.05.

**RESULTS:** Leukocytes and Monocytes presented a significant increase in AR(Leu: PR=3.23±2.63;PL=1.42±0.24 mm); Ne(1.22±0.24;1.62±0.47 mm).

*Prolonged strenuous exercise cause an acute increase in leukocytes, including lymphocytes, neutrophils and monocytes. Evidences have suggested that probiotics can enhance athletes’ immunity.*
Molecular hydrogen (H₂) improves body composition, metabolic profiles and mitochondrial function in overweight women, yet no studies so far evaluated the effectiveness of H₂ for improving exercise capacity in this population.

PURPOSE: To examine the effects of 28-days supplementation with 1 L per day of hydrogen-rich water on exercise capacity and quality of life in overweight mid-age women.

METHODS: Twelve women (age 53.8±13.0 years, BMI 28.8±3.3 kg/m², VO₂max 22.3±3.7 ml/kg/min) participated in this randomized, placebo-controlled, cross-over, repeated-measure intervention study. All participants were allocated in a double-blind design to receive two randomly assigned trials: first group received 1 L per day of HRW (supplying ~9 ppm of H₂), while the second group received placebo (tap water).

RESULTS: Baseline VO₂max was 1.46±0.21 ml/kg/min and improved in both groups with no differences between groups. After 28 days of supplementation, VO₂max was 1.46±0.21 ml/kg/min in the placebo group and 2.62±0.35 ml/kg/min in the HRW group (p=0.03). The second group showed no improvement. The alpha-level was set at p<0.05. Data are reported as means±standard deviation.

CONCLUSIONS: HRW can be used as an alternative hydration formulation to positively affect exercise performance in mid-age overweight women. Supported by the Serbian Ministry of Education, Science and Technological Development (175037), the Provincial Secretariat for Higher Education and Scientific Research (114-451-710), the University of Novi Sad Faculty of Sport and PE (2017 Award: Award HRW and Nutrition, New Lactobacillus Acidophilus). Clinical trial registration number: NCT02832219.
Sickle cell disease has a detrimental impact upon health-related quality of life (HRQL). No study has determined if vitamin D supplementation can improve HRQL in this population using the Pediatric Patient-Reported Outcomes Measurement Information System (PROMIS). PURPOSE: To assess the impact of vitamin D supplementation on HRQL over a 12-week period in 5- to 17-year-old African American children, with (n=21) and without (n=23) type SS sickle cell disease (SCD-SS). METHODS: Subjects were randomized to oral daily doses (4000 vs. 7000 IU) of cholecalciferol with (n=21) and without (n=23) type SS sickle cell disease (SCD-SS). Subjects completed the timed-up and go (TUG) and grip strength tests at baseline and after 10 weeks of intervention. RESULTS: A difference in the TUG between the two groups (PG=22.1±3.6 sec, CG=22.7±3.6 sec) was increased (F=5.1, P<.05). However, a significant group effect (F = 5.1, P<.01) showed that only PG presented a significant difference vs CG (P<.01). CONCLUSION: Chronic antioxidant supplementation may attenuate muscle performance improvements, but not muscle growth, in untrained young women after 10 weeks of ST.

People over the age of 70 have decreased muscular power and reduced functional ability. Vitamin D Supplementation Improves Health Related Quality of Life in Children with Sickle Cell Disease Kelly A. Dougherty1, Chiara Bertoloso2, Joan I. Schall3, Kim Smith-Whitley4, Virginia A. Stallings4, Stockton University, Galloway, NJ. 1University Hospital Umberto I, Sapienza University, Rome, Italy. 2The Children’s Hospital of Philadelphia, Philadelphia, PA. 3The Children’s Hospital of Philadelphia and University of Pennsylvania, Philadelphia, PA. (No relevant relationships reported)

Vitamin D plays an important role for immune functions. Insufficient serum 25(OH)D concentration during winter may be associated with increased risk for upper respiratory tract infection (URTI) in athletes. PURPOSE: This study was aimed to determine the effects of vitamin D supplementation on immune functions and URTI in male taekwondo athletes. METHODS: Twenty-five male taekwondo (TKD) athletes, aged 19-22 years with vitamin D deficiency (25(OH)D; 12.3±2.78 ng/ml), participated in this study. They were randomly assigned to receive 5,000 IU/day of vitamin D (n=20) or placebo (n=12) during 4 weeks of winter training. Blood samples were collected two times (pre- and post-tests) to analyze serum 25(OH)D concentration. Saliva samples were collected three times (1st, 2nd, and 4th week) to analyze the salivary immunoglobulin A (SlaG) and lactoferrin concentrations. URTI symptoms were reported daily during 4 weeks of training. Repeated measures ANOVAs were performed and significant level was set at p<.05. RESULTS: The serum 25(OH)D concentration increased by 255.6% in supplementation group, but this level did not change in placebo group (F=247.50, P=.001). SlaG (F=23.00, P<.001) significantly increased in both groups during the study period, but salivary lactoferrin level (F=5.79, P=.011) increased only in placebo group at the 2nd week of training. URTI symptoms significantly decreased only in supplementation group (F=4.56, P<.005) throughout the 2nd week of the study. CONCLUSIONS: The present study found that high dose of vitamin D supplementation (5,000 IU/day) increased the serum 25(OH)D concentration to sufficient level (40.1±6.79 ng/ml), and decreased URTI symptoms significantly only in supplementation group (F=5.456, P<.05) with serum 25(OH)D concentration increased by 255.6% in supplementation group, but this level did not change in placebo group (F=247.50, P=.001). SlaG (F=23.00, P<.001) significantly increased in both groups during the study period, but salivary lactoferrin level (F=5.79, P=.011) increased only in placebo group at the 2nd week of training. URTI symptoms significantly decreased only in supplementation group (F=4.56, P<.005) throughout the 2nd week of the study.

Recent literature has shown that cardiorespiratory fitness (CFR) and strength deficits are associated with greater muscleshedulakel injury (MSKI) risk. When combined, the Functional Movement Screen (FMS) and lower quarter Y-Balance test (YBT) are powerful indicators of MSKI risk in athletes and military personnel. As the premier combat force for countering explosive hazards, U.S. Navy Explosive Ordnance Disposal (EOD) operators must perform optimally in the most austere environments. To safeguard health and mission success, it is critical to assess factors that influence MSKI risk in this elite group.
PURPOSE: To assess the relationships between measures of fitness and injury risk in EOD operators.

METHODS: Fifty-one active duty men (ages 35.6 ±1.0 yr) were evaluated for body fat percentage (BF%) using dual-energy x-ray absorptiometry, CRF (maximum volume of oxygen uptake [VO2max]), muscular strength (one-repetition max [1-RM] back squat and bench press), and injury risk assessments (FMS, YBT). A quartile split for VO2max established the bottommost, low, high, and topmost VO2max groups. ANOVA and Pearson product-moment correlations were used to evaluate fitness and injury risk associations.

RESULTS: Means ± SE were as follows: BF% = 17.9 ± 0.5, VO2max = 47.0 ± 0.9 ml/kg/min, time on treadmill (TT) = 12.2 ± 0.2 min, time of ventilatory threshold (VT) = 6.2 ± 0.2 min, FMS total score = 15.8 ± 0.3, and YBT left composite (LC) = 99.0 ± 1.0% and right composite (RC) = 98.6 ± 1.0%. Mean FMS scores were different between quartiles (F[3,47] = 3.704, p < .01), where the bottommost VO2max group had the lowest scores. TT and VT were different between quartiles: LC (F[1,47] = 4.74, p = 0.035) and RC (F[1,47] = 8.999, p < .01), where the highest VO2max group had the greatest values. Associations with FMS were BF% (r = 0.53, p < .05), VT (r = 0.53, p < .05), and YBT (r = 0.50, p < .05). Correlations with LC and RC were BF% (r = 0.37 for both, p < .01) and TT (r = −0.46, p = .01). No associations with 1-RM were observed.

CONCLUSION: This study is consistent with accruing data that indicate more fit individuals have a lower injury risk. While strength is a critical element of overall fitness, CRF and BF% may better predict MSDK risk. Due to their unique and arduous operational demands, the EOD operator can further reduce injury risk by maintaining peak physical condition.

2949 Board #232 June 1 3:30 PM - 5:00 PM
Adrenal Stress and Performance during Military Survival Training
Tunde K. Szivak1, Elaine C. Lee2, Cathy Saenz3, Brian C. Focht, FACSM4, Jeff S. Volek, FACSM4, Carl M. Maresh, FACSM4, William J. Kraemer, FACSM4. 1 Merrimack College, North Andover, MA, 2 University of Connecticut, Storrs, CT. 3 The Ohio State University, Columbus, OH. (No relevant relationships reported)

PURPOSE: The purpose of this research study was to evaluate neuroendocrine and physical performance responses in sailors and Marines undergoing U.S. Navy Survival, Evasion, Resistance and Escape (SERE) training.

METHODS: 20 men (Age: 25.3 ± 3.6 years; Height: 178.1 ± 6.1 cm; Weight: 83.7 ± 12.6 kg) took part in the study. Men were further split into high fit (n = 10) and low fit (n = 10) subgroups based on physical fitness test scores. Blood samples were obtained at three timepoints (T1: baseline, T2: stress, T3: recovery), and were analyzed for plasma epinephrine, plasma norepinephrine, plasma dopamine, serum cortisol, serum testosterone, and plasma neuropeptide Y. Vertical jump and handgrip tests were performed at T1 and T2.

RESULTS: For the group as a whole (n = 20), stress hormone concentrations were significantly elevated at T2, with a concomitant reduction in testosterone concentrations. NPY concentrations did not increase at T2, but decreased significantly at T3. Subjects maintained performance on the vertical jump and handgrip tests from T1 to T2. Significant between group differences were observed in norepinephrine (high fit: 3.530 ± 0.64 µg/ml, low fit: 2.146 ± 0.54 µg/ml), plasma prolactin-L1 (low fit: 30.20 ± 8.59 µg/ml, high fit: 169.2 ± 8.86 µg/ml) and NPY (high fit: 169.2 ± 8.86 µg/ml) at recovery (T3).

CONCLUSIONS: This study revealed that despite differential catecholamine and NPY responses during recovery, the SERE training course resulted in significant increases in stress hormone concentrations in all subjects regardless of physical fitness level, with no reductions in physical performance measures.

2950 Board #233 June 1 3:30 PM - 5:00 PM
Differences between U.S. Army Trainees and Active Duty Soldiers in Physically Demanding Operational Tasks
Maria C. Canino, Bruce S. Cohen, Stephen A. Fouliis, Peter N. Frykman, Jan E. Redmond, Edward J. Zambraski, Marilyn A. Sharp. U.S. Army Research Institute of Environmental Medicine, Natick, MA. (No relevant relationships reported)

The training implemented during initial entry training (IET) for combat arms trainees (up to 16 weeks) is designed to sufficiently optimize performance of physically demanding operational tasks. Trainees must be physically capable of performing the tasks within their jobs to the minimal acceptable performance standard, as delineated by U.S. Army Training and Doctrine Command. PURPOSE: To compare U.S. Army trainees to active duty soldiers performing physically demanding occupational tasks.

METHODS: 192 U.S. Army male combat arms trainees (TRs) at the end of their IET and 369 active duty male combat arms soldiers (ADs) both performed the sandbag carry (SBC), casualty drag (CD) and move under direct fire (MUF) tasks. During the SBC, subjects wore personal protective equipment (PPE; ~32 kg) while lifting and carrying 16 pre-filled 18-kg sandbags a distance of 10m to build a fighting position (4 long x 2 wide x 2 high). For the CD, subjects wore PPE and a weapon while dragging a 123-kg simulated casualty 15m as fast as possible (60-s sec time limit). Time was recorded and later calculated as velocity (m • s⁻¹). During MUF subjects wore PPE and a weapon to perform a series of combat rushes covering 100m as fast as possible (min). The MUF course cycled between one prone and two kneeling positions, each 6.6 m apart. For ANCOVA (height and body mass as covariates) were used to compare differences in performances on the three tasks between TRs and ADs.

RESULTS: 94% of TRs and 99% of ADs performed the three tasks to the minimal acceptable performance standards. ADs performed significantly faster than TRs on SBC (AD: 1.73 ± 0.29 min, TR: 2.09 ± 0.46 min; p < 0.01) and AD (1.14 ± 0.28 min; F[2,47] = 19.80, p < 0.01) with no differences in MUF performance (AD: 2.24 ± 0.15 min, TR: 2.27 ± 0.22 min; p=0.90). CONCLUSIONS: Although majority of the TRs met the minimal acceptable performance standards on the three tasks, ADs performed the SBC and CD faster. This could be due to ADs having more experience performing the tasks. While further training occurs at TRs first duty station, TRs may benefit from additional occupational task training during IET.

PURPOSE: As a firefighter performs in live-fire suppression, it is critical to understand to the degree their physiological stress is exacerbated by the physical work they are required to conduct to reach a potential victim of an emergency. The purpose of this study was to evaluate physiological strain index (PSI) in response to a simulated firefighting occupation workload.

METHODS: Ten healthy male adults participated in this study. While wearing proper testing attire, participants completed a simulated fire stair climb (SFSC) by completing two consecutive 3-min workloads on a Matrix Climbing Mill (Matrix Fitness USA, Cottage Grove, WI, USA) at a stepping rate of 60 steps/min. The participants completed this protocol under four conditions, with some conditions including the wearing of a 34.04 kg (75 lbs) weighted vest to simulate the wearing of personal protective equipment (PPE) typically worn by a firefighter. Some conditions involved the inclusion of a color-word interference test (CWIT) as a distracting mechanism. PSI was evaluated by continuously monitoring HR and core temperature by using CorTemp® ingestible thermometers and radio receiver (HQ, Inc., Palmetto, FL). PSI was calculated using a previously published and validated equation (Moran et al., 1998). Blood pressure was measured pre-exercise, following initial 3 min workload, and following completion of total workload.

RESULTS: A repeated-measures ANOVA and ANOVA showed that there was a significantly different PSI when comparing conditions (p = 0.001). A significantly elevated PSI per min was exhibited during all six minutes of exercise for both the weighted vest and weighted vest + CWIT conditions compared to exercise conditions without the vest. Systolic blood pressure also exhibited a significantly different degree of elevation in the same manner (p = 0.006).

CONCLUSIONS: Based on the results of the current study, it appears that the wearing of a weighted vest to simulate PPE significantly elevates PSI above what would be expected by the exercise alone. These findings suggest that firefighters are potentially at a substantial degree of physiological stress from the exercise and weight of gear alone. Further work should be conducted to further evaluate the usefulness of PSI as a means to monitor firefighters during actual or simulated fire suppression.

2952 Board #235 June 1 3:30 PM - 5:00 PM
Effect of a Simulated Tactical Occupation Stressor on Perceived Exertion and Blood Lactate
Wesley A. Neal1, Cody E. Morris1, Lee J. Winchester1, Andrew J. Hussey1, Ariel S. Tomes1, Wesley A. Neal1, Damon M. Wilcoxen1, MiRanda N. Anderson1, William J. Bradshaw1, Dana N. Lucas1, Harish Chander2, Scott W. Arnett1. 1Western Kentucky University, Bowling Green, KY. 2Mississippi State University, Mississippi State, MS. (Sponsor: Scott Lyons, FACSM) (No relevant relationships reported)

PURPOSE: Findings by Marcora et al. (2009) and Zering et al. (2016) suggest that perceived exertion can be elevated during an exercise bout of a familiar intensity if it is
followed by a task requiring substantial cognitive attention. The purpose of this study was to evaluate rating of perceived exertion (RPE) and markers of physiological stress in response to a simulated firefighting occupation workload. **METHODS:** Ten healthy male adults participated in this study. While wearing proper testing attire, participants completed a simulated fire stair climb (SFSC) by completing two consecutive 3-min workloads on a Matrix C7xe ClimbMill (Matrix Fitness USA, Cottage Grove, WI, USA) at a stepping rate of 60 steps/min. The participants completed this protocol under four conditions, with some conditions including the wearing of a 34.04 kg (75 lbs) weighted vest to simulate the wearing of personal protective equipment (PPE) typically worn by a firefighter. Some conditions involved the inclusion of a color-word interference test (CWIT) as a distracting mechanism. RPE was measured each minute during exercise using Borg’s 15-point (6–20) scale (Borg, 1982; Borg, 1998). Lactate was measured following initial 3 min workload and following completion of total workload. **RESULTS:** A repeated-measures ANOVA showed that there was a significantly different RPE when comparing conditions (p < 0.0005). A significantly elevated RPE per min was exhibited during all six minutes of exercise for both the weighted vest and weighted vest + CWIT conditions compared to exercise conditions without the vest. A repeated-measures ANOVA showed that there was a significantly different blood lactate when comparing conditions (p < 0.0005). **CONCLUSIONS:** Based on the results of the current study, it appears that the wearing of a weighted vest to simulate PPE significantly elevates RPE above what would be expected by the exercise alone. Blood lactate levels mirrored these results. These findings suggest that firefighters are potentially at a substantial degree of perceived stress from the exercise and weight of gear alone.

**PURPOSE:** Walker et al., 2015 reported that increases in immune system markers [interleukin-6 (IL-6), C-reactive protein (CRP)] occur simultaneously with each increase in core temperature. A substantial physiological and psychological disturbance experienced by firefighters could potentially lead to a depression in immune system function. The purpose of this study was to evaluate specific immune system markers in response to a simulated firefighting occupation workload. **METHODS:** Ten healthy male adults participated in this study. While wearing proper testing attire, participants completed a simulated fire stair climb (SFSC) by completing two consecutive 3-min workloads on a Matrix C7xe ClimbMill (Matrix Fitness USA, Cottage Grove, WI, USA) at a stepping rate of 60 steps/min. The participants completed this protocol under four conditions, with some conditions including the wearing of a 34.04 kg (75 lbs) weighted vest to simulate the wearing of personal protective equipment (PPE) typically worn by a firefighter. Some conditions involved the inclusion of a color-word interference test (CWIT) as a distracting mechanism. Salivary cortisol (CORT) was measured at baseline, following initial 3 min workload, and following completion of total workload. CRP was evaluated at baseline and one hour following the completion of each workload. **RESULTS:** A repeated-measures ANOVA showed that there was a significantly different overall RT (p = 0.001) during the SFSC while wearing the weighted vest being significantly worse than baseline (p = 0.016). This difference was mirrored in RT during correct responses (p = 0.025) exhibiting a slowed RT while wearing the weighted vest (p = 0.106). CRIT accuracy (p = 0.159) or RT during incorrect responses (p = 0.630) was not shown to be significantly different from baseline. **CONCLUSIONS:** Based on the results of the current study, it appears that the wearing of a weighted vest to simulate PPE significantly impairs RT. These findings suggest that the decision-making ability of tactical-style occupations could be hampered in response to such a workload-induced physiological stress, exposing themselves and potential victims they are attempting to help to further harm. Physiological monitoring can be accomplished in a military field environment using wearable technologies, but information is limited on physical exertion measures that are most useful for military applications, such as mission planning and protective equipment evaluations. **PURPOSE:** Determine sensitivity of percentage heart rate reserve (%HRR) to variations in carried load using experimenter- and self-paced military tasks. **METHODS:** 38 Army male soldiers [M (SD): Age = 24.2 (4.1), Wt. = 80.7 kg (12.5), Ht. = 1.76 m (0.7)], volunteered for a 6-session study conducted under an IRB-approved protocol. Wearing a heart rate monitor, they executed 3 trials (1 trial/session) of an experimenter-paced, 4.83 km foot march (FM) at a 4.83 km h⁻¹ speed and 3 trials (1 trial/session) of a self-paced, maximum effort run of an obstacle course (OC) carrying a different military load (randomized) on each trial (FM: 8.8, 47.2, 50.7 kg; OC: 8.8, 28.1, 31.5 kg). Maximum heart rate (MHR) was obtained in the final 20 s of FOmax testing. Resting HR (RHR) was recorded in the final 20 s of a 5-min period of sitting prior to trial initiation. The highest HR in a trial (MHRₜⱼ) was also identified. %HRR was calculated: [(MHRₜⱼ – RHR)/MHR] x 100. Separate repeated measures ANOVAs (Subjects x Load) were applied to FM and OC %HRR and completion time. **RESULTS:** On the FM, completion time was not significantly affected by load, F(1,15, 42.6) = 2.68, p = 0.105, n² = .067, [M (SD) in min: 59.68 (1.06), 59.37 (1.08), 60.52 (3.74) for loads 1-3], but %HRR increased significantly with each load increase, F(1,66, 61.44) = 112.17, p < .001, n² = .752 [M (SD) in %: 54.15 (10.45), 54.15 (10.45), 76.15 (11.53), 82.32 (8.10) for loads 1-3]. On the OC, completion time increased significantly with each load increase, F(2, 74) = 132.25, p < .001, n² = .781 [M (SD) in min: 43.41 (10.13) for loads 1, 2, & 3], but %HRR did not show a significant load effect, F(1,51, 55.95) = 1.03, p = .347, n² = .027 [M (SD) in %: 91.02 (5.23), 91.97 (5.13), 91.18 (6.02) for loads 1-3].
CHRONIC EXPOSURE TO MULTIFACTORIAL STRESS, SUCH AS THAT/endured by elite military operators, may lead to overtaining syndrome and negatively impact hormonal regulation. In acute settings (<6 mos), military training has been shown to lead to hormonal dysfunction; however, less is known about the consequences of long-term military training. PURPOSE: The purpose of this study was to determine the chronic effects of military operations and training on the hormone profile of elite military operators. METHODS: Active-duty elite US military operators (n = 65, age = 29.8 ± 1.0 yrs, height = 178.4 ± 0.7 cm, weight = 85.1 ± 2.0 kg) concomitantly engaged in rigorous physical training were recruited to participate in the study. Basal plasma concentrations of luteinizing hormone (LH), total testosterone (TT), free testosterone (FT), sex-hormone binding globulin (SHBG), cortisol, thyroid stimulating hormone (TSH), triiodothyronine (T3), and thyroxine (T4) were obtained between 0600-1000 hrs. Data were analyzed for correlations and compared against normative reference values; all data are presented as mean ± SE. RESULTS: Mean LH, TT, FT, SHBG, cortisol, TSH, T3, and T4 for all subjects were: 3.4 ± 0.2 IU/L, 13.5 ± 0.9 nmol·L⁻¹, 28.2 ± 1.2 pmol·L⁻¹, 94.2 ± 6.4 nmol·L⁻¹, 441.3 ± 26.4 nmol·L⁻¹, 3.5 ± 0.7 mIU·L⁻¹, 150.4 ± 9.0 ng·dL⁻¹, and 7.8 ± 0.2 ng·dL⁻¹, respectively. There was a significant positive correlation between TT and cortisol (R² = 0.07; y = 0.0093x + 9.4364; P < 0.05). In addition, 43% of the participants (n = 28) had TT below age-based normative reference ranges. Those with lower than normal TT (82.0 ± 3.1 vs. 176.1 ± 3.3 nmol·L⁻¹; P < 0.01), also had lower FT (24.4 ± 1.9 vs. 31.1 ± 1.4 pmol·L⁻¹; P < 0.01), cortisol (367.4 ± 39.1 vs 497.2 ± 33.2 nmol·L⁻¹; P < 0.01), and TSH (1.57 ± 0.23 vs 1.54 ± 0.66; P < 0.01). CONCLUSION: These results indicate that military operations and training may place a large burden on the operators and depress or alter the hypothalamic pituitary, adrenal, gonadal and thyroid axes. Further research need be conducted to determine what, if any, consequences these differences may cause.

CONCLUSIONS: %HRR distinguished among external loads carried on an experimenter-paced task (FM). %HRR did not vary with load on a self-paced maximal effort task (OC), but, in conjunction with completion times, %HRR provided critical data on soldiers' physical exertion.

2956 Board #239
June 1 3:30 PM - 5:00 PM
Effect of Long-term Elite Military Training and Operations on Hormonal Profile
Andrew E. Jensen¹, Laura J. Arrington², Lorraine P. Turcotte, FACSM³, Karen R. Kelley¹,¹ University of Southern California, Los Angeles, CA; ² Leidos, Inc., San Diego, CA; ³Naval Health Research Center, San Diego, CA.

(No relevant relationships reported)

The purpose of this study was to determine the chronic effects of military operations and training on the hormone profile of elite military operators.

METHODS: Active-duty elite US military operators (n = 65, age = 29.8 ± 1.0 yrs, height = 178.4 ± 0.7 cm, weight = 85.1 ± 2.0 kg) concomitantly engaged in rigorous physical training were recruited to participate in the study. Basal plasma concentrations of luteinizing hormone (LH), total testosterone (TT), free testosterone (FT), sex-hormone binding globulin (SHBG), cortisol, thyroid stimulating hormone (TSH), triiodothyronine (T3), and thyroxine (T4) were obtained between 0600-1000 hrs. Data were analyzed for correlations and compared against normative reference values; all data are presented as mean ± SE. RESULTS: Mean LH, TT, FT, SHBG, cortisol, TSH, T3, and T4 for all subjects were: 3.4 ± 0.2 IU/L, 13.5 ± 0.9 nmol·L⁻¹, 28.2 ± 1.2 pmol·L⁻¹, 94.2 ± 6.4 nmol·L⁻¹, 441.3 ± 26.4 nmol·L⁻¹, 3.5 ± 0.7 mIU·L⁻¹, 150.4 ± 9.0 ng·dL⁻¹, and 7.8 ± 0.2 ng·dL⁻¹, respectively. There was a significant positive correlation between TT and cortisol (R² = 0.07; y = 0.0093x + 9.4364; P < 0.05). In addition, 43% of the participants (n = 28) had TT below age-based normative reference ranges. Those with lower than normal TT (82.0 ± 3.1 vs. 176.1 ± 3.3 nmol·L⁻¹; P < 0.01), also had lower FT (24.4 ± 1.9 vs. 31.1 ± 1.4 pmol·L⁻¹; P < 0.01), cortisol (367.4 ± 39.1 vs 497.2 ± 33.2 nmol·L⁻¹; P < 0.01), and TSH (1.57 ± 0.23 vs 1.54 ± 0.66; P < 0.01). CONCLUSION: These results indicate that military operations and training may place a large burden on the operators and depress or alter the hypothalamic pituitary, adrenal, gonadal and thyroid axes. Further research need be conducted to determine what, if any, consequences these differences may cause.

CONCLUSIONS: %HRR distinguished among external loads carried on an experimenter-paced task (FM). %HRR did not vary with load on a self-paced maximal effort task (OC), but, in conjunction with completion times, %HRR provided critical data on soldiers' physical exertion.
Field march performance (FMP) is an important skill of ground combat forces. Aerobic ability, or "GRIT," overall strength & perhaps lean body mass are the factors influencing FMP. PURPOSE: Investigate factors impacting FMP in a military school selection process of U.S. Service Academy Cadets.

METHODS: 230 relatively fit subjects participated in a one-day military school selection tryout culminating with an ~8.5 mile FMP carrying ~35-lb load on terrain including several elevation changes and then declined through seated recovery. In contrast, exhibit a less adaptive response. Collectively, these findings imply that CE disrupts the sympathetic response to acute stress.

RESULTS: Analysis revealed that service academy career run time was the most potent factor impacting FMP; multiple R = .79, adjusted R² = .62. Threshold measures appear present; 12:30 or faster 2MR (13 vs 8 subjects) and 2:38 or faster on an indoor obstacle course test (IOCT, 15 vs 2 subjects) reside in the Top 10% fastest FMP group. Body mass (adjusted R² = .02) and pull-ups (adjusted R² = .02; a questionable surrogate for strength) did not impact FMP. Descriptive data: run time was the most potent factor impacting FMP; multiple R = .79, adjusted R² = .62; a questionable surrogate for strength. Low-CE patterns were found in subjects who required 12:30 or greater to complete an FMP, and those who pulled up to 9 reps when required to complete 12 reps.

CONCLUSION: Dose-dependent effects of CE were demonstrated on EPA response to exercise stress. The low-CE pattern is consistent with the literature characterizing healthy plasma catecholamine responses during exercise stress, as well as with our prior research illustrating EPA responses in aerobically fit individuals. High-CE individuals, by contrast, exhibit a less adaptive response. Collectively, these findings imply that CE disrupts the sympathetic response to acute stress.

Lower extremity (LE) musculoskeletal injuries (MSIs) are a common and costly occurrence in US Navy Sea, Air, and Land (SEALs) Operators. Understanding the risk factors associated with LE MSI is an important step in designing injury prevention programs. PURPOSE: To develop a robust mathematical model to predict LE MSI in SEAL Operators.

METHODS: 285 subjects (age: 26 ± 5 years, height: 179 ± 7 cm, weight: 85 ± 9 kg) participated in testing, including: LE muscular strength and flexibility; body composition; anaerobic power/capacity; and aerobic capacity (VO2max). Medical charts were reviewed for LE MSI 365 days following laboratory testing. The correlated variable sets were identified using Hierarchical Clustering Analysis (HCA). Important features then were selected from the clusters and modeled with regression trees wherein output (predictions) were interpreted as the probability of injury for each individual. To classify observations, a decision threshold was defined that minimized the false positive rate (FPR) conditional on a true positive rate (TPR) of approximately 90% whenever all available variables were utilized. Variables selected in the final models were chosen in a forward fashion, with individual predictors that reduced the FPR without significantly lowering the TPR added to the model. The procedure stopped when no remaining predictor variables were able to produce a model that outperformed the current iteration. RESULTS: ESM was validated in 30% of the data (N = 13,285 vs 4.5%). Each cluster of feature sets from HCA consisted of variables mostly from the same laboratory test category. The final regression tree model contained knee flexion and left knee extension strength (normalized to body weight), fat-free mass (kg), and hamstring flexibility, as the best predictors (TPR of 92.3% and FPR of 2.9%). CONCLUSION: Knee strength, fat-free mass, and hamstring flexibility were important risk factors identified in the machine learning algorithm that accurately classified SEAL Operators with LE MSI. Alternative high prediction models also can be created using this modeling framework on different variable sets.

The Marine Corps Martial Arts Program (MCMAP) is designed to be delivered in an environment characterized by periods of intense physical activity and psychological stress. The purpose of the program is to prepare Marines for the stress and complex ethical decisions encountered in the modern-day battlefield. However, how multifactorial stressors effect ethical decision-making processes is not well understood.

PURPOSE: To quantify changes in ethical decision-making following MCMAP training.

METHODS: Fifty-five, active duty, newly enlisted U.S. Marines (Males: n = 37; age = 19 ± 1 yr; height = 176 ± 7 cm; mass = 74 ± 7 kg; Females: n = 18; age = 20 ± 2 yr; height = 164 ± 6 cm; mass = 61 ± 6 kg) volunteered for this investigation. Nine cohorts were recruited over a 12-month period and performed 2:45 times with 3 weeks between each visit. Serial blood samples for cortisol, norepinephrine (NE), and epinephrine (EPI) were collected before training and during the recovery period (Immediate Post (IP), 15, 30, 45 and 60min). Endocrine measures were quantified using summary measures and analyzed with RMANOVA. To quantify moral function, the Moral Functioning Continuum (MFC) was adapted from the American Medical Association’s Code of Ethics. The MFC represents a hierarchy from less severe to more severe aggressive actions. The subjects responded on a continuum as to whether they consider acts in hypothetical situations as legitimate or appropriate with scores assessed before training, IP, 30, and 60 min. Moral function variables were analyzed using a multilevel regression models.

RESULTS: There were no significant differences observed for the summary or baseline endocrine measures. Moral Intention exhibited a transient response to training with significantly impaired decision making observed immediately post training. Moreover, both Moral Intention and Moral Judgment worsened over the visits suggesting a chronic impairment related to time in training. CONCLUSION: We have identified a functional change in ethical decision-making following acute bouts of MCMAP. We would suggest future work not only examine the transient changes in decision making in response to an acute stressor, but also examine how time in service changes the individuals ethical decision-making process.
do not pass height and weight standards. However, use of a more easily defined site, such as the UMB, may improve reliability, especially on sailors whose IC may be difficult to palpate.

**Purpose:** The purpose of this study was to determine if obtaining circumference at the UMB is a valid measure for AC in the US Navy active duty population.

**Method:** UMB and IC circumference measurements were taken on 115 subjects, (79 male and 36 female), using a retractable tape measure on the skin. Trained researchers took measurements at end of expiration with the tape parallel to the floor while ensuring tape tension did not cause indentation of the skin. Three measurements were taken at both sites per individual by the same researcher. Averages were calculated and used for analysis.

**Results:** Mean circumference for males was 35.3 ± 3.8 inches at UMB and 35.7 ± 3.6 inches at IC. Mean circumference for females was 33.8 ± 4.1 inches at UMB and 35.3 ± 3.8 inches at IC. There was a high correlation between UMB and IC measurements (r² = .981 and .966 for males and females, respectively). For intra-rater reliability, interclass correlation coefficients (ICC) for the three measurements for males were ICC = .996 at both UMB and IC. For females correlations were ICC = .992 at UMB and .996 at IC.

**Conclusion:** High correlation between sites suggests UMB can be a valid substitute for IC when measuring AC. The high ICC for both sites supports reproducibility of AC measures at these sites. The ease of locating the UMB eliminates the need to palpate correct IC measurement site. Based on these results, use of the UMB as the Navy standard to obtain an AC measurement may be preferable as it can be less intrusive and more easily located.

**2964 Board #247 June 1 3:30 PM - 5:00 PM**

**Evaluation of The US Navy’s Physiological Heat Exposure Limits during Deployment in The Persian Gulf**

Douglas M. Jones¹, Katherine M. Wilson¹, Eric Duckworth¹, Magnus Perkin¹, Melissa Laird¹, Jay H. Heaney¹, ¹Leidos Inc., San Diego, CA, ²USS Nimitz, Bremerton, WA, ³Naval Health Research Center, San Diego, CA.

No relevant relationships reported

The U.S. Navy uses Physiological Heat Exposure Limits (PHEL curves) to reduce heat stress casualties aboard naval vessels. The PHEL curves, established in the 1960s, have not been examined over several decades of advancements in shipboard technology. PHEL curves ranging from I to VI (low to high metabolic work), are assigned to each job which, in combination with ambient workspace conditions, determine allowable stay times in a particular workspace. Due to advancements in shipboard design, it is probable that the metabolic rate while performing certain shipboard duties has changed, which could reduce the accuracy of current PHEL assignments.

**Purpose:** To compare predicted and measured metabolic rates of scullery personnel aboard an aircraft carrier deployed in the Persian Gulf.

**Methods:** Eight military personnel (age: 22 ± 2 yrs, ht: 165 ± 6 cm, wt: 71.8 ± 11.9 kg) assigned to shipboard scullery work (designated PHEL V) had their metabolic rate predicted based on established PHEL guidance. They then performed routine scullery work for the duration of their shift while measurements of oxygen consumption (VO2), heart rate (HR), and core temperature (Tcore) were collected for 3-4 hours. Measurements were collected again during a second shift to determine consistency of metabolic rates. Predicted and measured VO2 recordings, converted to watts (W), were then compared to determine accuracy of existing PHEL curve assignments.

**Results:** VO2 measurements between the first and second shifts were not different (229 ± 33 vs 220 ± 31 W; p = .72), suggesting that duties performed were consistent. However, the predicted metabolic rates of the current PHEL assignments were significantly higher than those actually measured (240 ± 22 vs 227 ± 28 W; p < .03). Mean Tcore of scullery personnel during both shifts was 37.4 ± 0.2°C, with the highest Tcore recorded at 38.3°C. Mean HR was 96 ± 12 bpm, equivalent to 49 ± 6% of age-adjusted maxHR.

**Conclusion:** From this limited data set identify a discrepancy between current PHEL curve assignments and measured metabolic rates in scullery personnel, likely resulting from task automation. Further work on this issue is warranted, as discrepancies between predicted and actual work rates could alter workspace allowable stay times and reduce the frequency of required workspace heat stress monitoring.

**2965 Board #248 June 1 3:30 PM - 5:00 PM**

**Fitness and Body Composition Characteristics of Special Weapons and Tactics Team Members of Law Enforcement**

Rafael A. Alamilla¹, Javier D. Romero¹, Kong Tu¹, Christina N. Cooper², Gary W. Berwick III¹, Matthew C. Jackson¹, Guillermo Escalante¹, Nicole C. Dabbs¹, Jason Ng¹, ¹California State University, San Bernardino, San Bernardino, CA, ²California State University, Long Beach, San Bernardino, CA (Sponsor: Bryan Haddock, FACSMD)

No relevant relationships reported

The job demands of members in Special Weapons and Tactics (SWAT) teams of law enforcement agencies involve heavy exertion, yet it remains uncertain whether this special population has adequate fitness levels to sustain high intensity work efforts.

**Purpose:** To examine the fitness and body composition characteristics of SWAT members.

**Methods:** Fourteen healthy men (mean ± SD; age = 33.1 ± 5.7 years; height = 180.7 ± 5.4 cm, mass = 90.6 ± 10.0 kg) from SWAT teams of local law enforcement agencies completed five health-related fitness assessments. These included 1) a total body dual-energy x-ray absorptiometry (DEXA) scan to determine lean body mass (LBM), fat mass (FM), bone mass (BM), percent body fat (%body fat), bone mineral density (BMD), and a BMI T-score; 2) a one-repetition maximum (1RM) test of upper body strength on a bench press; 3) a graded exercise test on a treadmill to measure maximum oxygen uptake (VO2max); 4) a YMCA submaximal bench press test to measure upper body muscular endurance; and 5) the Canadian trunk forward flexion test to measure hamstring flexibility. **Results:** Participants had an LBM of 70.1 ± 7.2 kg, FM of 17.2 ± 5.5 kg, BM of 3.7 ± 0.6 kg, %body fat of 18.7 ± 4.7%, a BMD of 1.3 ± 0.1 g·cm–2, and a T-Score for BMD of 1.06 ± 1.15. Absolute and relative 1RM on the bench press were 120.9 ± 14.5 kg and 1.35 ± 0.22 kg·kg–1, respectively. VO2max was 47.9 ± 5.5 ml·kg–1·min–1. Participants completed 52 ± 15 repetitions on the YMCA submaximal bench press test, Distance reached on the Canadian trunk forward flexion test was 30.7 ± 5.7 cm. **Conclusion:** According to ACSM normative data for 30-39-year-old males, participants’ body fat percentage is classified as fair. According to normative data from the World Health Organization, this population displayed a higher-than-average BMD T-score compared to other 30-39-year-old men. Participants demonstrated very good to excellent levels of cardiorespiratory fitness, muscular strength, muscular endurance, and flexibility, suggesting their fitness levels are appropriate for the vigorous exertions involved in this occupation. This information is beneficial for fitness professionals who train the tactical population. Partially Supported by NIGMS Training Grant GM083883

**2966 Board #249 June 1 3:30 PM - 5:00 PM**

**Body Composition Indices to Classify Activity Level in Air Force Men and Women**

Guy D. Lechly¹, Todd A. Cromwell¹, Jerry L. Mayhew¹, ¹Kirtland Air Force Base, Kirtland AFB, NM, ²United States Military Academy, West Point, NY, ³Truman State University, Kirksville, MO.

No relevant relationships reported

The search continues for a simple, accurate means of classifying the best body build and/or composition of active duty military personal. Various branches of the military consider body composition assessment an integral part of determining combat readiness. Heretofore, branches of the military have relied on a tape measure test to estimate body fat (%fat), which has not proven entirely successful. Recent interest has increased in body composition ratios to discern proportions of muscle and fat to identify personnel with greater military-task performance potential.

**Purpose:** To evaluate the ability of selected body composition ratios to differentiate among activity level groups of active duty Air Force personnel.

**Methods:** Air Force men (n = 604) and women (n = 343) were evaluated for body composition using air displacement plethysmography (BodPod®), Life Measurement to identify fat mass (FM), fat-free mass (FFM) and %fat. Participants were stratified into 4 age groups, determined by decade, with individuals <20 yrs (n = 13) combined with the 20-29 yr-old group and into 4 activity groups (sedentary, low active, active, and very active). Height and weight were used to calculate BMI = kg/m2. Fat-free mass index (FFMI) and fat mass index (FMI) were determined by evaluating each component relative to height (m2). Body type was estimated from the ratio of FFMI:FFM. **Results:** An activity category x age group MANOVA was performed on each ratio. In men, MANOVA was performed on each ratio. In men, BMI, BMI, and %fat were significantly different (p = 0.0001) among activity groups and age groups, with no significant interactions. In women, BMI, FMI, and %fat were significantly different (p = 0.004) among activity groups. Among age groups, FFMI, %fat, and body type were significantly different. No interactions were significant. Discriminant analysis identified FFMI as the best discriminant of activity group for each sex, but the success rate of each category was <10%. **Conclusion:** Body composition indices do not appear to offer a simple solution to identifying military
through the regression equation yields small to moderate overestimates of maximal
due to the high cardiovascular
training academy volunteered to participate in the current study (mean ± SD, age =
5.6 ± 10.1 s, with
and 1000 m. Whether such errors remain
perspective) for all analyses. The Friedman test
is needed to concentrate on the relationship
between body composition indices and physical performance tasks.
METHODOLOGY: One board of 323 subjects was required to complete
the physical performance tasks of the 800 and 1000 m loaded sprints. This
were administered at the end of the training academy (W1), during
recruits as they progress from their training academy to active-duty service. However,
was significantly different than non-successful performers for all morphological
significant and large effect of time on dynamic balance
was reduced (37.6 ± 10.3 vs. 37.8 ± 8.3°C, P < 0.001). HR (70 ± 10 to
5.1 ± 0.6 s). Table 3 (all, p < 0.05, control vs. cool). Time to 50% recovery (46 ± 41 vs. 43 ± 41 sec) and
differences in Tinv were not significant between trials for HR, HRV, VAS, or Tinv. During
fatigue (visual analog scale; VAS) were recorded. Results of the
were significantly different than non-successful performers for all morphological
the study showed that significant differences in energy
significant differences in morphology
these tests and standards.
showing that significant differences in morphology
resulting in severe fatigue and/or cardiac
 recruited to participate in the current study (mean ± SD, age =
60.8 ± 75.9 kg, body mass index 16.6 kg/m² - 17.9 kg/m², fat-free mass 53.5 kg - 70.8
while HRV (LnRMSSD; 4.1 ± 0.9 vs. 4.2 ± 1.0, and TS (3.7 ± 0.8 vs. 3.8 ± 0.8)
were not significantly different with the band active (both, p < 0.05, control vs. cool). During recovery, there was no significant
distance on the time to complete exercise (3 min/h, 5% grade) in full PPE and SCBA
(20-30%), and in a single blind, counterbalanced, crossover design, we assessed the
estimated using the CV concept to specifically increase CV would be of considerable use for
informed targeted selection processes and training programs
enhancing recovery from firefighting is paramount due to the high cardiovascular
Fatigue, and hence, associated with wearing PPE.
cooling of exercise-induced heat stress
 hierarchical (HIIT) prescribed
used the CV concept to specifically increase CV would be of considerable use for
improving tactical performance. PURPOSE: We investigated the validity of a recently
developed equation for predicting sprinting times of various tactical loads based
upon performance of a running 3 min-all-out exercise test (3MT).
comparative performance measures. Tactical professionals are often burdened with
load carriage that takes the form of duty gear, equipment, weapons, body armor, and
protective gear. Thus, a model of high-intensity interval training (HIIT)
resulting in severe fatigue and/or cardiac
HRV band active (both, p < 0.05, control vs. cool). During recovery, there was no significant
differences in HRv (Friedman test). VASs displayed a significant (P < 0.05, control vs. cool) time to 50% recovery (46 ± 41 vs. 43 ± 41 sec)
was of 0.05 determined statistical significance for all analyses.
expressed as a ratio of the mean power spectral density of the
and fatigue (visual analog scale; VAS) were recorded. Results of the
be of considerable use for
enhanced recovery from heat stress might enhance recovery of core temperature,
fatigue, and HR, without notable impact on heart rate variability or thermal sensation. Supported by:
the basic research conducted in the current study.
their training academy to active-duty service. However,
such changes in health and fitness occur among firefighter recruits as they progress from their training academy to active-duty service.
produced by the authors and printed as submitted.
Firefighters (FFs) work in hazardous, volatile environments with considerable physical and mental demands that might influence cognitive performance. The nature and extent of such influence requires examination. PURPOSE: Determine the influence of a night-burn FF drill on new-recruit FFs’ perceptual sensations (thermal, respiratory, effort), physical workload (heart rate; HR), and cognitive performance (modified Flanker task), while identifying individual risk factors. METHODS: New-recruit, male FFs (N=28; 24.96 ± 4.2 yrs) participated in a live-fire night-burn drill (48:54±03:46 mins) as part of a 6-wk training program. This involved emergency response, fire attack, and search and rescue. Aerobic fitness was estimated from 1.5-mi run time. Cognitive behavioral performance on a modified Flanker task and perceptual states (thermal sensation, RPE, respiratory distress, feelings, felt arousal, fatigue, anxiety) of each FF were measured on a separate baseline day, as well as pre- and post-firefighting (Post-0, End). HR was continuously recorded throughout. RESULTS: After accounting for baseline, M HR during drill predicted variance in post-task affect (state anxiety: 24.5%, F= 0.01; TS: 18.1%, P= 0.025; FS: 14.6%, P= 0.046); VAS nervousness: 17.4%, P= 0.028). M HR during drill also predicted cognitive performance Post-0 for Flanker Accuracy on all trials (16.8%, P= 0.033). FS change from Pre to Post-0 also explained Accuracy for all trials (14.4%, P= 0.047). 1.5-mi run time predicted variance in Post-0 Flanker SD for all trials (20.2%, P= 0.016). VAS fatigue change from Post-0 to Post-6 also explained Accuracy for Post-6 Flanker SD (16.5%, P= 0.032). CONCLUSIONS: Simple, on-line tracking of HR may be able to help incident commanders recognize FFs who, indicated by greater relative HR during emergency response, may have diminished decision-making capacity on the fireground. Other factors (e.g., trait anxiety, dispositional resilience) may influence physical effort put forth in an emergency scenario and may put certain FFs at higher risk for making errors. Future research should determine the influence of factors such factors in order to enhance performance and, ultimately, safety for FFs. Manifestation of such changes in cognitive performance, in terms of decision making during a live-fire emergency, needs further investigation.

**Table 1:**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Absolute (min)</th>
<th>Relative (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>1085.8 (562.5 - 1315.0)</td>
<td>95.8 (86.9 - 99.9)</td>
</tr>
<tr>
<td>Moderate</td>
<td>23.9 (3.3 - 140.6)</td>
<td>2.3 (0.3 - 11.1)</td>
</tr>
<tr>
<td>Heavy</td>
<td>15.7 (0.0 - 65.8)</td>
<td>1.3 (0.0 - 5.6)</td>
</tr>
<tr>
<td>Very heavy</td>
<td>0.0 (0.0 - 35.0)</td>
<td>0.0 (0.0 - 4.5)</td>
</tr>
<tr>
<td>Wear time</td>
<td>1180.5 (639.0 - 1323.0)</td>
<td></td>
</tr>
</tbody>
</table>

**Conclusion:** Firefighters spent most of their time in light activities, including sedentary and resting periods. However, >80% of the volunteers interspersed the light activities with periods of MVPA. No firefighter reported any heavy demand during the monitored days. New studies including firefighters’ activities during huge wildland fires are needed.

**References:**

1. Bergstrom, S., Summer Cook, FACSM®; Robert Kenefick, FACSM®; Timothy Quinn, FACSM®; University of New Hampshire, Durham, NH. U.S. Army Research Institute of Environmental Medicine, Natick, MA. (Sponsor: Timothy Quinn, FACSM®)

**Purpose:** To determine the influence of night-burn FF drills on new-recruit FFs’ perceptual sensations (thermal, respiratory, effort), physical workload (heart rate; HR), and cognitive performance (modified Flanker task), while identifying individual risk factors.

**Methods:** New-recruit, male FFs (N=28; 24.96 ± 4.2 yrs) participated in a live-fire night-burn drill (48:54±03:46 mins) as part of a 6-wk training program. This involved emergency response, fire attack, and search and rescue. Aerobic fitness was estimated from 1.5-mi run time. Cognitive behavioral performance on a modified Flanker task and perceptual states (thermal sensation, RPE, respiratory distress, feelings, felt arousal, fatigue, anxiety) of each FF were measured on separate baseline days, as well as pre- and post-firefighting (Post-0, End). HR was continuously recorded throughout. Results: After accounting for baseline, M HR during drill predicted variance in post-task affect (state anxiety: 24.5%, F= 0.01; TS: 18.1%, P= 0.025; FS: 14.6%, P= 0.046); VAS nervousness: 17.4%, P= 0.028). M HR during drill also predicted cognitive performance Post-0 for Flanker Accuracy on all trials (16.8%, P= 0.033). FS change from Pre to Post-0 also explained Accuracy for all trials (14.4%, P= 0.047). 1.5-mi run time predicted variance in Post-0 Flanker SD for all trials (20.2%, P= 0.016). VAS fatigue change from Post-0 to Post-6 also explained Accuracy for Post-6 Flanker SD (16.5%, P= 0.032). Conclusions: Simple, on-line tracking of HR may be able to help incident commanders recognize FFs who, indicated by greater relative HR during emergency response, may have diminished decision-making capacity on the fireground. Other factors (e.g., trait anxiety, dispositional resilience) may influence physical effort put forth in an emergency scenario and may put certain FFs at higher risk for making errors. Future research should determine the influence of factors such factors in order to enhance performance and, ultimately, safety for FFs. Manifestation of such changes in cognitive performance, in terms of decision making during a live-fire emergency, needs further investigation.

**Table 1:**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Absolute (min)</th>
<th>Relative (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>1085.8 (562.5 - 1315.0)</td>
<td>95.8 (86.9 - 99.9)</td>
</tr>
<tr>
<td>Moderate</td>
<td>23.9 (3.3 - 140.6)</td>
<td>2.3 (0.3 - 11.1)</td>
</tr>
<tr>
<td>Heavy</td>
<td>15.7 (0.0 - 65.8)</td>
<td>1.3 (0.0 - 5.6)</td>
</tr>
<tr>
<td>Very heavy</td>
<td>0.0 (0.0 - 35.0)</td>
<td>0.0 (0.0 - 4.5)</td>
</tr>
<tr>
<td>Wear time</td>
<td>1180.5 (639.0 - 1323.0)</td>
<td></td>
</tr>
</tbody>
</table>

**Conclusion:** Firefighters spent most of their time in light activities, including sedentary and resting periods. However, >80% of the volunteers interspersed the light activities with periods of MVPA. No firefighter reported any heavy demand during the monitored days. New studies including firefighters’ activities during huge wildland fires are needed.

**Funding:** CNPq 480092/2013.3
Firefighters experience a rise in body temperature during exertion. The use of active cooling modalities during firefighting is crucial to prevent hyperthermia and ensure occupational performance. The study aimed to evaluate changes in core body temperature and thermal sensations during a firefighting-based exercise circuit in 40°C and 60% relative humidity. Firefighters were exposed to various conditions, including breathing apparatus (SCBA) and wearing turnout gear and neck protection.

RESULTS: The results indicated a significant decrease in core body temperature and an increase in thermal comfort during the cooling period. The use of SCBA significantly reduced core body temperature compared to breathing through the SCBA and baseline conditions. Firefighters reported improved thermal sensations and comfort during SCBA use.

CONCLUSIONS: The application of active cooling strategies, such as SCBA use, is effective in reducing core body temperature and improving thermal sensations during firefighting activities in hot and humid environments. Firefighters should incorporate such cooling modalities to prevent hyperthermia and maintain optimal performance.
INTRODUCTION: Studies have shown that employee productivity and satisfaction decline with number of hours worked [1,2]. However, most of these studies looked at sedentary career fields when many careers require long hours of standing and walking. PURPOSE: The purpose of this study was to determine if repeated breaks from walking has an effect on productivity and satisfaction.

METHODS: 23 healthy adults (11 males, 12 females) mean age of 22.5 ± 3.4 years volunteered to participate in the study. Participants were split into two groups. Continuous walkers, (n=11) who walked around a standard 400 meter track at a self-selected pace for 6 hours with one 10 minute break at 3 hours. Intermittent walkers (n=12), who walked for 50 minutes followed by a 10 minute break, repeated 6 times. Heart rate (HR), Blood pressure (BP), laps, and feeling scale were analyzed at Pre-walking, Midpoint, and Post walking. Dependent variables were analyzed utilizing a 2 (group) x 3 (time) ANOVA with repeated measures on time. Significance was accepted at the p<0.05 level.

RESULTS: Continuous group walked significantly more laps total and more laps per hour (mean 58.8 ±5.9 vs. 46.9 ±4.91 mean total laps, p < 0.01). However, there was no difference in number of laps per relative hours walked (9.8 ±0.98 vs. 9.4 ±0.84 laps/hr, p = 0.894). Although a decline in feeling scale from hour one to hour 6 was observed, it was not similar for both groups (Continuous p=0.039, Intermittent p=0.032). No significant differences were observed between groups in HR, Systolic BP or Diastolic BP.

CONCLUSIONS: Individuals walked the furthest distance when walking continuously. Six hours may not be enough time to see a significant decline in walking performance measures. The test environment may have been more enjoyable than a usual work environment.

Health programs incorporating physical activity components in office space work environments are encouraged to reduce sedentary/sitting down time that has recently been shown to be detrimental to employee health. PURPOSE: The aim of this pilot project is to compare energy expenditure of three methods to play dance active video games to reduce employee sedentary time and explore the possibilities and limitations to using this video game type as part of an employee based health program. METHODS: A total of 8 desk based worker participants (men, 26 ± 5 years) were recruited to perform 3 types of active video games playing using original instructions and a modification to allow individuals with limitations to play. The 3 dances were Party Rock Anthem, Land of 1000 Dances, and No limit (Just Dance, Ubisoft, Ontario). The modifications were to play with a motion capture device (Kinect, Microsoft, USA), with a controller device (PSMove, Sony, Jp), and with a controller device in a sitting position (PSMove, Sony, Jp). The energy expenditure was measured by oxygen uptake using a portable metabolic analyser (K4b2, Cosmed, It) and the heart rate by a heart rate monitor (v800, Polar, Fi). RESULTS: The group average METS with Kinect vs PS vs sitting position during the Party Rock Anthem was 6.3 ±3.0, 5.5 ±1.2, and 3.0 ±0.8 METS (p<0.001). The group average METS on Kinect vs PS vs sitting position during Land of 1000 Dances was 7.4 ±1.6, 6.1 ±1.4, and 3.6 ±1.4 METS (p<0.001). Finally, the group average METS on Kinect vs PS vs sitting position during No limit was 6.8 ±1.3, 5.8 ±1.3, and 3.5 ± 1.1 METS (p<0.001). CONCLUSIONS: Knowing that now these games are available using only a cell phone as a controller and a simple computer with internet, it seems feasible to use these video games to reach the minimum ACSM guidelines in a health program for an office company, even when modified for physically limited employees. However, a significant difference between the different types of play and individual needs must be considered in a workplace health program. Furthermore, additional research needs to be done to measure the impact of implementing physical active work breaks on personnel fitness changes and retention.
Body composition changes differ in all sports due to specific training. In the off season, athletes prioritize strength training programs, however during the competitive season, training is often replaced with team sport training. Lacrosse players in previous studies showed better performance with decreased body fat percentage and increased lean body mass. However, its common during the competitive season to show an increase in % body fat and a minimal increase in lean body mass from pre to post season in Division II male lacrosse players. These changes do not demonstrate negative energy balance throughout the competitive season as previous research suggests.  

Conclusion: Although these results were not significant, there was a decrease in % body fat and a minimal increase in lean body mass from pre to post season in Division II male lacrosse players. These changes do not demonstrate negative energy balance throughout the competitive season as previous research suggests.

Stress urinary incontinence (SUI), usually defined as involuntary leakage from the urethra, synchronous with exertion/effort, or on sneezing or coughing with an incidence rate of 4-35% in the general population has an unknown incidence with female powerlifters. PURPOSE: The purpose of this anonymous online survey was to identify trends related to SUI in female powerlifters who do not otherwise have risk factors for or symptoms of SUI in their daily lives. METHODS: Female powerlifters between the ages of 18-35 who have successfully been competing for at least two years on a National level or higher, are nulligravida, have no history of SUI symptoms with ADLs, as well as no history of kidney disease, bladder disease, diabetes mellitus, pelvic floor, bladder, or rectal prolapse were eligible to participate.  

Solicitation scripts were posted on both USA Powerlifting and the United States Powerlifting Association’s Facebook pages. 51 competitive female powerlifters completed the survey (ht. 162.6 ± 7.0 cm, body mass 71.4 ± 13.7 kg, waist 77.2 ± 8.3 cm, and hip 100.3 ± 10.0 cm). RESULTS: 74.5% (38) of participants indicated that they have experienced SUI while training the power lifts. Only 7.8% (4) who reported suffering from SUI while lifting indicated that they spoke to their doctors about the condition. 35.3% (18) indicated that they had not tried anything to help them manage their symptoms. 68.6% (35) indicated that they experience SUI while performing the deadlift while 49% (25) reported experiencing SUI while performing the squat. No participants reported experiencing SUI while performing the bench press. Additionally, 31.4% (16) reported experiencing symptoms while performing sets of 2-3 reps while 21.6% (11) subjects reported experiencing symptoms only while performing singles. 56.9% (29) reported that their symptoms were worse while wearing a weightlifting belt. Finally, 35.3% (18) reported that their symptoms of SUI while lifting causes them distress or anxiety. CONCLUSION: SUI is a significant issue for female powerlifters that may cause distress and anxiety when training and competing. SUI is more prevalent during heavy lower body lifting and may be made worse when wearing a weightlifting belt. This information can be useful to coaches and lifters when trying to manage the symptoms of SUI.

Purpose: To determine the effects of sickle cell trait (SCT) on hydration status and body temperature regulation in collegiate female football players during 17 days of pre-season training. METHODS: Twelve female athletes were recruited to two groups: 6 with the SCT and 6 position-matched control players (CON). Body weight was measured and urine collected pre- and post-practice to examine urine color, specific gravity (USG), and electrolytes (Na+, K+, and Cl). Sweat was collected using gauze covered by a waterproof patch on the lower back. Each player ingested a core temperature pill 4-6 hours prior to practice. Ambient and black globe temperatures and humidity were collected pre-and post-training to assess wet-bulb globe temperature (WBGT). Results: Mean WBGT was 28.6±3.1°C (24.1-33.5°F). Average weight loss was -1.1±1.0kg (mean±SE). Weight loss, maximal core temperature and heat storage (change in core temperature) were similar in CON and SCT (P>0.05). However, SCT had significantly higher sweat sodium and chloride levels (Na+: 60.79±7.18 mmol/L; Cl: 118.47±8.79 mmol/L vs. CON: 51.57±6.49 mmol/L) compared to CON (Na+: 47.54±7.17 mmol/L; Cl: 40.33±6.48 mmol/L; P<0.001 for both). CON had higher post-training USG (1.028±0.007) compared to SCT (1.018±0.022; P<0.001). Urine electrolytes were significantly higher for Hb electrophoresis (Hb-A, Hb-A2, Hb-S, and Hb-F), complete blood count with differential, chemistry panel 26, and prothrombin time, activity and international normalized ratio (INR). RESULTS: Baseline total Hb was similar between SCT and CON (mean±SD; 14.2±1.3 vs. 14.1±0.9 g/dL, resp; P=0.87), but as expected, Hb-A and Hb-A2 were lower and Hb-A and Hb-Bs were higher in SCT than CON (P=0.001 for all). Baseline neutrophils were higher (4.43±1.29 vs. 3.28±0.93 cellsx10^9/mL, P=0.005) and lymphocytes tended to be lower (1.56±0.45 vs. 1.99±0.39 cellsx10^9/mL, P=0.09) amongst SCT compared to CON, respectively. Baseline amylase (99.4±25.4 vs. 72.9±18.6 U/L; P=0.03), uric acid (6.8±1.7 vs. 5.5±1.0 mg/dL; P=0.08), and creatinine (1.2±0.2 vs. 1.0±0.2 mg/dL; P=0.07) were higher in SCT compared to CON. All Hb measures in SCT were similar after camp compared to baseline (P=0.33 for all). Baseline and position adjusted change in neutrophils were similar between SCT and CON (mean, 95%CI; -0.09, -2.06 to 1.89 vs. -0.3, -1.61 to 0.78 cellsx10^9/mL; P=0.77). Similarly, the adjusted change in lymphocytes was not different between SCT and CON (-0.2, -1.05 to 0.15, 0.37 to 0.67, resp; P=0.40), however, total lymphocyte counts increased in SCT over time (P<0.05). Creatinine responses differed between SCT and CON (-0.05, -0.12 to 0.02 vs. -0.05, 0.03 to 0.12, P=0.05) and potassium decreased a greater extent in SCT (-0.44, -0.6 to -0.3 vs. -0.2, 0.3 to -0.1; P=0.05) after camp. CONCLUSION: Despite major hematological differences due to SCT, very few changes occurred during the exhaustive, pre-season camp at sea level. Funded in part by the Robert and Patricia Hines Endowed Professorship in Kinesiology, LSU, and unrestricted funding provided in part by a gift to the Tiger Athletic Foundation.
Cardiometabolic Changes During the Hormonal Transition Of A Male-to-female Athlete: A Case Study
Shannon L. Wilson1, Andrew C. D’Lagos1, Theresa M. Jorgensen1, Joanna Harper1, Corrie M. Whisner2, Jared M. Dickinson, FACSM3, Glenn A. Gaesser, FACSM1, Siddhartha S. Angadi, FACSM4, 1Arizona State University, Phoenix, AZ. 2Providence Portland Hospital, Portland, OR.

PURPOSE: To assess the cardiovascualr changes during estrogen treatment for gender reassignment in an aerobically trained, male-to-female transgender athlete.

METHODS: Subject is a biologically male distance runner (age 27) that initiated gender reassignment. Social male-to-female transition was completed prior to testing. The following assessments were performed: anthropometry, DXA (dual energy x-ray absorptiometry) scan (1st, 3rd, and 4th visit only), resting echocardiogram, treadmill-based VO2peak, resting carotid-femoral pulse wave velocity (cf-PWV), resting peripheral/central blood pressures and augmentation index (normalized at heart rate of 75 bpm; AIX@75). Baseline assessments were made during two separate visits completed prior to estrogen treatment (visits were averaged). Subsequent assessments were made at 2 and 6 weeks following the initiation of the estrogen treatment (10 mg estradiol valerate s.c. once per week).

RESULTS:

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Baseline</th>
<th>2 weeks</th>
<th>6 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td>18.5</td>
<td>19.8</td>
<td>19.6</td>
</tr>
<tr>
<td>Total body fat</td>
<td>18.80%</td>
<td>21.80%</td>
<td>22.50%</td>
</tr>
<tr>
<td>Visceral body fat</td>
<td>143.3 g</td>
<td>274.2 g</td>
<td>230.0 g</td>
</tr>
<tr>
<td>Absolute VO2</td>
<td>3.3</td>
<td>3.3</td>
<td>2.9</td>
</tr>
<tr>
<td>Relative VO2</td>
<td>58.7</td>
<td>55.8</td>
<td>50.3</td>
</tr>
<tr>
<td>SBP</td>
<td>118</td>
<td>111</td>
<td>109</td>
</tr>
<tr>
<td>DBP</td>
<td>73</td>
<td>71</td>
<td>65</td>
</tr>
<tr>
<td>cSBP</td>
<td>106</td>
<td>99</td>
<td>96</td>
</tr>
<tr>
<td>cDBP</td>
<td>74</td>
<td>71</td>
<td>65</td>
</tr>
<tr>
<td>cf-PWV</td>
<td>6.7</td>
<td>6.2</td>
<td>6.2</td>
</tr>
<tr>
<td>AIX@75</td>
<td>4.75</td>
<td>-13</td>
<td>-6</td>
</tr>
</tbody>
</table>

RHR: Resting heart rate; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; cSBP: Central systolic blood pressure; cDBP: central diastolic blood pressure; cf-PWV: carotid femoral pulse wave velocity; AIX@75: Augmentation Index normalized at a heart rate of 75 bpm.

CONCLUSIONS: Significant increases in body fat and waist size were noted with the initiation of estrogen treatment. Prepubertal VO2peak was maintained at a heart rate of 75 bpm. Significant decreases were noted in resting carotid-femoral pulse wave velocity and augmentation index at heart rate of 75 bpm.

EF: Ejection fraction; SV: Stroke volume; LVEDV: Left Ventricular End Systolic Volume; LVESV: Left Ventricular End Systolic Volume; LVDD: Left Ventricular systolic diameter;LVDD: Left Ventricular diastolic diameter;CONCLUSIONS: Body composition and cardiorespiratory physiology are altered during the immediate weeks of male-to-female estrogen therapy.
The International Olympic Committee (IOC) proposed the term Relative Energy Deficiency in Sport (RED-S) to describe the health and performance consequences beyond the well-established Female Athlete Triad (Triad). Both the IOC and the Triad Coalition have developed return-to-play (RTP) criteria to guide clinical decision making on clearance for participation in sports based on health assessment.

**PURPOSE:** To determine the agreement between the RED-S Clinical Assessment Tool (RED-S CAT) and Triad risk assessment criteria (Triad-RA) for sports participation clearance levels for female athletes.

**METHODS:** 1000 female athletes (ages 15-30 years) presenting to a sports medicine clinic completed a comprehensive, 400+ question survey covering topics related to RED-S, including Triad risk factors, and sports participation. Clearance level/risk assessment for each athlete was assigned according to each syndrome’s model as low (green light), moderate (yellow light), or high risk (red light). Clearance level by each model was compared within each athlete.

**RESULTS:** Using the RED-S CAT, 26.6% of athletes were green light (full clearance), 29.7% were yellow light (provisional/limited clearance), and 43.7% were red light (fully restricted). Using the Triad-RA, 30.2% of athletes were low risk, 61.9% were moderate risk, and 7.9% were high risk. Overall the models agreed that 86% of the athletes were at elevated risk, moderate or high. The worst discordance occurred for athletes deemed to be at high risk by RED-S CAT, but moderate risk by Triad-RA; these athletes accounted for 37.3% of all subjects. The RED-S CAT cleared 8.8% of the sample for full participation that the RED-S CAT categorized as elevated risk; the RED-S CAT cleared 5.2% of the sample for full participation that the Triad-RA categorized as elevated risk.

**CONCLUSIONS:** Most female athletes surveyed met elevated risk categories using both RED-S CAT and Triad-RA. The RTP criteria for both syndromes should be further refined for use in primary care settings as part of pre-participation examinations to appropriately categorize athletes needing further medical care and potential restriction from sport.

Sport and exercise can improve cardiovascular health for someone with type 1 diabetes mellitus (T1DM), but it must be performed safely. Blood glucose control in adolescent athletes can be critical, especially on the day of competition. Because of the complexity of the hormonal response to stress of a game, blood glucose will be altered even if exerting a similar amount of energy. PURPOSE: The purpose of this case study was to examine average daily glucose for a period of 72-hours starting on and following a non-gamedy day (NGD) compared with a game day (GD) for a high school soccer player with type 1 diabetes. METHODS: Data from a 15 year old male athlete with T1DM was used for this case study. The athlete wore an accelerometer on his upper left arm during competition. The athlete wore an accelerometer on his upper left arm during competition and the change in %fat.

**RESULTS:** Using the RED-S CAT, 26.6% of athletes were green light (full clearance), 29.7% were yellow light (provisional/limited clearance), and 43.7% were red light (fully restricted). Using the Triad-RA, 30.2% of athletes were low risk, 61.9% were moderate risk, and 7.9% were high risk. Overall the models agreed that 86% of the athletes were at elevated risk, moderate or high. The worst discordance occurred for athletes deemed to be at high risk by RED-S CAT, but moderate risk by Triad-RA; these athletes accounted for 37.3% of all subjects. The RED-S CAT cleared 8.8% of the sample for full participation that the RED-S CAT categorized as elevated risk; the RED-S CAT cleared 5.2% of the sample for full participation that the Triad-RA categorized as elevated risk.

**CONCLUSIONS:** Most female athletes surveyed met elevated risk categories using both RED-S CAT and Triad-RA. The RTP criteria for both syndromes should be further refined for use in primary care settings as part of pre-participation examinations to appropriately categorize athletes needing further medical care and potential restriction from sport.

Mechanically overloaded muscle and its subsequent damage are strong stimuli for eliciting acute hormonal changes, and muscle adaptation following exercise-induced muscle damage may be a complex hormonal response before the completion of muscle regeneration. PURPOSE: This study investigated systemic responses of thyroid-stimulating hormone (TSH), free thyroxine (fT4) and prolactin (PRL) for several days after eccentric exercise-induced muscle damage in humans. METHODS: Nine healthy men (age 25.7 ± 1.7 years, height 180.4 cm ± 1.7 cm, body mass 77.2 ± 2.7 kg, body mass index 23.7 ± 0.6) performed 50 maximal eccentric muscle actions using the knee extensor muscles of both legs on an isokinetic dynamometer. Blood samples were withdrawn before and at 6, 48 and 120 hrs post-exercise, and serum levels of TSH, fT4, and PRL were measured by ELISA using commercially available kits. Myoglobin (Mb) concentration and lactate dehydrogenase (LDH) activity were also measured for the assessment of muscle damage. One-way ANOVA was used for statistics. RESULTS: Significant alterations in Mb and LDH were observed over time after eccentric exercise (p<0.05-0.001). Serum fT4 levels exhibited a gradual increase reaching statistical significance at 48 and 120 hrs following the muscle damaging exercise (1.29±0.05 ng/ml, 1.29±0.04 ng/ml, and 1.26±0.05 ng/ml at 6, 48 and 120 hours after exercise, respectively, compared to 1.13±0.02 ng/ml at baseline; mean±SE, p<0.05). Both PRL and TSH showed also a gradual increase up to 33% at 48 hrs and 120 hrs post exercise, respectively, however they failed to reach statistical significance due to a large variability shown between the subjects’ responses (PRL: 23.84±3.1 ng/ml, 28.1±4.7 ng/ml, 30.2±4.1 ng/ml and 25.7±4.6 ng/ml; TSH: 1.99±0.14 pU/ml, 1.27±0.15 pU/ml, 1.17±0.20 pU/ml and 1.33±0.17 pU/ml at baseline, 6, 48 and 120 hrs post-exercise, respectively, mean±SE, p=0.05). Both PRL and TSH showed also a gradual increase up to 33% at 48 hrs and 120 hrs post exercise, respectively, however they failed to reach statistical significance due to a large variability shown between the subjects’ responses (PRL: 23.84±3.1 ng/ml, 28.1±4.7 ng/ml, 30.2±4.1 ng/ml and 25.7±4.6 ng/ml; TSH: 1.99±0.14 pU/ml, 1.27±0.15 pU/ml, 1.17±0.20 pU/ml and 1.33±0.17 pU/ml at baseline, 6, 48 and 120 hrs post-exercise, respectively, mean±SE, p=0.05). CONCLUSION: The late elevated levels of TSH and PRL, and particularly of fT4, during the recovery period after muscle damage may suggest functional interactions between those
hormones and muscle regeneration. Further studies are needed to characterize the mechanisms by which those hormonal responses are triggered and regulated at the systemic level during recovery after exercise-induced muscle damage.

F-66 Free Communication/Poster - Clinical Exercise Physiology of Cancer and Exercise
Friday, June 1, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B
2993 Board #276 June 1 3:30 PM - 5:00 PM
Physical Functioning in Older Breast Cancer Survivors: A 12-Month Randomized-Controlled Trial with 6-month Follow Up.
Mary E. Medysky1, Sydnee Stoyles1, Nathan F. Dieckmann1, Kerri M. Winters-Stone, FACSSM2, Oregon Health and Science University, Portland, OR. 2Knight Cancer Institute, Portland, OR. (Sponsor: Kerri Winters-Stone, FACS)

The largest age group of breast cancer survivors (BCS) in the U.S. is comprised of women ages 65+, who are susceptible to age-related decrements in physical function accelerated by cancer treatment toxicities. Though exercise is known to reverse age-related functional limitations, older BCS may be heterogeneous in baseline functioning which may affect the efficacy of exercise to reverse functional declines. PURPOSE: Determine the efficacy of each aerobic and resistance training to improve physical function in older BCS, considering baseline physical functioning. METHODS: Older, early-stage, BCS (mean age=72), who underwent chemo- or radio-therapy in the previous 2 years were randomized to 12 months of supervised, group aerobic (AER) or resistance (RES) training or control (CON) (flexibility exercise, followed by 6 months of home-based training. Physical function was assessed by the Physical Performance Battery (PPB), 5x chair stand time (sec), maximum bench and leg press (kg), and 4-meter usual walk speed (m/sec) tests and self-reported lower-body function with the Late-Life Function and Disability Instrument (LLFDI). A linear mixed effects model was used to assess function after 12 and 18 months on the full sample and only in BCS with PPB scores ≥9. RESULTS: 114 BCS were enrolled and randomized to AER (n=37), RES (n=39), or CON (n=38). Within the full sample there was a significant improvement in bench press strength at 12 months (p=0.03) and PPB at 18 months in RES vs CON. After removing participants with low baseline physical functioning (n=79), the following additional significant differences were found between: 1) RES (mean=2.72±1.7) and CON (mean=3.06±2.0) for self-report physical function at both 12 (p=0.04) and 18 months (p=0.005), 2) AER (mean=4.0±1.0) and CON (mean=0.03±0.0) at 12-months for average walk speed and, 3) AER (mean=0.32±0.3) and RES (mean=0.50±0.2) at 18 months, for chair time (p=0.05).

CONCLUSIONS: Although AE and RT are efficacious in improving physical function in older BCS across a range of baseline physical functioning, broader improvements may only be possible among women with better functioning and thus capable of achieving a greater dose of exercise. Older BCS may need to be stratified into groups based on their initial functioning, then matched to appropriate training.

2994 Board #277 June 1 3:30 PM - 5:00 PM
The Relationship Between Six Minute Walk Distance And Dyspnea Symptoms Among Preoperative Lung Cancer Patients
sung-a kong1, Jaekyung Lee1, Jinhee Lee2, Hye氰 Park2, Juhee Cho3. Sungkyunkwan University, seoul, Korea, Republic of. 1Samsung Medical Center, seoul, Korea, Republic of.

Results: Lung cancer patients with low 6MWD (<450m) were more likely to have dyspnea than those with high 6MWD(>450m). mMRC and CAT score were -0.256 (95% CI -0.387, -0.125), -2.427(95% CI -3.751, -1.104). Quality of life were general health score 10.456 (95% CI 5.030, 15.882), fatigue score 8.891 (95% CI 14.618, 3.165). Differences of dyspnea and QoL by 6MWD before surgery

<table>
<thead>
<tr>
<th>6MWD</th>
<th>mMRC</th>
<th>CAT score</th>
<th>General Health, QoL</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;450m</td>
<td>0.53 (0.52-0.54)</td>
<td>8.10 (7.88-8.30)</td>
<td>58.53 (58.02-59.04)</td>
</tr>
<tr>
<td>&gt;450m</td>
<td>0.24 (0.24-0.25)</td>
<td>5.43 (5.32-5.55)</td>
<td>67.41 (67.14-67.70)</td>
</tr>
</tbody>
</table>

S260 Vol. 49 No. 5 Supplement
resistance exercise (CE) reduces insulin levels and improves MST, and has been shown to improve elevated insulin and reduced MST. In particular, combined aerobic and resistance exercise (CE) reduces insulin levels and improves MST, and has been shown to be superior to resistance or aerobic exercise alone at reducing insulin resistance in patients with type 2 diabetes. The purpose of this study was to determine whether fasting insulin levels and muscle strength (MST) can be improved following a 16-week supervised CE intervention in overweight and obese breast cancer survivors (BCS). We further sought to determine whether exercise-induced changes in fasting insulin are associated with changes in MST.

METHODS: Sedentary, overweight/obese (BMI ≥25 kg/m²) BCS (Stage I-III) were randomized to the Control (CON) or the Exercise (EX) groups. EX underwent supervised CE sessions 3 times per week for 16 weeks. CON was asked to maintain their current level of activity. Fasting serum insulin was measured using enzyme-linked immunosorbent assays. MST was assessed from 10-RM (repetition maximum) tests of the leg extension (LE) and chest press (CP) to estimate 1-RM values. Repeated measures ANOVA was used to examine the effects of exercise on insulin and MST. Pearson’s correlations were performed to examine the association between MST changes for each exercise and insulin.

RESULTS: At baseline, EX (n=48) and CON (n=46) did not differ by age (53.0 ± 10.4 yr), insulin (35.2 ± 15.4 pmol/L), or BMI (33.5 ± 5.5 kg/m²). Post-intervention, insulin was significantly reduced (-13.5 ± 3.1%) and all MST measures (35.9 ± 6.7%) significantly increased in EX compared to CON (P=0.01). Significant correlations were found between reduced insulin and improved MST for LE (r=-0.67, p=0.001) and CP (r=-0.81, p=0.001) in EX.

CONCLUSION: A 16-week supervised CE intervention is an effective approach to reduce insulin, and increase MST, and reductions in insulin are associated with improved muscle strength in BCS. Collectively, this supports the utilization of aerobic and resistance exercise as vital components of cancer rehabilitation following completion of cancer treatment.

F-67 Basic Science World Congress/Poster - Skeletal Muscle II
Friday, June 1, 2018, 1:00 PM - 6:00 PM
Room: CC-Hall B

Females are more likely to experience poor knee-related outcomes and are less likely to return to pre-injury levels of return to sport following ACLR as compared to males of the same age and pre-injury activity level. Evidence has shown that young adults with ACLR participate in significantly less moderate-to-vigorous physical activity (MVPA) as compared to healthy matched. However, it is not clear if an individual’s sex is a factor in their determining the likelihood of engagement in healthy levels of MVPA following ACLR. Purpose: To examine the effects of sex and ACLR status on the volume of MVPA in which an individual engages as well as the likelihood that an individual will meet national guidelines for weekly MVPA. Methods: 31 individuals with a history of ACLR (Sex = 22F/9M, Age = 20.3 ± 1.7 years, BMI = 23.3 ± 2.8 kg/m², Time since surgery = 28.2 ± 17.1mo) and 32 healthy individuals (Sex = 22F/10M, Age = 20.8 ± 1.6 years, BMI = 23.3 ± 3.0 kg/m²) were enrolled in this study. Objective MVPA in Freedom Bouts (min/wk) were assessed with an ActiGraph GT3X-BT accelerometer worn on an elastic belt at the hip over a period of 7 days with a minimum of 4 days of wear with ≥10 hours per day. Wear time (min/day) was validated using recommendations of Choi et al. Between group (ACLR, Healthy) and sex (F vs M) differences in Freedom Bouts were investigated using a 2(group) x 2(sex) ANOVA. Fischer’s exact test was utilized to test the sex-based difference in meeting national MVPA recommendations (MVPA > 150 min/wk) among individuals with ACLR. Results: Overall, individuals with ACLR (MVPA = 114±95 min/week) participated in less MVPA in Freedom Bouts per week as compared to healthy individuals (MVPA = 212±138 min/wk, p = 0.002). Females (MVPA = 184±133 min/wk) were more active than males (MVPA = 116±102 min/ wk, p = 0.02). There was no meaningful interaction between group and sex (p = 0.06) but females with ACLR (72.0%) were more likely to meet MVPA guidelines when compared to males (36.3%, p = 0.05). Conclusion: Individuals with ACLR participate in less MVPA than those with no history of knee injury which is consistent with previous findings. While no interaction was present between sex and history of ACLR, females with ACLR were more likely to meeting MVPA guidelines which may have implications for long term health risks associated with ACLR.
The saddle is an integral part of riding a bicycle, however research examining determinants of cycling saddle preference/comfort is limited. PURPOSE: To determine if trained cyclists can differentiate between road bicycle saddle shapes and whether preferences are related to anatomy and/or cycling position variables.

METHODS: Cyclists riding 5-12 h/wk for a cycling event participated (21 M and 21 F). Pelvic anatomy (composition plus ischial tuberosity width) and overall body composition were determined by DXA. Cycling position variables were determined using 3D motion capture. Subjects then completed 3 separate saddle evaluations using identical cycling shorts while riding 3 differently shaped saddles (flat, concave widthwise and concave lengthwise). The 1st and 3rd evaluations were identical and occurred in the lab on an ergometer adjusted to the subject’s personal cycling position. In a blinded, randomized design, subjects rode each saddle twice for 5 min. A 6-item visual analog comfort questionnaire (0-100 with 100 being extreme comfort) was completed after each bout. For evaluation 2, subjects rode each saddle for 1 wk on their road bike while maintaining normal riding hours with comfort assessed at the end of each week. Upon study completion, subjects chose a preferred saddle, which was collected independent of comfort ratings. RESULTS: For evaluations 1 and 3, comfort ratings were not different between saddles or across evaluation sessions. With prolonged testing, significant (p<0.05) differences were observed for overall comfort for convex vs. concave (72.5 ± 18.0 and 61.2 ± 17.9) and flat vs. concave (70.7 ± 19.1 and 61.2 ± 17.9). Evaluation 2 comfort ratings matched preferred saddle choice, but did not improve subjects’ ability to differentiate saddles during evaluation 3. No relationships were observed between saddle comfort and any anatomy or cycling position variables. CONCLUSION: Trained cyclists in an acute, blinded setting cannot differentiate saddle shapes even when accustomed to the saddle. With longer exposure, cyclists that have examined associations of intracortical facilitation and inhibition of the soleus with popliteal venous flow. Determining these associations may help to establish neurophysiological mechanisms that cause altered venous return. Soleus dysfunction has been attributed to altered intracortical excitability within the central nervous system. However, there is little evidence to examine associations of intracortical facilitation and inhibition of the soleus with venous flow in the popliteal vein. Determining these associations may help to establish neurophysiological mechanisms that cause altered venous return. PURPOSE: Determine if intracortical facilitation and inhibition of the soleus are associated with popliteal venous flow. METHODS: Ten participants (6 M and 4 F; 20-31 ± 0.9 yrs; 165.0 ± 7.6 cm; 61.0 ± 5.4 kg) were enrolled in this current study. Pared-up transcranial magnetic stimulation was used to assess intracortical facilitation (ICF) and short-interval intracortical inhibition (SICI) in the soleus muscle. Blood flow velocities in the popliteal vein were measured using Doppler ultrasound in a standing position and immediately after five repetitions of maximum voluntary isometric contraction (MVIC) strength of the plantar flexors. Peak velocity and time-averaged maximum velocity (TAMAX) were assessed. Pearson Product Moment Correlations were used to examine associations of ICF and SICI in the soleus muscle with measures of blood flow velocity in the popliteal vein. Significance was set at a priori p<0.05. RESULTS: TAMAX immediately after MVIC was moderately correlated with ICF (r=0.63, p=0.03) and SICI (r=0.59, p=0.04). CONCLUSION: These findings indicate the potential for associations of intracortical facilitation and inhibition of the soleus with blood flow velocities in the popliteal vein. Further study with a larger sample size is needed to examine these associations in specific pathological condition in order to determine the effects of clinical dysfunctions on venous return.
Some myokines such as irisin and myostatin have considerable effects on energy metabolism in addition to the musculoskeletal system. **PURPOSE:** Our aim was to investigate the effects of 9 weeks different training methods on circulating irisin and myostatin. **METHODS:** For this purpose, 20 Sprague Dawley rats with the weight range of (130±30gr) were divided into three groups: control (n=7), high intensity interval training (n=6), and eccentric training (n=7). They were held in the dark: light of 12:12. 48 hours after the last exercise session, protein measurement was performed using enzyme-linked immunosorbent assays (ELISA) test. **RESULTS:** Serum myostatin and irisin levels increased significantly following eccentric but they decreased following high intensity interval training. **CONCLUSIONS:** Despite these differences both myokines indicated significant relationship following 9 weeks of eccentric and high intensity interval training. Given the markedly increase in circulating myokines after eccentric training sessions these data suggest that eccentric training is probably more effective to stimulate skeletal muscle metabolic regulation.
G-19 Thematic Poster - Aging/Lifecycle

Saturday, June 2, 2018, 9:00 AM - 11:00 AM
Room: CC-Mezzanine M100C

3059 Chair: Steven K. Malin, FACSM. University of Virginia, Charlottesville, VA.
(No relevant relationships reported)

3060 Board #1
June 2 9:00 AM - 11:00 AM
Changes In Vitamin D Status Before And After Nordic Summer In Overweight Middle-aged Participants
(No relevant relationships reported)

Background: Sun exposure is the main source to synthesize vitamin D. Obesity, type II diabetes mellitus, and living at high altitude are risk factors for low vitamin D status. Seasonal variations in affected populations are unknown. Purpose: We investigated the effect of sun exposure during a summer season on vitamin D status in Sweden, and its association with fat mass and deranged carbohydrate metabolism. Methods: One hundred sixty-nine subjects (91 women and 70 men), with an age of 60-5 years with body mass index ≥ 25 kg/m², with or without deranged carbohydrate metabolism were studied. The participants were divided into groups based on an oral glucose tolerance test. Glucose tolerance was classified as normal (NGT) ≤ 8.9 mmol/L, impaired glucose tolerance ≥ 8.9-12.1 mmol/L or T2DM ≥ 12.2 mmol/L. Blood samples, body composition, and food questionnaires were taken before and after a summer season with a second year follow-up.

Results: Eighty-five percent of participants showed low to deficient levels of vitamin D before summer (55.1 ± 21.5 mmol/L). After the summer level the increased significantly to 66.4 mmol/L (P < 0.01) but remained below the recommended value (≥ 75 mmol/L) in 65% of the subjects. Similar low vitamin D levels were found in a follow-up study. Before summer, we did not find any interactions between vitamin D, carbohydrate metabolism, or gender. There were no significant differences in the mean value of vitamin D before and after the second summer compared with the first. Before summer, Vitamin D in women with NGT correlated with fat mass (% and kg) (r = -0.34, P = 0.01). There was no correlation between vitamin D levels and the intake of fatty fish.

Conclusion: In most of this overweight/obese population, sun exposure at high latitudes had a beneficial but often insufficient effect on circulating vitamin D levels compared with those currently recommended.

3061 Board #2
June 2 9:00 AM - 11:00 AM
Continuous Glucose Monitoring in Older Adults: Impact of Aerobic Exercise and Metformin on Glucose Variability
Osar D. Safaiard, Hayden M. Schoenberg¹, Laime L. Laurin,² Benjamin F. Miller, FACSM³, Karyn L. Hamilton, FACSM³, Adam R. Konopka¹. ¹University of Illinois at Urbana-Champaign, Urbana, IL. ²Colorado State University, Fort Collins, CO. (Sponsor: Karyn L. Hamilton, FACSM)
(No relevant relationships reported)

A greater magnitude and frequency of glucose fluctuations within or between days is significantly to 66.4 nmol∙L⁻¹. After the summer level the increased significantly to 66.4 mmol/L (P < 0.01) but remained below the recommended value (≥ 75 mmol/L) in 65% of the subjects. Similar low vitamin D levels were found in a follow-up study. Before summer, we did not find any interactions between vitamin D, carbohydrate metabolism, or gender. There were no significant differences in the mean value of vitamin D before and after the second summer compared with the first. Before summer, Vitamin D in women with NGT correlated with fat mass (% and kg) (r = -0.34, P = 0.01). There was no correlation between vitamin D levels and the intake of fatty fish.

Conclusion: In most of this overweight/obese population, sun exposure at high latitudes had a beneficial but often insufficient effect on circulating vitamin D levels compared with those currently recommended.

3062 Board #3
June 2 9:00 AM - 11:00 AM
Effect of Moderate Intensity Exercise Dose on Lipoprotein Concentrations and Particle Size in Older Women
Ryan R. Porter, J. Larry Durstine, FACSM, Charity B. Breneman, Xuewen Wang. University of South Carolina, Columbia, SC. (Sponsor: J. Larry Durstine, FACSM)
(No relevant relationships reported)

Lipoprotein concentrations are well established biological markers associated with cardiovascular disease (CVD) risk. Recent research has placed great importance on the function of different lipoprotein subfractions (medium and small VLDL, small and large LDL, small, medium and large HDL). Current literature supports exercise as being protective by affecting lipoprotein particle size and concentration, whereas little research has been conducted to determine the effects of exercise dose on these outcomes.

Purpose: To determine if exercise dose has an effect on VLDL, LDL, and HDL particle size and concentrations in older sedentary women after 16 weeks of moderate-intensity aerobic exercise.

Methods: Sixty-five women (age = 64.7 ± 4.2 years) were randomized into higher-dose (n = 30) and lower-dose (n = 35) exercise groups. Supervised treadmill walking sessions lasted approximately 35 or 55 minutes, 3 times per week, for lower-dose and higher-dose groups, respectively. All exercise was completed at an intensity of 50-55% of heart rate reserve. Fasting plasma samples were collected before and after exercise intervention. Plasma lipoprotein particle concentrations and average sizes were determined by nuclear magnetic resonance spectroscopy.

Results: Exercise, in the entire sample, lowered total HDL and small VLDL particle concentration (1.5 ± 3.6 µmol/L and 4.2 ± 6.4 µmol/L, p < 0.05, respectively), and increased mean HDL particle size (0.1 ± 0.3 mm; p < 0.01). When analyzed by exercise groups, the lower-dose group displayed a decrease in total HDL particle concentration (1.9 ± 3.1 µmol/L; p < 0.001), while the higher-dose group increased an increase in mean LDL particle size (0.3 ± 0.5 mm; p < 0.05). Both exercise higher-dose and lower-dose treatments were found to significantly increase HDL particle size (0.1 ± 0.2 mm and 0.1 ± 0.3 mm, respectively; p < 0.05) with no significant difference between groups.

Conclusions: The results from this study support that exercise in sedentary older women decreased CVD risk. Though the HDL particle concentration decreased in the lower-dose group, maintenance of HDL particle concentration in the higher-dose group along with the increase in mean HDL and LDL size are characteristics associated with lower CVD risk. Supported by NIH Grant R00AG031297

3063 Board #4
June 2 9:00 AM - 11:00 AM
Resistance Exercise and Low Dose Protein Ingestion Augments Anabolic Signaling Mechanisms In Older Women
Susannah E. Scaroni¹, Sarah K. Skinner, 61801; Joseph W. Beals¹, Stephan van Vleit², Elizabeth Poozhikunnel¹, Ralf Jager³, Martin Purpura³, Jonathan Oliver³, Scott Paluska, FACSM, Nicholas A. Burd, 1. University of Illinois at Urbana-Champaign, Urbana, IL. ²Increnovo LLC, Milwaukee, Wt. ³Texas Christian University, Fort Worth, TX. (Sponsor: Scott Paluska, FACSM)
(No relevant relationships reported)

Resistance exercise enhances skeletal muscle anabolic signaling responses to the ingestion of sub-optimal amounts of protein in young men. However, the effectiveness of resistance exercise to potentiate the phosphorylation of the mechanistic target of rapamycin (mTORC1) to the ingestion of minimal amount of protein in aging women has not been well characterized. Purpose: We compared the phosphorylated-state ofmTORC1 before and after ingestion of ~14 g whey protein or water at rest and after resistance exercise in middle-aged and older women. METHODS: 10 women (59±2 yr; BMI: 25.5±1 kg/m²; LM: 46.2±2 kg) performed a bout of unilateral leg extension exercise (3 sets × 12 repetitions at 60% estimated 1RM) prior to ingesting whey protein (0.3g/kg LBW; WHEY, n = 5) or water (WATER, n = 5). Blood and skeletal muscle biopsies were used to measure plasma amino acids and insulin concentrations and phosphorylation ofmTORC1 at Ser2448 at 2 and 4 h of the postprandial phase in both exercise (EX) and non-exercised (CON) legs. RESULTS: Plasma branched chain amino acid concentrations were increased from basal (2-5-fold) in WHEY (p < 0.05), but not in WATER condition (P > 0.05). Plasma insulin concentrations increased after WHEY (2.3±0.8 fold change from basal, P < 0.02), but not after WATER ingestion (1.0 fold change from basal) the metformin group, 24-hr mean glucose was decreased (P < 0.05) 1 day after AET and gradually increased the next 7 days (P = 0.06 Days 5-7 vs. Day 1) back to baseline.

Conclusion: In older adults, cumulative mean glucose and GV were decreased toward young values during AET. While improvements in cumulative GV dissipated after AET, the addition of metformin to exercise may delay the return of 24-hr glucose to baseline values. These data highlight the need for regular exercise to sustain improvements in GV in older adults.
Muscle Protein Synthetic Responses After Low-dose Protein Ingestion and Resistance Exercise in Older Women

Sarah K. Skinner, Joseph W. Beals, Stephan van Vliet, Justin T. Parrel, Elizabeth Poozhikunnel, Alexander V. Ulanov, Lucas Li, Ralf Jager, Martin Purpura, Scott A. Paluska, FACSM, Jonathan Oliver, Nicholas A. Burrell. University of Illinois at Urbana-Champaign, Urbana, IL. Increnovo LLC, Milwaukee, WI. Texas Christian University, Fort Worth, TX. (Sponsor: Scott Paluska, FACSM)

(No relevant relationships reported)

Resistance exercise enhances the anabolic sensitivity of myofibrillar protein synthesis rates (MPS) to the ingestion of a moderate amount of protein in young and older men. However, the effectiveness of resistance exercise to potentiate postprandial MPS after the ingestion of minimal dose of protein in aging women has not been well characterized. PURPOSE: We compared changes in MPS to ingestion of ~14 g whey protein or water at rest and after resistance exercise in middle-aged and older women. METHODS: 10 women (59±2 y; BMI: 25±1 kg/m²; LBM: 46±2 kg) performed a bout of unilateral leg extension exercise (3 sets × 12 repetitions at 60% estimated 1RM) prior to ingesting whey protein (0.3 g/kg LB; WHEY; n=5) or water (WATER n=5). Primed continuous infusions of L-[ring-¹³C]phenylalanine, blood, and skeletal muscle biopsies were used to measure MPS over 4 h postprandial phase in both exercise (EX) and non-exercised (CON) legs. RESULTS: Plasma essential amino acid concentrations were increased to basal (2.5-fold) in WHEY group (P<0.05), but not in WATER group (P>0.05). EX significantly increased MPS above basal in both WHEY (5-fold) and WATER (2.3-fold) groups over the 4-hour postprandial period (P<0.05). MPS were not significantly increased above basal rates in the CON leg throughout the postprandial period in either condition (P>0.10). No group differences in MPS were observed between the WHEY or WATER groups in either the EX or CON legs (P>0.05). CONCLUSION: A moderate volume of resistance exercise significantly increased MPS in aging women. However, the ingestion of a low dose of whey protein immediately after resistance exercise did not potentiate the MPS response when compared to ingesting water. Therefore, more targeted anabolic strategies are warranted to maximize the MPS response to feeding and exercise in older women.

Muscle Protein Synthetic Responses After Low-dose Protein Ingestion and Resistance Exercise in Older Women
Sarah K. Skinner, Joseph W. Beals, Stephan van Vliet, Justin T. Parrel, Elizabeth Poozhikunnel, Alexander V. Ulanov, Lucas Li, Ralf Jager, Martin Purpura, Scott A. Paluska, FACSM, Jonathan Oliver, Nicholas A. Burrell. University of Illinois at Urbana-Champaign, Urbana, IL. Increnovo LLC, Milwaukee, WI. Texas Christian University, Fort Worth, TX. (Sponsor: Scott Paluska, FACSM)

(No relevant relationships reported)
Ischemic preconditioning (IPC) of the legs prior to exercise has been shown as a novel approach to improve performance in a number of different exercise modes in normoxia. Very little has been done to examine the influence of these mechanisms during exercise in hypoxia. PURPOSE: To determine if IPC is an effective intervention for improving 5km cycle time trial (TT) performance in both normoxia and hypoxia. METHODS: Thirteen men (age= 24 ± 4 years, VO2 max= 63.1 ± 5.1 ml·kg⁻¹·min⁻¹) completed four randomized trials of each combination of hypoxia (F2O, = 0.16) or normoxia with a resting pre-exercise IPC protocol (4 x 5min at 220mmHg) or SHAM (4 x 5min at 20mmHg) procedure. Procedure was determined by IPC/SHAM subjected to randomized load bouts with a 5km time trial on a cycling ergometer. Break-by-break VO2, oxyhemoglobin saturation, and skeletal muscle oxygenation/extraction (measured via near-infrared spectroscopy) were continuously monitored throughout the trials. RESULTS: IPC significantly improved 5km TT time in normoxia by 0.9 ± 1.7% compared to SHAM (IPC: 491.2 ± 33.7 vs. SHAM: 495.9 ± 34.5, P < 0.05). IPC did not alter 5km TT performance in hypoxia. Muscle oxygenation, extraction, and tissue saturation did not differ between treatments or inspirates (P > 0.05). CONCLUSION: IPC improves 5km cycling TT performance in normoxia only. Muscle oxygenation was unchanged suggesting that highly trained subjects choose power output based on a set level of muscular oxygenation regardless of the fraction of inspired oxygen or treatment with IPC.
10; 4 men) group. Participants maintained their normal routine. Pre- and post-testing included a VO_{2\text{max}} on a cycle ergometer with continuous metabolic gas analysis allowing submaximal power outputs (PO) measures of economy. All participants completed POs of 100, 125, and 150W as they exercised to VO_{2\text{max}}. Ventilatory threshold 2 (VT2) was determined graphically using metabolic equivalents. Participants cycled on an ergometer 2x/week for 30 min/session for six weeks. Sessions included a 5-min warm-up and cool-down with 20 min of HIIT (30s at 100% peak power output (PPO) to 70% recovery of economy). 90% active recovery at 25W, 10 bouts. Repeated measures ANOVA and one-way ANOVA determined statistical significance for training changes and percent change, respectively (p < 0.05). RESULTS: All groups significantly improved PPO by 8.3-13.0% (M: F_{1,10} = 17.28, A: F_{1,10} = 7.45, C: F_{1,10} = 11.96, p < 0.05). The M group improved PO at VT2 by 13.8% (p = 0.009). There was a nonsignificant improvement (8.3%) in PO at VT2 for the A group (p = 0.054). However, no significant differences occurred between groups for PPO and PO at VT2 (p = 0.481 and 0.250, respectively). The M group was significantly less economical (higher VO_{2}) at 125W before and after training compared with the C group (p = 0.003). However, percent change in submaximal VO_{2} at 100, 125, and 150W were not different between groups (p = 0.907, 0.743, and 0.985, respectively). Percent improvements in VO_{2\text{max}} were not different between groups (C: 3.6%; M = 2.6%; A = 6.5%; p = 0.623). CONCLUSION: Since all groups demonstrated similar HIIT adaptations, using the mask or training in hypobaric hypoxia may not be needed for training adaptations. The protocol followed a low, train high altitude model which typically lacks training improvements compared with a live high, train low altitude model.

3073 Board #6
June 2 9:00 AM - 11:00 AM
Muscle Oxygenation During Repeated Double-poling Sprint Exercise Under Hypoxic Condition
Keichii Yamaguchi, Nobukazu Kasai, Daichi Sumi, Haruka Yatsutani, Kazuhige Goto. Ritsumeikan University, Kusatsu, Japan. (Sponsor: Robert R Kraemer, FACSM) (No relevant relationships reported)

PURPOSE: To compare acute physiological responses to repeated double-poling sprint exercise between normoxic condition and hypoxic condition.

METHODS: Eight male athletes (19.8 ± 1.0 yrs, 174.9 ± 6.5 cm, 71.1 ± 5.8 kg) completed repeated exercise (double-poling exercise) under either hypoxic (HYP, FiO_{2} = 14.5%) or normoxic condition (NOR, FiO_{2} = 20.9%). The exercise consisted of 9 × 20 s maximal sprint exercise (40 s or 5 min rest periods between sprints). Power output, muscle oxygenation of triceps brachii muscles (evaluated by near infrared spectroscopy; NIRS), arterial oxygen saturation (SpO_{2}) and respiratory variables were continuously monitored throughout exercise. Changes in blood lactate and glucose concentrations were also determined.

RESULTS: SpO_{2}, during exercise remained significantly lower in HYP (p < 0.05). Mean power output during exercise did not differ significantly between HYP and NOR. No significant difference between the trials was observed for blood lactate and glucose concentrations. Both trials showed significant increases in deoxygenated hemoglobin (deoxy-Hb) (241.7 ± 46.9 % in HYP vs. 175.8 ± 27.2 % in NOR) and total hemoglobin (total-Hb) (138.0 ± 18.1 % in HYP vs. 112.1 ± 6.7 % in NOR) for triceps brachii muscle, but the exercise-induced elevations of these variables were significantly greater in HYP (p < 0.05). During exercise, systemic oxygen uptake was significantly lower in HYP (2126 ± 108 ml/kg/min) than in NOR (2351 ± 74 ml/kg/min) (P < 0.05).

CONCLUSIONS: Exercise-induced elevation of total-Hb was profound during repeated double-poling sprint exercise in hypoxia, suggesting augmented blood volume (blood perfusion) in working muscles. In addition, power output during exercise was not affected by hypoxia, although systemic oxygen uptake was significantly lower.

3074 Board #7
June 2 9:00 AM - 11:00 AM
High-Intensity Interval Training In Hypoxic Condition Accelerate The Anerobic Glycolytic System
Marie Oriishi,1 Hayato Ohnuma,2 Masahiro Hagiwara,3 Ryo Yamanaka,1 Toshiyuki Ohya,1 Kazunori Asabuki,2 Kawahara,2 Yashiro Suzuki,2 Tsukuba University, Ibaraki, Japan. 1Japan Institute of Sports Sciences, Tokyo, Japan. 2Japan Olympic Committee, Tokyo, Japan. 3Teikyoheisei University, Chiba, Japan. (No relevant relationships reported)

We previously demonstrated that 7 days of intermittent hypoxic training improved performance in the maximal anaerobic running test (MART) (ACSM 2015). It is expected that the high-intensity interval training (HIIT) in hypoxic condition is one of the key of performance enhancement method. However, the differences of physiological response during HIIT between in hypoxia and in normoxia in well-trained 400m or 800m runners.METHODS: Thirty-five well-trained university female 400m or 800m runners were assigned to either hypoxic group (n=18) or normoxic group (n=17). The hypoxic group completed 5 sets of 30 seconds maximal effort pedaling in a normoxic condition (PO) room (FT02=14.4%; 3000m). The rest periods between each sets were 4 minutes. The normoxic group completed the same exercise in ambient normobaric normoxia (60m). Mean power and peak power of each sets were recorded. Blood lactate concentration (La) was measured 1 minute after each sets of pedaling. RESULTS: No significant differences with hypoxic and normoxic group were found in mean power of each sets (hypoxic group: 464.7 ± 56.2, 396.4 ± 39.0, 324.7 ± 31.6, 286.2 ± 28.2, 245.7 ± 24.5, 29.5, normoxic group: 455.5 ± 61.5, 396.9 ± 43.0, 339.0 ± 31.6, 293.2 ± 29.8, 249.1 ± 25.6 W). No significant differences between hypoxic and normoxic group were found in peak power of each sets (hypoxic group: 577.0 ± 77.2, 509.7 ± 55.1, 407.0 ± 46.6, 345.8 ± 41.9, 287.6 ± 30.6, normoxic group: 553.3 ± 85.4, 493.2 ± 61.6, 412.1 ± 45.3, 344.9 ± 41.0, 287.5 ± 34.0 W). La values from hypoxic group were significantly higher than normoxic group after every sets of pedaling (p < 0.01, 1st set: 16.5 ± 2.5 vs. 13.3 ± 2.1, 2nd set: 19.9 ± 2.5 vs. 16.7 ± 2.0, 3rd set: 21.7 ± 2.5 vs. 17.5 ± 1.9, 4th set: 21.1 ± 2.4 vs. 17.6 ± 1.9, 5th set: 21.3 ± 2.2 vs. 17.9 ± 1.7 mmol/l). CONCLUSIONS: The production during high-intensity interval training is not affected by hypoxic condition. However, energy production through anaerobic glycolytic system seems to accelerate in hypoxic condition.

G-21 Thematic Poster - Bone Quality in Athletes and Special Populations

3075 Chair: George A. Kelley, FACSM. West Virginia University, Morgantown, WV. (No relevant relationships reported)

INTRODUCTION: Bone mineral density (BMD) is an important aspect of bone health in endurance runners. Musculoskeletal overuse injuries to the bone, such as stress reactions and stress fractures, are of major concern to endurance runners and coaches because of the debilitating nature they have on training and performance. A greater understanding of BMD in these athletes can lead to a reduction in stress injuries to bone. PURPOSE: To determine changes in total and segmental BMD over the course of an indoor track season between sexes and between middle and long distance event groups. METHODS: Volunteers from a collegiate track team (N=21; men=13/women=8; Age: 20.3 ± 1.1 yrs.) were recruited. Dual x-ray absorptiometry (DEXA) was used to measure BMD before and after the 8-week indoor track and field season. Runners were classified as long or middle distance based on their current and past training history. Total and segmental BMD data were collected from DEXA output. A 2x2 factorial design using an ANCOVA procedure, adjusting for the pre-season BMD, was used to identify differences by sex and distance. RESULTS: Significant differences (p<0.001) were observed in leg BMD by sex (Men= 1.54± 0.12 g/cm²; Women= 1.34± 0.04 g/cm²) with an adjusted mean difference of 0.176 g/cm². The men had an increase in their leg BMD, while women did not change over the length of the season. No other significant differences were found in total body BMD or any segmental BMD measures when comparing event classification or sex. CONCLUSION: The findings provide support for BMD awareness with runners to facilitate mechanisms for reduced injuries. For the current study, the stress placed on the bones of the runners over the span of an indoor track and field season was enough to maintain and even elicit favorable changes in leg segmental BMD. Training volume and intensity were not factors in BMD changes across a track season. Additional investigation on differences among sex is warranted for healthy endurance athletes.

3076 Board #1
June 2 9:00 AM - 11:00 AM
Changes in Bone Mineral Density of Middle and Long Distance Runners Across an Indoor Season
Ronald Otterstetter, FACSM1, Jordan T. Olson1, Marissa N. Baranaukska2, Brian Miller1, Michelle M. Boltz1, Laura Richardson2, Matthew Juravich.1 The University of Akron, Akron, OH. 2Indiana University, Bloomington, IN. (No relevant relationships reported)

Bone Mineral Density in Master Olympic Weightlifters

3077 Board #2
June 2 9:00 AM - 11:00 AM
Bone Mineral Density in Master Olympic Weightlifters
Kayleigh Erickson1, Mara Mercado1, Kailey Goins2, Monica R. Lininger2, Bryan Rieman3, Armstrong State University, Savannah, GA. 2Northern Arizona University, Flagstaff, AZ. (No relevant relationships reported)

Research has demonstrated the effects of resistance training on bone mineral density (BMD). Olympic style weightlifting, unlike traditional resistance training, uses...
the entire body to conduct higher load lifts at higher velocities and lower training volumes. Little research has been done in looking at the Olympic style weightlifting and the impact it can impose on the body. Whether this mode of training results in similar BMD adaptations is unknown, particularly in middle and older age adults.

**PURPOSE:** To determine the influence of age and sex on BMD in Masters Olympic Weightlifters when body mass index, weighting experience and strength were controlled. **METHODS:** Men (n = 27) and women (n=24) competitors from the 2017 National Masters Championship (age: 35 to 76 years) volunteered for BMD (g/cm²) measurement using a dual energy X-ray absorptiometry (DXA) for the following sites: spine (L1-4), femoral neck, radius and total body. For each site, separate regression models were developed using age, sex, body mass index (BMI), experience level (years of competitive lifting), and strength (mean clean and jerk performance to body mass ratio). **RESULTS:** The set of independent variables were statistically significant predictors of BMD for the radius (P=0.01, R² = 50%), femoral neck (P=0.09, R² = 25%) and total body (P=0.01, R² = 26%). The model for BMI was not statistically significant (P=0.056, R² = 15%). BMI and strength, individually, were significant predictors of radial BMD while BMI was a significant predictor for total body BMD. Neither sex nor age were significant predictors of BMD for any of the four sites. **CONCLUSIONS:** Previous studies have noted that with aging, BMD declines, especially in women post-menopause. Our study revealed that there were no sex differences, nor was age or weight lifting experience significant predictors for BMD at the four sites considered. One interpretation of these results is that the Olympic style weightlifting may reduce age and sex related declines in BMD. Future research will compare BMD between and sex matched runners and sedentary individuals to determine the accuracy of this interpretation.

**3078 Board #3**
June 2 9:00 AM - 11:00 AM
**Effect Of Symmetric Weight Training On Imbalanced Humerus Bone Mineral Density Of Arms In Baseball Pitchers**
Maryam Rahmani¹, Chen-Wei Chung², Chia-Hua Kuo, FACSM³.
¹Islamic Azad University Science and Branch, Tehran, Iran, ²Islamic Republic of ³Shih Hsin University, Taipei, Taiwan, ³University of Taipei, Taipei, Taiwan. (Sponsor: Chia-Hua Kuo, FACSM) (No relevant relationships reported)

**Background:** Mechanical stress is known as a strong stimulus for bone growth. **Purpose:** To examine effect of bilateral balanced weight training on the disparity in bone mineral density (BMD) between dominant and non-dominant arm of baseball players. **Methods:** Baseball players (N = 25, aged 18-22 y) participated in this study after baseline measurement of BMD for the radius (P=0.01, R² = 50%), femoral neck (P=0.09, R² = 25%) and total body (P=0.01, R² = 26%). The model for BMI was not statistically significant (P=0.056, R² = 15%). BMI and strength, individually, were significant predictors of radial BMD while BMI was a significant predictor for total body BMD. Neither sex nor age were significant predictors of BMD for any of the four sites. **Conclusions:** Previous studies have noted that with aging, BMD declines, especially in women post-menopause. Our study revealed that there were no sex differences, nor was age or weight lifting experience significant predictors for BMD at the four sites considered. One interpretation of these results is that the Olympic style weightlifting may reduce age and sex related declines in BMD. Future research will compare BMD between and sex matched runners and sedentary individuals to determine the accuracy of this interpretation.

**3079 Board #4**
June 2 9:00 AM - 11:00 AM
**A 9-month Jumping Intervention to Improve Bone Acquisition in Adolescent Male Athletes: The PRO-BONE Study**
Dimitris Vlachopoulos, Alan R. Barker, Esther Ubogo-Guisado, Craig A. Williams, FACSM, Luis Gracia-Marco. University of Exeter, Exeter, United Kingdom. (No relevant relationships reported)

Participation in different loading sports during growth can have different effects on bone status and development. However, there is no evidence how to improve bone acquisition in adolescent male athletes involved in weight-bearing and non-weight bearing sports. **Purpose:** To investigate for first time the effect of a 9-month jumping intervention programme on bone mass, geometry and microarchitecture in adolescent males participating in weight-bearing (soccer, SOC) and non-weight bearing (swimming, SWI & cycling, CYC) sports. **Methods:** 93 adolescent males (13-15 years) were included. Sport groups were randomly selected and sport (INT-SWI=19, INT-SOC=15, INT-CYC=14) or sport only (CON-SWI=18, CON-SOC=15, CON-CYC=12). The intervention comprised a progressive jumping programme of 3 levels (3 months each) using weighted vests (Level 1= 20 jumps, 0 kg, 3 sets/day, 3 times/week; Level 2= 20 jumps, 2 kg, 4 sets/day, 3 times/week; Level 3= 20 jumps, 5 kg, 4 sets/day, 4 times/week). Dual-energy x-ray absorptiometry (DXA) assessed bone mineral content (BMC) and dual energy X-ray absorptiometry (DXA) with structural analysis (HSA) assessed cross-sectional area (CSA), cross-sectional moment of inertia (CSMI) and section modulus, trabecular bone score (TBS) assessed bone microarchitecture and quantitative ultrasound assessed bone stiffness before and after the intervention. One-way analysis of variance compared the bone gains after controlling for pre-intervention bone, change in lean mass and post maturity status. **Results:** was set at p=0.05. **Results:** INT-CYC gained significantly (p<0.05) higher total body less head BMC (5.0 %), lumbar spine BMC (4.6 %), femoral neck BMC (9.8 %) and bone stiffness (12.3 %) than CON-CYC. INT-SWI gained significantly (p<0.05) higher femoral neck BMC (6.0 %), legs BMC (4.2 %) and bone stiffness (12.7 %) than CON-SWI. INT-SWI gained significantly (p<0.05) higher total body BMC (5.0 %) than CON-SWI. There were no significant (p>0.05) differences between INT-SOC and CON-SOC for any bone outcomes (0.9-3.9 %). **Conclusions:** The present 9-month jumping intervention improved bone outcomes in non-weight bearing sports, such as swimming and cycling, but not in a weight-bearing sport, such as soccer.

**3080 Board #5**
June 2 9:00 AM - 11:00 AM
**Calcium, PTH, And CTX Responses to Treadmill Walking During Different Thermal Environments in Older Adults**
Sarah J. Wherry, Christine M. Swanson, Pamela Wolfe, Rebecca S. Boxer, Rpbhert S. Schwartz, Wendy M. Kohrt, FACSM. University of Colorado Anschutz Medical Campus, Aurora, CO. (Sponsor: Wendy Kohrt, FACSM) (No relevant relationships reported)

Serum ionized calcium (iCa) decreases and parathyroid hormone (PTH) and c-terminal telopeptides of type I collagen (CTX; marker of bone resorption) increase during endurance exercise in younger and older adults. Evidence from equine models suggests this may be due to dermal calcium loss. **Purpose:** To determine if exercise in a warm environment exaggerates the decrease in iCa and increases in PTH and CTX compared to a cool environment. **Methods:** Women (n=5) and men (n=7) aged 61-78 years performed two identical 1-hour treadmill walking bouts under warm (~28°C) and cool (~21°C) conditions at ~75% of maximal heart rate. iCa, PTH, and CTX were measured every 15 minutes starting 15 minutes before and continuing for 60 minutes after exercise. Sweat calcium loss was estimated from sweat volume and sweat calcium concentration. Changes in iCa, PTH, and CTX were adjusted for plasma volume shifts. Between and within group differences were evaluated using maximum likelihood estimation in a repeated measures analysis. **Results:** There was no difference in sweat calcium loss between thermal conditions. iCa decreased similarly during exercise in both conditions (W: 0.16, 95% CI: -0.28, -0.08 mg/dL; C: 0.16, 95% CI: -0.24, -0.04 mg/dL). After adjusting for plasma volume shifts, change in iCa_w= was significantly less than iCa_c. For the warm condition, PTH decreased similarly during exercise in both conditions (W: 0.24, 95% CI: -0.41, 0.04 mg/dL), but there was no difference between conditions. PTH increased similarly during exercise in both conditions (W: 0.16, 95% CI: 6.2, 26.5 pg/mL; C: 17.3, 95% CI: 8.1, 26.4 pg/mL). Adjusting for plasma volume shifts did not change the results. CTX increased similarly in both conditions (W: 0.08, 95% CI: 0.05, 0.11 ng/mL; C: 0.08, 95% CI: 0.01, 0.16 ng/mL), and adjusting for plasma volume shifts did not change the results. There were no differences between conditions for any outcome, even after adjusting for plasma volume shifts. **Conclusion:** Differing thermal conditions do not appear to be a major factor in the decrease in iCa and the increases in PTH and CTX observed during exercise in older adults. This may be due to the low sweat calcium loss during both conditions or small temperature difference. Future studies should determine if there are sex- or age-related differences that modify the relationship between sweat calcium loss and the activation of bone resorption during exercise.

**3081 Board #6**
June 2 9:00 AM - 11:00 AM
**Bone Density Measurements in an Elite Population of Older Weightlifters**
Kevin R.m. Coyle¹, Bryan L. Riemann², Robert LeFevi³, Kaley Goins¹, Kayleigh Erickson¹, Mara Mercado¹, Jody Stone¹, Jeremy Ford², David R. Hooper³. Jacksonville University, Jacksonville, FL. (Armstrong State University, Savannah, GA.) (No relevant relationships reported)

In the aging population, low bone mineral density (BMD) is a prevalent health concern, ranging from the milder condition of osteopenia, to the more severe osteoporosis. Resistance training, particularly with heavy resistance that loads the axial skeleton is often prescribed as an intervention to increase BMD. Training for the sport of Olympic Weightlifting requires consistently exposing the axial skeleton to high loads and thus should lead to increased BMD. **Purpose:** The purpose of this study was to measure total body and lumbar spine BMD in Olympic Weightlifters competing in the Masters National Championships. **Methods:** 26 men (age: 49.8 ± 11.6 years; height: 172.9 ± 7.3 cm; weight: 85.0 ± 13.1 kg) and 21 women (age: 47.1 ± 9.3 years;
MicroRNAs (miRNAs, miRs) are short, non-coding RNA molecules that regulate gene expression at posttranscriptional level. Recent research has indicated that some miRNAs, such as miR-21 and miR-23a, target genes on osteogenesis (Lian et al. 2012) and/or muscle atrophy (Wada et al. 2011). In the process of aging, there are progressive declines in bone mineral density (BMD) and muscle function, which potentially may be regulated by these miRNAs. **PURPOSE:** To examine the relationships between specific circulating miRNAs and bone density and muscle function in older postmenopausal women. **METHODS:** Seventy-five postmenopausal women aged 60 to 85 years old participated in this study. Body composition and areal BMD (aBMD) were measured by DXA. Volumetric BMD (vBMD) and bone strength were measured by pQCT. Grip strength was assessed by the digital grip strength dynamometer, whereas gait speed was assessed using the 4-meter path. Muscle power was assessed through countermovement jumps on the jump mat. Serum levels of miRNAs (miR-21, -23a, -23b, -100, -125b) were analyzed using real-time PCR.

**RESULTS:** MiR-21 was significantly correlated with left trochanter BMC (r = -0.252, p = 0.048), right trochanter BMC (r = -0.294, p = 0.020), and cortical vBMD at tibia 38% site (r = -0.253, p = 0.047). There also was a trend for a significant correlation between miR-21 and lumbar spine aBMD (r = -0.249, p = 0.051). MiR-125b was significantly positively correlated with jump velocity (r = 0.263, p = 0.05) and relative jump power (r = 0.294, p = 0.028). **CONCLUSION:** Our results suggest that a higher expression level of circulating MiR-21 is associated with decreased BMD in relatively healthy postmenopausal women, whereas a higher expression level of circulating miR-125b is associated with a greater jump power. Future investigations are needed to further explore circulating miRNAs in osteoporotic or fragile older adults.

**BMD values (lumbar, thoracic, pelvic, leg and whole body BMD) were compared with age, sex, and baseline measures for VO\textsubscript{2peak}, isometric strength, and T2DM duration. Changes over 9-months were analyzed for group effects after adjusting for baseline. Changes in BMD were compared with age, sex, and changes in VO\textsubscript{2peak} and muscle strength. **RESULTS:** Baseline associations showed that age was inversely related to pelvic BMD (p<0.006, r=-0.20) and females had significantly lower thoracic, lumbar, and whole body BMD (p<0.001). VO\textsubscript{2peak} was correlated to leg (p<0.001, r=0.31) and whole body (p=0.02, r=0.17) BMD, and isometric leg strength was correlated to thoracic (p<0.001, r=0.26), pelvic (p<0.001, r=0.28), leg (p<0.001, r=0.46), and whole body (p=0.01, r=0.34) BMD. All groups increased whole body BMD with exercise training (P<0.05); however, no group effects were found for BMD changes after 9-months (p>0.10). Changes in pelvic BMD were found to be higher in females (p<0.04) than males and changes in VO\textsubscript{2peak} were inversely correlated with changes in thoracic BMD (p<0.04, r=-15). No significant effects were observed. **CONCLUSION:** Sex, aerobic fitness, and muscle strength had similar relationships with BMD in individuals with T2DM as typically found in the normal adult population. However, group changes after 9-months of exercise training, while increased, were not different from the changes in CON. Funding provided by the National Institutes of Health, R01-DK086298.

**Exercise and Sport Psychology - Applications of Technology**

**G-22**

**Thematic Poster - Exercise and Sport Psychology - Applications of Technology**

**Saturday, June 2, 2018, 9:00 AM - 11:00 AM**

**Room:** CC-Lower level L100F

**3084**

**Chair:** Chris Pitsikoulis. *Aurora University, Aurora, IL.*

(No relevant relationships reported)

**3085**

**Board #1**

**June 2 9:00 AM - 11:00 AM**

**The Effect of Treadmill Walking, Smartphone Use and School Work on Positive and Negative Affective States in College Students**

Jacob E. Barkley, Andrew Lepp, Ashlyn Grose. *Kent State University, Kent, OH.* (Sponsor: Ellen Glickman, FACSM)

(No relevant relationships reported)

Excessive internet-connected, cellular telephone (smartphone) use is associated with greater anxiety and lower quality of life in college students. However, the acute effect of a bout of smartphone use on positive and negative affect and how this may differ from other, common activities (i.e., low-intensity exercise, school work) in college students, has not been studied.

**PURPOSE:** To compare the effects of separate bouts of smartphone use, treadmill walking, and school work on positive and negative affect in college students.

**METHODS:** Forty one college students (n = 25 female, 21.7 ± 2.0 years old) completed four, 30-minute conditions (control, treadmill walking, smartphone, school work), on separate days, in a controlled, laboratory environment: 1) Control, participants were seated on a chair in a quiet room. 2) Walking, participants walked at 3.1 mph on a treadmill. 3) Smartphone, participants utilized their smartphones to interact with their personal social-media accounts (e.g., Facebook, Twitter). 4) School work, participants completed self-selected school work (e.g., studying). Participants completed the positive and negative affect scale pre- and post-condition.

**RESULTS:** Analyses of variance revealed a significant (F = 22.3, p < 0.001) by time interaction for positive affect which significantly increased (r = 4.2, p = 0.001) from pre- to post-condition during walking (21.8 ± 8.4 pre, 27.4 ± 9.9 post), did not change (r = 1.2, p = 0.24) during school work (21.8 ± 7.7 pre, 23.0 ± 8.2 post) and significantly (r ≥ 3.7, p ≤ 0.001) decreased during both the smartphone (21.5 ± 8.1 pre, 17.2 ± 6.7 post) and control (19.8 ± 7.8 pre, 14.9 ± 5.8 post) conditions. There was also a significant (F = 15.6, p = 0.05) condition by time interaction for negative affect which significantly decreased (r = 2.3, p = 0.03) from pre- to post-condition during school work (13.4 ± 4.4 pre, 12.4 ± 4.1 post) and did not significantly change (r ≤ 1.6, p ≥ 0.11) for the remaining conditions (control: 12.5 ± 3.5 pre, 13.7 ± 4.1 post; walking: 12.3 ± 3.7 pre, 11.8 ± 2.7 post; smartphone: 12.5 ± 3.3 pre, 12.6 ± 2.6 post).

**CONCLUSION:** Walking on a treadmill increased positive affect and school work decreased negative affect in college students. Conversely, a bout of smartphone use significantly decreased positive affect and did not reduce negative affect.
Low-income children are at disproportionate risk of low physical activity (PA) and school achievement. Exercise has been shown to positively affect executive function (EF) in children, and may act to prime the brain for learning. Likewise, tablet-based learning applications are an engaging educational modality that can be employed in diverse settings. However, little research exists in real world settings, particularly regarding the robustness of EF improvements after engagement with electronic learning technologies. PURPOSE: To investigate changes in children’s EF pre-/post- PA, versus pre-/post-PA incorporating a tablet-based STEM learning platform in a real-world low-income childcare setting. METHODS: Children (n=19, ages 7-10) attending a YMCA summer childcare program serving low-income families participated in a control condition (40 minutes of quiet reading), and two, 40 minute PA sessions, one immediately followed by 5-10 minutes of a tablet-based science, technology, engineering, and math (STEM) lesson (PA+tablet). PA sessions utilized aerobically-oriented games led by trained staff. Pedometers were used to measure children’s total steps during PA. EF was measured pre- and post- all three conditions. Children were randomly assigned to condition order. Relationships between condition and Stroop score changes were assessed using multi-level mixed effects linear regression, controlling for condition order, test administrator, child age and gender. RESULTS: Children averaged 954.5 steps per PA session (SD±751.8). Relative to the control condition, participation in PA was associated with a 0.72 point improvement in Stroop score; that improvement was not significant (p=0.71). However, participation in PA+tablet resulted in a 3.5 point deterioration in Stroop score relative to the control condition (p=0.08). CONCLUSION: In a real world setting serving children at risk of low-physical activity and scholastic achievement, PA may prime children for learning by improving EF, but improvements do not appear to be sustained after engagement in tablet-based STEM learning.

Couch Potato Adults’ Smartphone Use Predicts Being an Active Couch Potato Andrew Lepp1, Jacob E. Barkley1, Curtis Fennell2, Kent State University, Kent, OH. 1University of Montevallo, Montevallo, AL. (Sponsor: Ellen Gluckman, FACSM) (No relevant relationships reported)

Physical activity is typically negatively associated with sedentary behavior. However, individuals who exercise regularly but allocate large amounts of time to sedentary behavior are an exception to this relationship and known as “active couch potatoes” (ACP). The ACP is of concern as the negative health effects of sedentary behavior appear to be independent of the benefits of physical activity. Previously published research found a positive relationship between smartphone use and sedentary behavior but no relationship between smartphone use and physical activity. Therefore, being a high smartphone user may predict being an ACP (i.e., being highly sedentary yet sufficiently physically active). This idea was previously explored with a correlational study using a sample of college students. In that study, smartphone use was associated with being an ACP. However, this relationship has not been tested in adults beyond college age. Furthermore, previous research did not include the most commonly studied predictor of sedentary behavior - TV viewing. PURPOSE: To test whether adults’ smartphone use, TV viewing, sex and age predicts being an ACP.

METHODS: A sample of 423 adults (n=277 female, 40 ± 16 years old) completed surveys assessing physical activity, sedentary behavior, and technology use. Daily smartphone use and TV viewing were also assessed. Participants were coded as an ACP (or not) based off scores from the physical activity and sedentary behavior surveys. A binary logistic regression was used to test whether smartphone use, TV viewing, sex and age were predictors of being an ACP.

RESULTS: The binary logistic regression model was statistically significant, χ² = 50.96, p < 0.001 (df = 4). Sex and TV watching were not significant predictors of being an ACP (Wald ≤ 1.148, p ≥ 0.284). Age and smartphone use were significant predictors of being an ACP (Wald ≥ 6.545, p ≤ 0.011). Results revealed an inverse relationship between age and the likelihood of being an ACP, and a positive relationship between smartphone use and the likelihood of being an ACP.

CONCLUSIONS: Similar to college students, increased smartphone use predicted being an ACP in adults beyond college age. Because TV viewing was not a predictor, greater attention should be given to understanding the relationship between smartphone use and the health compromising ACP lifestyle.
more chronic diseases (vs. less, on continuous scale, 95% CI = 1.5, 11.7). Having low educational attainment (vs. high, OR = 0.04, 95% CI = 0.0, 0.9) was inversely associated with being in the ‘increased’ group. No studied factors were significantly associated with being in the ‘decreased’ group.

CONCLUSION: PA patterns are dynamic and suggest that sociodemographic, PA preferences, and health factors relate to change patterns over time. Future studies should examine the role of these factors over longer follow-up periods, and consider these factors when designing interventions.

RESULTS:

Alarming trends in obesity precipitate the examination of current weight-management strategies used by exercise professionals (EPs). Unaddressed energy balances negatively affect the efficacy of weight-management interventions. However, the scope of practice of EPs limits their ability to address energy imbalances through observation of trends in dietary intake. Common methods, such as the 24-h dietary recall, tend to underestimate energy intake (EI) especially in overweight and obese populations, and are associated with poor adherence. Furthermore, traditional dietary recall methods assess past EI without considering how future changes occur. Therefore, the development of new technologies to accurately facilitate EPs in addressing EI imbalances, and improve the effectiveness of weight-management interventions is warranted.

PURPOSE: To investigate perceptions of new technology designed to track EI via computerized forecast modeling.

METHODS: Evaluating perspectives towards technology can be difficult using traditional Likert scale surveys. Q Methodology provides an avenue to systematically study subjectivity by using factor analysis and correlation to assess agreement and variances of views. Participants (N = 11, 2 males, 9 females; 47 ± 17 yrs; BMI: 26 ± 5 kg/m²) sorted 44 statements from “most like my view” to “most unlike my view.” The Q sort consisted of statements associated with the Transtheoretical Model of behavior change, barriers, and the adoption of a new technology to track EI. RESULTS: Factor analysis revealed two factors of participants’ views: compliant dieters and dedicated exercisers. CONCLUSION: Two converging views emerged surrounding the adoption of a new technology designed to track nutritional intake. Correlations between factors provided valuable evidence of technology apprehension. Overall, the analysis identifies how facets of a diverse population will perceive a novel technology designed to track EI, and provides insight into how distinct barriers can be overcome to enhance adoption. Conducting preliminary research regarding perceptions of technology adoption can enhance the development and marketability of an EI forecasting system.

3090 Board #6 June 2 9:00 AM - 11:00 AM

Computerized Forecast Modeling to Predict Energy Intake: Perceptions of Adopting New Technology

Marissa Baranaukas, Judith A. Juvancic-Heltzel, Laura Richardson, Shiva Sastry. The University of Akron, Akron, OH. (Sponsor: Ronald Otterstetter, FACSM) (No relevant relationships reported)

A majority of Americans do not meet physical activity or nutrition guidelines for health. Convenient interventions to support healthy behaviors may be beneficial. Smartphone use has become ubiquitous, with apps that are an integral part of life for many. The health and fitness category of apps is robust and growing, but the potential for these apps to affect health behavior change is poorly understood.

PURPOSE: To evaluate top-ranked fitness, nutrition, and weight-loss smartphone apps for incorporation of evidence-based behavior change strategies. METHODS: Two investigators coded descriptions of the 150 top-ranked “free” apps in the health and fitness category of the US iOS app store for evidence of health behavior change strategies using the Behavior Change Technique (BCT) Taxonomy (v1). Prevalence of taxonomy items were calculated and Pearson correlations were estimated for the relationship between BCTs per app and customer ranking, as well as for the relationship between BCTs per app and app store ranking. Significance was set at p < 0.05. RESULTS: 71 app descriptions were identified as fitness, nutrition, and/or weight-loss focused. Of those, 45.1% incorporated goals and planning; 57.7% incorporated feedback and monitoring; 56.8% incorporated social support; 29.6% incorporated comparison of behavior; 29.6% incorporated shaping knowledge; 22.5% incorporated associations; 11.6% incorporated reward and threat; 9.9% incorporated antecedents; and 5.6% incorporated natural consequence. Overall, 17 of the 93 techniques in the BCT taxonomy were utilized across all coded apps. There was a trend towards a weak negative correlation between number of BCTs per app and app store ranking (r = -0.22, p = 0.06) and no significant correlation between number of BCTs and customer rating (r = -0.02, p = 0.87). 45.1% of the “free” apps offered a premium version, in addition, and 11.3% required paid subscription after download. CONCLUSIONS: Goal planning, monitoring, feedback, and social support were the most common strategies found in the popular fitness, weight-loss, and nutrition apps, though more must be learned about their effectiveness. Furthermore, there is potential to incorporate a greater variety of health behavior change techniques.

3091 Board #7 June 2 9:00 AM - 11:00 AM

Effects of Physical Activity Trackers and Motivational Interviewing on Mood in Chronic Low Back Pain

Maria Perez, Laura D. Ellingson, Jeni E. Lansing, Kathryn J. Southard, Jacob D. Meyer, Gregory J. Welk, FACSM. Iowa State University, Ames, IA. (Sponsor: Gregory J. Welk, FACSM) (No relevant relationships reported)

Annually, ~23% of individuals suffer from chronic low back pain (CLBP). Physical activity (PA) is a recommended treatment and increasing PA also improves mood-related symptoms, which are prevalent in those with CLBP. However, effective strategies to increase PA and their effects on mood in CLBP are unknown.

PURPOSE: We examined the effects of using an activity tracker (AT) alone or in combination with motivational interviewing (MI) on PA and mood in CLBP.

METHODS: Fifty-one adults with CLBP (51% women; mean age 44 ± 10.6) were randomized to receive either: an AT (AT, n = 18), an AT with three sessions of MI (MI, n = 17) or were placed in a wait-list control group (WL, n =16) for 12 weeks. Changes steps/day (activPAL) and mood (Profile of Mood States [POMS]) over the intervention were evaluated with Group X Time repeated measures ANOVA and effect sizes (Cohen’s d). Correlation coefficients (Pearson’s r) assessed relationships between changes in PA and changes in mood.

RESULTS: There were non-significant (p > 0.05) increases in steps/day for the intervention groups (MI: 1,019 ± 2,665; AT: 897 ± 2,468) and a small decrease for WL (-182 ± 2,434). POMS Total Mood Disturbance (TMD) improved across all intervention groups (MI: 1,019 ± 2,665; AT: 897 ± 2,468) and a small decrease for WL. Changes in PA were significantly and positively associated with change in Vigor (r = 0.32; p = 0.022). When examining groups individually, the association remained significant for the MI group only (r = 0.62; p = 0.006).

CONCLUSION: Results suggest that AT alone and with MI may be effective for improving PA and vigor in CLBP. Future research is needed to determine the intervention components that are most effective for increasing PA and to elucidate possible mechanisms underlying the beneficial effects of changes in PA for patients with CLBP.

3092 Board #8 June 2 9:00 AM - 11:00 AM

Behavior Change Theory Taxonomy Analysis of Smartphone Apps for Fitness, Nutrition, and Weight Loss

Joy Furlipa, Kimberly Reich. High Point University, High Point, NC. (No relevant relationships reported)

A majority of Americans do not meet physical activity or nutrition guidelines for health. Convenient interventions to support healthy behaviors may be beneficial. Smartphone use has become ubiquitous, with apps that are an integral part of life for many. The health and fitness category of apps is robust and growing, but the potential for these apps to affect health behavior change is poorly understood.

PURPOSE: To evaluate top-ranked fitness, nutrition, and weight-loss smartphone apps for incorporation of evidence-based behavior change strategies. METHODS: Two investigators coded descriptions of the 150 top-ranked “free” apps in the health and fitness category of the US iOS app store for evidence of health behavior change strategies using the Behavior Change Technique (BCT) Taxonomy (v1). Prevalence of taxonomy items were calculated and Pearson correlations were estimated for the relationship between BCTs per app and customer ranking, as well as for the relationship between BCTs per app and app store ranking. Significance was set at p < 0.05. RESULTS: 71 app descriptions were identified as fitness, nutrition, and/or weight-loss focused. Of those, 45.1% incorporated goals and planning; 57.7% incorporated feedback and monitoring; 56.8% incorporated social support; 29.6% incorporated comparison of behavior; 29.6% incorporated shaping knowledge; 22.5% incorporated associations; 11.6% incorporated reward and threat; 9.9% incorporated antecedents; and 5.6% incorporated natural consequence. Only 17 of the 93 techniques in the BCT taxonomy were utilized across all coded apps. There was a trend towards a weak negative correlation between number of BCTs per app and app store ranking (r = -0.22, p = 0.06) and no significant correlation between number of BCTs and customer rating (r = -0.02, p = 0.87). 45.1% of the “free” apps offered a premium version, in addition, and 11.3% required paid subscription after download. CONCLUSIONS: Goal planning, monitoring, feedback, and social support were the most common strategies found in the popular fitness, weight-loss, and nutrition apps, though more must be learned about their effectiveness. Furthermore, there is potential to incorporate a greater variety of health behavior change techniques.

3093 Chair: Robin Queen, FACSM. Virginia Tech, Blacksburg, VA. (No relevant relationships reported)

3094 Board #1 June 2 9:00 AM - 11:00 AM

Association Of Flexibility And Jump Landing Kinematics On The Recovery Of Lower Body Power And Strength Following Exhaustive Exercise

Thomas Kopec1, Mark Richardson2, Phillip Bishop3, Lizzie Hibberd2, James Leeper3, Bailey Welborn3, Mike Esco, FACSM1. Samford University, Birmingham, AL. 1University of Alabama, Tuscaloosa, AL. Liberty University, Lynchburg, VA. (Sponsor: Mike Esco, FACSM) (No relevant relationships reported)

PURPOSE: The purpose of this study was to determine the relationship between knee flexion range of motion (ROM) and jump landing kinematics evaluated via the landing error scoring system (LESS) and the change in performance variables following an exhaustive bout of exercise. METHODS: Participants were measured for ROM and LESS, and then completed performance tests consisting of vertical jump (VJ), and isometric quadriceps strength assessment (ISO). Next, participants completed an exhaustive bout of exercise, and upon termination, performance variables were reassessed. Participants returned for follow-up testing at 24-, 48-, and 72-hours.

Abstracts were prepared by the authors and printed as submitted.
RESULTS: ROM was significantly correlated with the changes in VJ (r = .65) and the changes in ISO (r = .75) at 24-hours after baseline, and ROM was also significantly correlated with the change in VJ (r = .66) and the change in ISO (r = .79) at 48-hours follow-up, but not at 72. LESS scores were significantly correlated with ROM (r = .67), as well as ISO (r = .62), respectively, but not at 72. CONCLUSIONS: These findings indicate that higher levels of flexibility resulted in better mitigation of the decreases to VJ and ISO following the exhaustive bout of exercise at both 24- and 48-hours post-exercise, but not at 72. A possible explanation for the association between higher LESS scores (poorer mechanics) and faster return of ISO towards baseline may be that those with poorer LESS scores exerted less effort during the exhaustive exercise bout and therefore did not manifest a high level of muscle damage. However, this was not supported by the non-significant relationships between LESS and the number of repetitions participants completed (r = .27); or LESS and RPE following exercise (r = .27). The reason for these findings remains unclear. Clinicians can use ROM before training to predict the recovery of lower extremity power and strength following intense physical activity.

The countermovement jump (CMJ) is a common test of athletic ability. Kinetic analysis indicates phase-specific CMJ ground reaction force rate of force development (RFD) and rate of force unloading (RFU) are associated with jump performance. Collegiate athletes complete strength and conditioning regimens to maximize athletic ability and sports performance, but it is unclear what elements of the CMJ moderate adaptations relate to changes in jump height. METHODS: 79 healthy NCAA Division I athletes (60 males) participating in football, soccer, basketball, hockey, and wrestling performed maximal CMJs on force plates (800 Hz) as part of standard yearly preseason evaluations. ECC and CONC phase force-time curve variables were computed, and Wilcoxon Signed-Ranks tests were used to evaluate changes in variables of interest between 1st and 4th year CMJ performance. Spearman’s correlation was used to evaluate associations between CMJ height and force-time curve variable differences.

RESULTS: Jump height increased significantly (p < .001) from 1st to 4th year (38.3 ± 9.5 cm to 40.1 ± 9.1 cm), along with early phase (0-50%) ECC RFD (41.1 ± 37.6 N/kg to 55.1 ± 35.1 N/kg). Improved jump height was significantly associated with improved peak ECC RFD (r = -.274, p = .015), late phase (50%–100%) ECC RFD (r = -.308, p = .006), and peak CONC RFU (r = -.383, p < .001). Across the force-time curve variable most strongly associated with CMJ height was peak CONC RFU (r = -.560, p < .001).

CONCLUSIONS: Improved CMJ performance is associated with increased ground reaction force ECC RFD and CONC RFU from 1st to 4th year of participation in Division I collegiate athletics. Our results suggest that CMJ height may be maximized by training to enhance the rate of unloading through rapid generation of hip, knee, and ankle extensor torque in combination with utilization of stored elastic energy.

Investigations of lower extremity movement biomechanics in injured populations are often designed with the assumption that limb symmetry and reliability across measurement intervals are inherent. However, between-limb variation and long term reliability of lower extremity kinetics and kinematics in healthy comparison groups is unknown.

PURPOSE: To evaluate the test-retest reliability and between-limb symmetry of hip, knee, and ankle joint kinetics and kinematics of the countermovement jump (CMJ) in healthy Division I collegiate athletes. METHODS: 22 Division I collegiate cross country athletes (13 females, age 19.7 ± 1.1, BMI 20.8 ± 2.2) performed maximal CMJs as part of preseason evaluations in 2 consecutive years. Whole body kinematics and ground reaction forces were recorded bilaterally. Eccentric (ECC), concentric (CONC), and landing (LAND) phase sagittal plane hip, knee, and ankle joint angles, moments, and powers were computed. Between session reliability was assessed with intraclass correlation coefficients (ICC). To evaluate limb symmetry, median between-limb differences were expressed as a percentage of the median absolute values of each variable.

RESULTS: Most variables demonstrated fair to good reliability (4 < ICC < .75). CONC phase hip, knee, and ankle joint moment impulses (ICCs 0.69 - 0.73), peak powers (ICCs 0.75 - 0.82), and LAND phase peak angles (ICCs 0.70 - 0.71), excursions (ICCS 0.70 - 0.82), and peak powers (ICCS 0.66 - 0.72) demonstrated the greatest consistency. Rate of hip, knee, and ankle joint moments during the ECC (ICCs 0.37 - 0.56) and CONC phases (ICCs 0.37 - 0.58) were less reliable. Between-limb variation in hip and knee joint peak angles throughout all CMJ phases was < 5% of absolute values. LAND moments, impulses, powers, and work demonstrated substantially greater between-limb asymmetry (14 - 46% of absolute values) than CONC phase variables (6 - 12%).

CONCLUSIONS: CMJ CONC phase hip, knee, and ankle joint impulses and powers have the greatest limb symmetry and reliability across intervals in healthy collegiate athletes. Sports medicine clinicians and scientists should be aware of the expected between-limb asymmetry and variation across testing intervals when assessing CMJ biomechanics in injured populations or attempting to evaluate the effects of intervention.

Altered movement patterns have consistently been observed in chronic ankle instability (CAI) patients during landing and cutting tasks. Altered foot placement along with changes in joint moments have been identified as risk factors for ankle sprains. However, to examine a causal effect between biomechanical factors and risk of ankle injury, research should be conducted in a prospective design.

PURPOSE: To identify biomechanical risk factors related to recurrent ankle sprains during jump landing/cutting in CAI patients at a 6-month follow-up.

METHODS: 91 of 100 CAI patients completed a 6-month follow-up survey, and 13 CAI patients (7M, 6F, 22 ± 2 yrs, 174 ± 1 cm, 75 ± 15 kg, 84 ± 5% FAAM-ADL, 65 ± 12% FAAM-Sports, 5.8 ± 3 sprains) reported recurrent sprains within 6 months, and 78 CAI patients (39M, 39F, 22 ± 2 yrs, 174 ± 1 cm, 74 ± 14 kg, 85 ± 6% FAAM-ADL, 69 ± 10% FAAM-Sports, 3.3 ± 2 sprains) did not have recurrent injury after the initial data collection where subjects performed 10 jumps consisting of a maximal vertical jump-landing and cutting at 90°. Functional linear models were used to detect between-group differences. If 95% confidence intervals did not cross zero, differences were significant.

RESULTS: Figure 1 shows that CAI patients who suffered ankle sprains within 6 months showed several biomechanical differences including (i) more plantarflexion, less knee flexion and more knee abduction angles, and (ii) increases in plantarflexion, inversion, knee extension, knee abduction and hip abduction moments over various portions of stance relative to those who did not have recurrent injury.

CONCLUSIONS: CAI patients who suffered recurrent sprains within 6 months demonstrated altered foot placement (4° more plantarflexion) along with more inversion moment and altered frontal knee and hip biomechanics. Moreover, these patients reported a greater number of previous ankle sprains (5.8 sprains) relative to those who did not have reinjury at a 6-month follow-up (3.3 sprains).
Professional dancers (PD) have a high injury rate (42% to 97%) with more than 50% occurring in the lower extremity (LE). PD are required to perform repetitive multidirectional single-leg landings. Therefore, it is important to investigate the landing biomechanical strategies in various jump directions between PD and non-dancers (ND).

**PURPOSE:** To compare LE biomechanics during multidirectional single-leg landings between PD and ND.

**METHODS:** 15 PD (20±7 years, 1.69±0.1m, 66±10.2kg) and 15 ND (25±5 years, 1.69±0.1m, 66±10.2kg) conducted single-leg jumps in three directions (diagonal-DJ, frontal-FJ, and lateral-LJ) followed by a vertical jump. The second landing was used for analysis. Dominant LE biomechanical data was collected using a motion capture system (200Hz) and a force plate (1000Hz). Visual3D was used for data processing.

**RESULTS:** A main effect was found for direction (p<0.05). LJ (2.9±0.5) had the lowest vGRF compared to FJ (3.1±0.6) and DJ (3.3±0.7). HF at PKF was lower in the FJ direction (32±12), compared to LJ (39±11) and to DJ (39±10). A main effect for group was attained (p<0.05). Particularly, PD (2.9±0.5) had lower vGRF than ND (3.3±0.7). At IC, PD had lower HF (193±47), KF (3.1±3.5), and 1st metatarsophalangeal extension (MTPE: -9.9±7.0), and higher hindfoot-tibia (-32.7±4.5), and forefoot-tibia (-49.1±6.1) plantarflexion (PF) than ND (HF: 25.2±6.6, KF: -13.6±4.1, MTPE: -4.8±7.5, hindfoot-tibia: -23.8±6.8, forefoot-tibia: -30.1±12.5).

Lastly, at IC, PD had a lower knee adductor moment (1.26±1) than ND (1.31±1). Yet, at VGRF, PD had a higher knee adductor moment (-51.3) than ND (-41.2).

**Conclusion:** This study demonstrated that PD had an extended landing pattern compared with ND. Despite the extended landing posture at IC, PD showed a lower vGRF, suggesting that a higher PF angle of the ankle may improve energy absorption and dissipate landing forces. Further research should investigate the role of PDs’ ankle range of motion and shock absorption in landings.
While there have been several school-based physical activity (PA) interventions targeting improvement in cardiovascular disease (CVD) risk factors, including cardiorespiratory fitness (CRF), few have assessed the long-term effect on a cardiometabolic health composite score. PURPOSE: To determine the effect of a two-year school-based PA intervention on CVD risk factors five years after cessation. METHODS: We recruited two elementary schools, assigned to intervention (n=125 children) or control (n=134 children). The intervention school offered 210 min/week more PA than the control school over two consecutive years (4th and 5th grades) during 2004-2007. A follow-up assessment was conducted 5-7 years post intervention (10th grade) during 2011-2012 where 180-210 (73-85%) children provided valid data. Primary outcomes were several CVD risk factors: triglyceride (TG), total to high-density lipoprotein cholesterol ratio (TC:HDL ratio), insulin resistance (HOMA), systolic blood pressure (SBP), waist circumference (WC), and CRF measured as peak oxygen uptake (VO2peak). These variables were analyzed individually and as a composite score through linear mixed models, including random intercepts for children. Results: Analyses revealed significant effects of the intervention five years after cessation for HDL (ES = .26), diastolic BP (ES = .48), VO2peak (ml/kg/min) (ES = .29), and the composite risk score (ES = .38). These effects were similar to the immediate results following the intervention. In contrast, while TC:HDL ratio initially decreased post intervention (ES = -.27), this decrease was not maintained at 5-7 years post intervention (ES = .02), whereas WC was initially unchanged post intervention (ES = .03), but decreased at 5-7 follow-up (ES = -.44). Conclusion: These data reveal that the significant effects of a two-year school-based PA intervention remained in effect for CVD risk factors five years after cessation of the intervention. As cardiometabolic health can be maintained long-term after school-based PA, this paper demonstrates the sustainability and potential of schools in the primary prevention of future CVD risk in children.

Preschool centers are ideally situated to intervene on preschoolers’ health behaviors such as physical activity (PA), diet, and sleep (PDAs). In order for health behavior interventions to be sustainable within the preschool center, the intervention needs to be implemented by classroom teachers. Unfortunately, teachers are constrained by demands such as meeting early childhood education learning standards (state mandated policies). It is possible that integrating health behavior lessons and activities into learning standard could improve teachers’ compliance with health behavior interventions. PURPOSE: To examine the impact of integrating health behavior interventions into learning standards on preschoolers’ PA, diet and sleep behavior. METHODS: This was a parallel group pilot randomized control study. Data were collected in Spring 2016 and analyzed in Fall 2016. Two preschool centers were randomized to either the PADs (children, n = 60) or the control (CON; children, n = 54) group. The PADs intervention consisted of a PA, diet, and sleep curriculum and activities embedded into Massachusetts early education learning standards and was implemented for four days/week for 12 weeks. PADs also had a parent component, which was delivered online. CON preschool participated in their usual activity. PA was assessed using accelerometers for seven days per week. Diet and sleep variables were assessed using a parent report surveys. Outcome variables were assessed at baseline, 6-weeks, and 12-weeks. RESULTS: After adjusting for baseline differences, significant group by visit interaction were observed for during preschool-day percent of time spent in moderate-to-vigorous PA (PADs: baseline 7.7 ± 3.6, 12-week 11.7 ± 3.8; CON, baseline 10.7 ± 3.7, 12-week = 10.9 ± 3.5; p = 0.03) and sedentary time (PADs: baseline 83.6% ± 5.8, 12-week 77.2% ± 6.4; CON; baseline 79.1% ± 5.4, 12-week = 78.4% ± 5.5; p = 0.03). At 6-week, significant improvement (p = 0.02) was observed in percent of time spent in total daily vigorous activity for the PADs compared to the CON group. CONCLUSION: This pilot study provides preliminary evidence that integrating health behaviors into learning standards are feasible and potentially an effective way for increasing preschoolers PA level but not effective in changing either diet or sleep behaviors.
Young children spend a significant amount of time in structured preschool settings; however, the majority of this time is spent in sedentary behaviors. Given that obesity, physical activity (PA), and sedentary behaviors track throughout development, interventions aimed at increasing PA opportunities for young children in the preschool setting may be critical in establishing healthy trajectories for young children. PURPOSE: To examine PA in preschool-aged children during school days when a PA curriculum was administered as compared to non-intervention days.

**METHODS:** A pilot PA curriculum, Kiddie CATS on the Move, was implemented in local preschools over 23-weeks, 2-3 times per week by classroom teachers and college students enrolled in a service-learning course. Physical activity was objectively measured by accelerometer during the preschool day at 3 intervention timepoints. A total of 32 children (M±SD: 3.9±0.6, 12 males, 20 females) who had at least 2 days of valid data on both intervention days and non-intervention days were included in the analyses. Minutes per hour (min/hr) of moderate-to-vigorous (MVPA), PA total (light + MVPA), and sedentary as well as percentage of time in each were calculated. Paired-samples t-test was used to compare intervention vs. non-intervention days. **RESULTS:** Children engaged in significantly more total PA (min/hr) on days when the PA curriculum was administered vs. non-intervention days (17.2±3.5 vs. 16.0±3.5, p<0.001) and significantly more min/hr in MVPA (9.5±2.7 vs. 8.5±2.9, p=0.001). On intervention days, children spent significantly less time in sedentary behavior compared to days without the intervention (71.3% vs. 73.4%, p<0.001). **CONCLUSIONS:** The current findings suggest the Kiddie CATs on the Move curriculum significantly increased the amount of time preschoolers engaged in PA (total and MVPA) throughout their school day. This teacher- and student-led intervention in the preschool setting may represent a viable approach to increase PA and aid in the establishment of healthy behaviors in young children.
Low physical activity (PA) and increased screen time (ST) is problematic for preschool-age children (2.9-5 years), and is attributed to childhood overweight/obesity. Due to this, several organizations have provided recommendations surrounding these behaviors. However, few studies have examined the compliance rates of preschoolers based on the recently released PA and ST recommendations (≥15 minutes of PA/hour and ≤60 min/day).

PURPOSE: To assess preschool-age children’s compliance with PA and screen time recommendations and identify variables contributing to compliance. METHODS: Baseline data from preschoolers (n=52, 50% male, age 3.7±0.8 years, BMI % = 50.2±26.5) in two preschool centers (T1: 3.7±0.8 years, BMI % = 50.2±26.5) in two preschool centers were used. The PA was assessed with an Actigraph GT3X accelerometer worn on the lower back of children for seven consecutive days. PA data were reduced using Pate et al. cut points, and compliance was assessed for school-day (≥15 min/hour) and total day (≥180 min) recommendations. ST and parent variables were assessed with self-report validated questionnaires. Appropriate descriptive statistics were calculated for all variables. Logistic regression was used to determine differences in compliance based on gender, ST, school-day PA, parent PA and parent PA knowledge.

RESULTS: Children engaged in 11.3±3.6 min/hour of PA and 102.6±79.6 min/day of ST. The percentage of preschoolers meeting school-day PA and total day recommendations were 17.1% and 26.5%, respectively. Approximately 35.9% of preschoolers met ST recommendations. There were no gender differences in PA (p=0.052) or ST (p=0.91) compliance. Additionally, only school-day PA significantly contributed to the likelihood of meeting total day recommendations (OR=1.05, 95% CI=1.002, 1.104). There were no significant predictors for ST compliance. Practical intervention strategies are needed to increase PA and reduce ST in preschoolers, specifically in the preschool environment.

CONCLUSION: Preschoolers’ compliance with PA and ST recommendations was low in this sample. Additionally, only school-day PA was a significant predictor of meeting total day recommendations (OR=1.05, 95% CI=1.002, 1.104). No significant predictors were identified for ST compliance. Practical intervention strategies are needed to increase PA and reduce ST in preschoolers, specifically in the preschool environment.

HISTORY: A 79-year-old female presented to sports clinic with 2 weeks left anterior elbow pain that developed following a Pilates class. She described a pulling type of discomfort in the left antecubital region worse with elbow extension and improved with rest. She noted associated swelling in the region over the same period. She denied history of bruising, trauma, or obvious injury to the arm during the class. She exercised regularly with Pilates methods and denied engaging in any novel activities prior to pain onset. She denied changes in strength or sensation. She had cochlear implants which were not MRI compatible.

PHYSICAL EXAMINATION: There was fullness about the left anterior distal arm to antecubital fossa which was tender and hard on palpation. The left biceps tendon was palpable in the antecubital fossa but less prominent than the contralateral side. She had a left elbow extension lag of 15 degrees; elbow flexion and forearm prono-supination were not limited. She had intact radial pulse and no neurovascular deficits.


TEST AND RESULTS: Elbow anterior-posterior & lateral radiographs: Normal. Elbow anterior musculoskeletal ultrasound: Lateral portion of brachialis muscle had heterogeneous echogenicity, large areas of hypoechogenicity in between fibers and discontinuity of proximal fibers with the distal insertion. Medial half of brachialis muscle had intact fibers. Remainder of exam was normal including brachialis tendon insertion, biceps muscle and tendon, vasculature, and nerves.

FINAL WORKING DIAGNOSIS: High grade partial thickness tear of the distal lateral brachialis muscle.

TREATMENT AND OUTCOMES: She was managed with compression sleeve and initiation of physical therapy for range of motion with later progression to elbow flexor strengthening. Three months post injury she was at normal baseline for motion and activity.
**3114 June 2 9:20 AM - 9:40 AM**

**Left Arm Pain and Numbness-Recreational Athlete**

Paul A. Krebs, Clinton Hartz. *The Ohio State University, Columbus, OH.* (Sponsor: James Borchers, MD, MPH, FACSM) (No relevant relationships reported)

**History:** A 41 year old right hand dominant female presented with left arm pain and numbness of 6 months duration with progressive worsening. Symptoms started in the distal posterior medial aspect of her arm and radiated to the 4th and 5th fingers of the hand. The pain was worse with lifting, swimming, hiking, and tennis, forcing her to stop her normal athletic activities. She also noticed swelling in the distal aspect of the arm where the pain originated and a palpable bump. She denied history of trauma, clicking, locking, or instability. **Physical Exam:** Neck exam showed full painless range of motion, no tenderness, and a negative Spurling test. Shoulder exam showed full strength and range of motion. Her left elbow had full range of motion with pain, no instability or crepitus. She had soft tissue tenderness and swelling in the distal arm medially with palpable nodules just proximal to the medial epicondyle. Cozen’s, Speed’s, and Yergason’s tests were negative. She had 5/5 strength and full range of motion of her left hand. Neurologic exam showed decreased sensation in the ulnar nerve distribution. Capillary refill and radial pulses were intact.

**Differential Diagnosis:**
1. Cubital Tunnel Syndrome
2. Ulnar Neuropathy Secondary to Mass Effect
3. Fracture/Stress Fracture
4. Cervical Radiculopathy
5. Thoracic Outlet Syndrome

**Tests and Results:**
- XR Humerus: No soft tissue swelling or acute osseous abnormality
- Limited Diagnostic Ultrasound: 4 hypervascular nodules adjacent to ulnar nerve, likely lymph nodes

**Final Working Diagnosis:**
Ulnar neuropathy secondary to mass effect, lymphadenopathy, need to rule out malignancy.

**Treatment and Outcomes:**
1. MRI Left Humerus: abnormal enlarged lymph nodes. Mass effect evident along the ulnar nerve.
2. Referred to Hematology Oncology.
4. PET scan: hypermetabolic lymphadenopathy above and below the diaphragm, uptake in the spleen and liver, consistent with a Stage III lymphoma.
5. Bendamustine/Rituximab (BR) was started because of its response rate and lower side effect profile compared to other chemotherapies.

**Patient:**
- She has undergone 2 cycles of BR with good response, including near resolution of her humeral disease.
- She is restarting activities as tolerated. The expectation is that her ulnar neuropathy will improve with remission of her lymphoma.

**3115 June 2 9:40 AM - 10:00 AM**

**Bilateral Wings**

Nina Yaftali. Rush, Chicago, IL. (No relevant relationships reported)

**HPI:**
19 year-old right hand dominant male high school recreational basketball player who presents with chief complaint of bilateral shoulder pain for one year. About one and half years ago patient was training in the gym when he did a heavy overhead press and heard an audible pop in his shoulders. He complained of a dull, achy posterior shoulder that increased the following day with radiation into the neck. He was evaluated by orthopedics 5 days post-injury. Initial X-rays of the cervical spine and left shoulder were unremarkable and subsequent left shoulder MRI 12 days post-injury was also unremarkable. Over the next few weeks the pain resolved but weakness in the shoulder persisted. He was then referred to our clinic for further evaluation approximately 3 months post-injury with ongoing shoulder weakness. He denied paresthesias.

**Physical Examination:**
- Weakness was isolated to left shoulder external rotation and abduction. Shoulder flexion, extension and internal rotation were intact. Inspection showed atrophy of left supraspinatus and infraspinatus. Full pain free ROM of neck. Sensation and reflexes were intact in upper extremities.

**Differential Diagnosis:**
1. Suprascapular nerve injury
2. Rotator cuff tear
3. Cervical radiculopathy
4. Brachial plexus injury

**Tests and Results:**
- Diagnostic US of left shoulder: Increased echogenicity of left supraspinatus and infraspinatus
- EMG/NCS: Increased insertional activity, 1+ fibrils, 2+ sharps, increased phasicity and decreased recruitment in supraspinatus and infraspinatus. Membrane instability in deltoid and teres minor. No other abnormalities.

**Final Working Diagnosis:**
- Atrophy of supraspinatus and infraspinatus. No mass or anatomic abnormality

**Treatment and Outcomes:**
1. Referral to surgery resulted in nerve transfer surgery from spinal accessory nerve to suprascapular nerve
2. One month post-op little to no return of external rotation with mild weakness in left shoulder shrug as expected course post-operatively
3. Returned to football one month after surgery with recommendation to avoid positions requiring tackling

**4. Limb Girdle Muscle Dystrophy**

**Test and Results:**
- MRI right shoulder: Minimal tendinosis of supraspinatus and subscapularis tendon.
- MRI left shoulder: Mild tendinosis of subscapularis tendon.
- EMG: Myopathic process with chronic features affecting the right upper extremity and periscapular region.
- Genetic test: FSHD1 confirmed

**Final Working Diagnosis:**
- Facioscapulohumeral muscle dystrophy

**Treatment and Outcomes:**
- Patient was prescribed physical and occupational therapy for stretching, and range-of-motion exercise. It is recommended he no longer do heavy weightlifting, just low intensity aerobic exercise. His pain is controlled with NSAIDS currently, as no other drug shows any clear benefit. He received a baseline pulmonary function test, and dilated retinal exam. Patient is doing well overall. The shoulder surgeon is evaluating him for possible scapular fixation if his range of motion worsens.

**3116 June 2 10:00 AM - 10:20 AM**

**Shoulder Weakness- Football**

Daniel Sisk, Mindy Loveless. *University of Washington, Seattle, WA.* (No relevant relationships reported)

**HISTORY:** A 17-year-old high school football player sustained a left shoulder injury while tackling an opposing player to the ground. He had pain in the left shoulder that increased the following day with radiation into the neck. He was evaluated by orthopedics 5 days post-injury. Initial X-rays of the cervical spine and left shoulder were unremarkable and subsequent left shoulder MRI 12 days post-injury was also unremarkable. Over the next few weeks the pain resolved but weakness in the shoulder persisted. He was then referred to our clinic for further evaluation approximately 3 months post-injury with ongoing shoulder weakness. He denied paresthesias.

**Physical Examination:**
- Weakness was isolated to left shoulder external rotation and abduction. Shoulder flexion, extension and internal rotation were intact. Inspection showed atrophy of left supraspinatus and infraspinatus. Full pain free ROM of neck. Sensation and reflexes were intact in upper extremities.

**Differential Diagnosis:**
1. Suprascapular nerve injury
2. Rotator cuff tear
3. Cervical radiculopathy
4. Brachial plexus injury

**Test and Results:**
- Diagnostic US of left shoulder: Increased echogenicity of left supraspinatus and infraspinatus
- EMG/NCS: Increased insertional activity, 1+ fibrils, 2+ sharps, increased phasicity and decreased recruitment in supraspinatus and infraspinatus. Membrane instability in deltoid and teres minor. No other abnormalities.
- Repeat MRI of left shoulder: Atrophy of supraspinatus and infraspinatus. No mass or anatomic abnormality

**Final Working Diagnosis:**
- Left supraspinatus and infraspinatus nerve injury

**Treatment and Outcomes:**
1. Refer to surgery resulted in nerve transfer surgery from spinal accessory nerve to suprascapular nerve
2. One month post-op little to no return of external rotation with mild weakness in left shoulder shrug as expected course post-operatively
3. Returned to football one month after surgery with recommendation to avoid positions requiring tackling
Forearm Pain-Diving
D. Copa, Jaime Aparicio. Memorial Hermann Ironman, Houston, TX.
E-mail: Dorcasa.copa@memorialhermann.org.

PURPOSE: To examine the athlete was done in the athletic training room by a physical therapist. Subjectively, questions about female athlete triad indicated inconsistent menstrual cycle. However, she did consume adequate calories including foods with calcium and protein. Further questioning about hormone levels and nutrition indicated she had been found to have low levels of vitamin D in previous blood tests as well as very low estrogen. The athlete reported having to take estrogen supplements in the past.

The physical exam revealed normal active range of motion bilaterally, normal strength, reflexes, and sensation. Vascular system was noted to be intact. Upper limb nerve tension was tested, resulting in negative findings. Pin point pain with palpation along the ulna in two places, one approximately 2 inches from the proximal radialulnar joint, reproduced her pain. Applied manual force at each end of the ulna over a fulcrum also reproduced her pain suggesting an osseous pathology so imaging was suggested by the physical therapist and ordered by the orthopedic surgical fellow.

DIFFERENTIAL DIAGNOSIS:
1. Ulnar Stress Reaction
2. Periostitis
3. Bone Contusion

TESTS AND RESULTS: Plain Radiographs demonstrate bowing of the ulna and periosteal new bone formation. Negative ultrasound. Negative MRI.


DIFFERENTIAL DIAGNOSIS:
1. Ulnar Nerve palsy
2. Ulnar Neuropathy
3. Ulnar Tunnels Syndrome
4. Ulnar Tendinitis

TESTS AND RESULTS: Tinel’s sign on the left at the olecranon fossa. Negative Phalen’s test. Negative weakness. Negative anesthesia.


DIFFERENTIAL DIAGNOSIS:
1. Ulnar Nerve palsy
2. Ulnar Neuropathy
3. Ulnar Tunnels Syndrome
4. Ulnar Tendinitis

TESTS AND RESULTS: Tinel’s sign on the left at the olecranon fossa. Negative Phalen’s test. Negative weakness. Negative anesthesia.

G34 Free Communication/Poster - High Intensity Interval Training

3133 Board #2 June 2 8:00 AM - 9:30 AM

Biomarkers of Inflammation and Angiogenesis Following Short Vs. Long Bouts of High-Intensity Training

Chad D. Markert1, Khalha N. Clemmons1, Emily E. Bechke2, Cassie M. Williamson1, Michael J. McKenzie, FACSM, Brian M. Kliszczewicz2,1, Winton Salem State University, Winston Salem, NC, ‘Kennesaw State University, Kennesaw, GA.

(No relevant relationships reported)

Effects of varying types of high-intensity training (HTT) on the appearance and time course of circulating biomarkers have not been adequately characterized. PURPOSE: The purpose of this study was to examine the effects of HTT on biomarkers of inflammation and angiogenesis, over time, in HTT bouts of varying duration (short bout, 5 min, and long bout, 15 min). METHODS: Ten males, 18-45 years old, who had participated in CrossFit for at least 6 months, were recruited from local affiliates. The participants completed a total of 3 lab visits [Visit 1: collection of descriptive data; the next 2 visits were randomized between the short bout and long bout]. All subjects completed the same exercises. Blood was drawn pre and post-exercise, and 1 hour, 3 hours, and 6 hours post-exercise, centrifuged, and plasma frozen for analysis. A multiplex assay (Millipore MagPix) was used to determine concentrations of the biomarkers of interest [interleukin 6 (IL-6), interleukin 10 (IL-10), tumor necrosis factor alpha (TNF-α), and vascular endothelial growth factor (VEGF)]. Results: The short bout produced results similar to those of the long bout. Repeated measures ANOVA revealed no trial-dependent differences (p > 0.05) in any of the biomarkers. Both temporal responses and concentrations were similar in the short and long bout. Conclusions: The biomarkers IL-6, IL-10, TNF-α, and VEGF all follow a similar pattern of peak post-exercise, and returning to baseline within 6 hours, regardless of the duration of the HIT. A practical implication is that a 5 min bout of HIT may be just as effective as a 15 min bout in terms of eliciting certain specific physiologic responses. Supported by WSSU Office of Student Research, Honors Student Research Grant (K.N.C.).

3134 Board #3 June 2 8:00 AM - 9:30 AM

Reducing Sprint Duration in A REHIT Protocol on Changes in VO2max and Mood

Preychaphorn Songsorn1, Gulbin Naclakan1, Richard Metcalfe2, Niels Vollaard1, University of Ege, Izmir, Turkey. ‘Ulster University, Belfast, United Kingdom.

(No relevant relationships reported)

Sprint interval training (SIT) is associated with health benefits, but ‘classic’ SIT (6x30-s ‘all-out’ cycle sprints) requires high motivation and is associated with negative affective responses and high levels of perceived exertion. In order to make SIT more suitable for sedentary individuals, the number of sprints and sprint duration have previously been reduced to develop a reduced-exertion high-intensity interval training (REHIT) protocol consisting of 2x20-s ‘all-out’ cycle sprints within a 10-min session. This genuinely time-efficient protocol remains effective at improving aerobic capacity (VO2max). It is unknown if further reducing the sprint duration in the REHIT protocol affects improvements in VO2max changes in mood. PURPOSE: To examine the effect of reducing sprint duration from 20-s to 10-s in a REHIT protocol on VO2max and psychological perceptions. METHODS: Thirty-five healthy untrained subjects (mean±SD age: 22±3 y; BMI: 25±5 kg·m−2; VO2max: 33±8 mL·kg−1·min−1) were randomised into groups performing two 10-s sprints (REHIT10; n=18) or 20-s sprints (REHIT20; n=17), within a 10-min session performed 3 times a week for 6 weeks. VO2max was examined before and after training. Rating of perceived exertion (RPE), psychological perceptions (BRUMS, PANAS and acceptability of HIT) were evaluated during training sessions. RESULTS: The increase in VO2max was significantly greater in REHIT20 (2.7±0.75 vs. 3.04±0.75 L·min−1; 16%) compared to REHIT10 (2.58±0.57 vs. 2.67±0.61 L·min−1; 4%: time x group interaction effect: p<0.05). There were no significant differences between REHIT10 and REHIT20 in mean RPE (REHIT10: 13.6±0.4, REHIT20:14.5±0.4), changes in mood status, or affective responses. CONCLUSIONS: Reducing REHIT sprint duration from 20-s to
High intensity intermittent training (HIIT) enhances anaerobic and aerobic capacities. Our recent study have demonstrated in animal study that the 6-week combination of chlorella intake and HIIT further elevated glycylated and oxidative phosphorylation as ATP supply in skeletal muscle as compared with chlorella alone and HIIT alone, resulting in enhancement of anaerobic and aerobic exercise capacities. However, the combined effects of chlorella intake and HIIT on anaerobic and aerobic capacities in human remain unclear. PURPOSE: The aim of this study was to investigate whether the combination of chlorella intake and HIIT further enhanced anaerobic and aerobic capacities as compared with HIIT alone in human. METHODS: Twelve healthy young male subjects (21 ± 1 years) were participated in this study. Subjects completed 3-week of exhaustive HIIT consisting of 6-7 bouts of 20-second cycling at an intensity of 170% maximal oxygen uptake (VO2max) with a 10-second rest between each bout, 3 days/week. They orally took chlorella or placebo (10 tablets) after the breakfast and dinner between the 3-week in a double-blind, randomized, crossover design with 4 weeks between each intervention. We measured VO2max as an indicator of aerobic capacity and maximal oxygen deficit (MOD) as an indicator of anaerobic capacity.

RESULTS: After each HIIT intervention, VO2max was significantly increased in both chlorella and placebo groups (P<0.05). However, the amount of change in VO2max after the intervention was significantly higher in chlorella intake than placebo intake (P<0.05). After each HIIT intervention, MOD was significantly increased in both chlorella and placebo groups (P<0.05). However, the amount of change in MOD after the intervention was significantly higher in chlorella intake than placebo intake (P<0.05).

CONCLUSIONS: These results suggest that the combination of chlorella intake and HIIT may further enhance anaerobic and aerobic capacities in human. Supported by Grants-in-Aid for Scientific Research (17H02183, 18K13059, M. Iemitsu)

Effect of a Short-term HIIT Program on Systemic Brain-Derived Neurotrophic Factor in Healthy Males
Iván Rentería1, Patricia C. García-Suárez1, David O. Martínez-Corona1, Luis M. Gómez-Miranda2, Alberto Jiménez-Maldonado1, 1Universidad Autónoma de Baja California, Ensenada, Baja California, México. Universidad Autónoma de Baja California, Tijuana, Baja California, Mexico. (No relevant relationships reported)

Effect of a Short-term HIIT Program on Systemic Brain-Derived Neurotrophic Factor in Healthy Males
Iván Rentería1, Patricia C. García-Suárez1, David O. Martínez-Corona1, Luis M. Gómez-Miranda2, Alberto Jiménez-Maldonado1, 1Facultad de Deportes, Universidad Autónoma de Baja California, México. 2Escuela de Ciencias de la Salud, Universidad Autónoma de Baja California Campus Ensenada, México.

The brain-derived neurotrophic factor (BDNF) is a member of the neurotrophin family of growth factors. Several stimuli, such as physical exercise have the potential to increase BDNF production. Ambiguous findings regarding the exercise intensity that elicits changes in systemic BDNF levels have been reported in the literature. PURPOSE: To determine the effects of short-term high intensity interval training (HIIT) on systemic BDNF levels in healthy males. METHODS: Eleven healthy young males (Age = 22.8 ± 2.3 yr.; body weight (BW) = 77.8 ± 11.9 kg; height = 173.4 ± 5.2 cm; BMI = 25.8 ± 3.3 kg/m²) participated in the study. A graded maximal exercise test (GXT) was used to determine the maximal aerobic power (MAP) required to design the exercise intensities. The short-term HIIT protocol consisted of cycle ergometer exercise 3 times/week for 4 weeks. Paired t-test was used to compare anthropometrics and cardiovascular variables, MAP and systemic BDNF levels before and after short-term HIIT. RESULTS: Short-term HIIT did not change significantly the systemic BDNF levels (Pre-HIIT = 18.8 ± 1.6 ng/mL vs. Post-HIIT = 19.2 ± 2.2 ng/mL, p = 0.6495). Similarly, the BW and BMI were not modified by HIIT. Contrary, the heart rate recovery was improved after the HIIT program (Pre-HIIT=159.5 ± 11.9 vs Post-HIIT = 148.1 ± 13.6, p = 0.04). CONCLUSION: The short-term HIIT protocol used in this study was unable to elicit significant changes on systemic BDNF levels in healthy males. The physiological mechanisms explaining this finding need further investigation. Further studies are needed to clarify the effect of HIIT interventions on systemic BDNF levels in healthy males. On the other hand, the same protocol improved the heart rate recovery in healthy men. These data suggest different response of the Central Nerve System and Peripheral Nerve System to the same exercise modality.

High Intensity Interval Training (HIIT) has been demonstrated to have a positive effect on a number of physiological variables in several clinical populations. However, little work has been done on this topic in China. PURPOSE: To investigate the effects of a 3-week HIIT program on physiological and physical performance parameters (blood pressure, time to exhaustion, peak heart rate, lactate threshold, and O2max) among three different Chinese groups. METHODS: Thirty males were categorized by current health status (blood pressure, O2max, and frequency of exercise per week): to healthy active group (n = 176.5 ± 21.9 kg; height = 178 ± 9.3, percentage of body fat = 13.0 ± 6.12), healthy inactive group (n = 10; age = 20.9 ± 1.85, height = 172.8 ± 4.4, weight = 69.1 ± 10.5, percentage of body fat = 18.35 ± 7.0), or prehypertensive group (n = 10; age = 22.1 ± 2.0, height = 176.3 ± 7.4, weight = 71.8 ± 12.8, percentage of body fat = 20.47). Baseline testing included body fat estimation, blood pressure measurement, and a O2max test conducted on a treadmill. Subjects completed a 3-week, 3 sessions per week intervention. Each session included a warm-up (5 min), 10 HIIT cycles (60 sec high intensity at 99% O2sat and 60 sec active recovery at 45% O2sat, 20 min), and a cool-down (5 min). Post intervention assessments repeated the baseline measures. Six (2 Time) x 3 (Group) mixed factorial ANOVAs were performed to determine if differences existed in the dependent variables. RESULTS: No significant interaction was found for any dependent variables. Significant main effects were identified for systolic blood pressure (120.1±8.3 to 116.8±7.2 mmHg, p < 0.001) diastolic blood pressure (72.3±6.7 to 69.5±5.5 mmHg, p < 0.001), time to exhaustion (16.0 ± 3.2 to 18.0 ± 2.5

Abstracts were prepared by the authors and printed as submitted.
High intensity interval training (HIIT) has recently gained popularity as an effective stimulus for eliciting adaptations in various aspects of physical fitness. These adaptations may also involve complex hormonal changes, however less is known about the hormonal responses to this type of exercise training. 

**Purpose:** To investigate the changes between steady-state training and HIIT training on respiratory exchange ratio (RER), peak oxygen consumption (VO2peak), heart rate (HR) and rate of perceived exertion (RPE) in recreationally trained, college-aged participants.

**Methods:** Thirteen men 21-27 years old (M = 23.31, SD = 3.57) were recruited for the study. Subjects participated two sessions and were randomly assigned to two groups: Steady-State (SS) or High Intensity Interval Training (HIIT) training on a treadmill. SS training consisted of a 3-minute warm-up at 2.0 mph with a 0% grade followed by the Balke Protocol. HIIT protocol consisting a 5-minute warm-up at 3 mph at 0% grade, followed by maximum effort sprints for 30 seconds followed by a 30 second active recovery with sprint intervals beginning at 4.5 mph increasing by .5 mph after recovery interval. 

**Results:** There was a significant difference in RER between groups (t(12) = 2.30, p < .05, d = .55). However, no significant differences in VO2 (t(12) = -1.06, p = .31, d = .36) and HR (t(12) = -8.12, p = .00, d = .26) were identified using a paired samples t-test, between treadmill conditions (SS, HIIT). Furthermore, there were no significant differences (z = -1.51, p = .13, r = .34) in RPE after conducting a Wilcoxon matched pairs signed-rank test. The results suggest that training at higher intensities for a shorter period of time yielded similar results to training at lower intensities for a longer duration. 

**Conclusion:** HIIT training allows for increased cardiovascular health in a time efficient manner, which can accommodate various schedules.

**Abstract**

High intensity Interval Training (HIIT) has become an increasingly popular mode of exercise, especially with those with the perception of a lack of time. These intervals have been shown to decrease the time spent being active while simultaneously providing similar results to steady-state training to elicit the cardiovascular adaptations.

**Purpose:** To determine if increasing BR weight during 6 wks of HIIT increases upper body MVO2 and upper body skeletal muscle strength, endurance and power, in male and female university students.

**Methods:** Thirty-two physically active males and female students aged 18-25 years old (M = 21.1, SD = 1.3) were randomly divided into 2 groups (n = 16): control (BR) and experimental (BR HIIT). The BR HIIT regimen included 6 wks of HIIT: 3x/week, 3 sets of 30s work: 60s rest, 30s work: 60s rest, followed by a 10min cool down. HIIT ratio, which may reflect a specific drive towards anti-catabolic and/or regulatory adaptations to exercise-induced stress. More studies are needed to further characterize the hormonal responses to HIIT in humans.

**Conclusion:**

- **CONCLUSION:** 3 wks of BR HIIT can significantly increase upper body MVO2 and skeletal muscle strength, endurance and power in male and female university students. Increasing BR weight prior to 3 more wks of BR HIIT produced additional significant improvements in MVO2 and skeletal muscle performance, suggesting progressive overload training principles can be applied to BR training.

**Abstract**

**Purpose:** 18 recreationally active men and 15 women (23±2y) performed 10 BR HIIT sets, 30min rest, 3x/week, for 6 wks. For the first 3 weeks, women used 40, 1.5t; 20lb BR and men used 50, 1.5t, 25lb BR, after which BR weight was increased by 10lb using a heavier rope for another 3 wks in both groups. Upper body MVO2 (arm ergometer) and skeletal muscle performance (isometric shoulder [shld] flexion/extension, dynamic shoulder power, maximum sit-ups and push-ups) was used for statistics.

**Results:** During BR HIIT male and female heart rates were >85% of predicted maximums, and peak HIIT blood lactates (BLA) reached 10.79 and 8.33 mmol/L, respectively. See table below for MVO2 and skeletal muscle performance adaptations after 3 and 6 wks of BR HIIT.

<table>
<thead>
<tr>
<th>Test</th>
<th>Control 3 wks</th>
<th>Experimental 6 wks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper body MVO2 (ml/kg/min)</td>
<td>36.5±5.5</td>
<td>39.9±7.1</td>
</tr>
<tr>
<td>Isometric shld flexion (lb)</td>
<td>31.5±5.5</td>
<td>34.3±5.5</td>
</tr>
<tr>
<td>Isometric shld extension (lb)</td>
<td>46±8.7</td>
<td>49.6±6.6</td>
</tr>
<tr>
<td>Dynamic shld power (N)</td>
<td>3904±528</td>
<td>4724±528</td>
</tr>
</tbody>
</table>

**Conclusion:**

**CONCLUSION:** 3 wks of BR HIIT may significantly increase upper body MVO2, and upper body skeletal muscle strength, endurance and power in male and female university students.
24 and 48 hrs post-exercise. Serum levels of TSH, FT4 and PRL were measured by ELISA using commercially available kits. Two-way ANOVA was used for statistics and data are presented as mean±SE. RESULTS: TSH levels peaked at 0.5 hr post exercise, both before (3.41±0.44, 4.85±1.54, 3.14±0.283, and 2.91±0.31 µIU/ml at baseline, 0.5, 24, and 48 hrs post-exercise, respectively) and after the 3-week HIIT regimen (2.55±0.34, 1.44±0.70, 2.44±0.22, and 2.37±0.49 µIU/ml at baseline, 0.5, 24, and 48 hrs post-exercise, respectively). FT4 levels peaked 24 hrs post exercise, both before (2.70±0.17, 2.90±0.17, 3.16±0.12, and 2.77±0.07 µIU/ml at baseline, 0.5, 24, and 48 hrs post-exercise, respectively). PRL levels peaked at 0.5 hrs post exercise, both before (38.30±9.69, 50.66±13.52, 27.86±4.40, and 20.14±7.90 µg/ml at baseline, 0.5, 24, and 48 hrs post-exercise, respectively, and after 3-week HIIT regimen (2.70±0.17, 2.90±0.17, 3.16±0.12, and 2.77±0.07 µIU/ml at baseline, 0.5, 24, and 48 hrs post-exercise, respectively). Reaching statistical significance compared to baseline only after the 3-week regimen (p<0.01). CONCLUSION: Our findings suggest that HIIT triggers mild acute hormonal changes, particularly of PRL, which may reflect regulatory responses to exercise-induced stress; however more studies are needed to further characterize the hormonal responses to HIIT in humans.

3143 Board #12
June 2 8:00 AM - 9:30 AM
The Physical and Psychological Effects of Tactical High-Intensity and Jiu-Jitsu Training on Law Enforcement Officers
Charlie Shervheim, Nick Powell, Maxwell Rasmussen, Jennifer DysterHeft. Hamline University, St. Paul, MN. (Sponsor: Robert Pettitt, FACSM)

Law enforcement officers (LEO) require speed, strength, agility, and endurance for their job; however, the training requirements for many LEO departments are minimal. Tactical-specific high-intensity interval training (TS-HIIT) and jiu-jitsu martial arts practices are theoretically effective in improving performance in tactical fields, however no research exists on this. PURPOSE: To examine whether TS-HIIT and jiu-jitsu training is more effective than current training practices to improve physical and psychological variables of experienced LEO. METHODS: 10 experienced LEO were recruited from local departments. Baseline testing included the Perceived Stress Scale (PSS), WHO Quality of Life (WQ), General Self-Efficacy Scale (GES), and skill-test. The skill-test examined upper-body maneuverability, heavy-object manipulation, lower-body power output, shooting accuracy, general grappling/gun retention, memory recall, and decision-making. LEO then completed a six-week TS-HIIT and jiu-jitsu program for three hours per week. LEO repeated baseline measures after completion and will again at three months post-completion. Results: Despite previous experience, 65% of LEO failed baseline tests. Preliminary t-test analysis revealed significant improvements in grappling technique, timing, and score (p = 0.02) as well as time to complete the skill-test (2.7 to 1.65 s; p = 0.01) post-intervention. Improvements on the grappling test were noted by less time gain control of the situation, prolonged time to failure, or improving from failed baseline tests to passing post-intervention. Two of the 10 LEO did not improve on the grappling test. LEO recalled 30% more phrases during the memory retention test post-intervention (p = 0.01). Post-intervention, there was no significant change in shooting accuracy (p = 0.37), perceived stress levels, (PSS; p = 0.58), or perceived quality of life (WQ; p = 0.30). The decision-making task was removed due to a number of participants having already viewed the specific scenarios used during data collection. Conclusion: Preliminarily, results indicate that a TS-HIIT and jiu-jitsu program may be critical for improving LEO fitness levels, memory retention, and gun retention skills. Three-month follow-up testing will be completed January 2018 to examine skill retention.

G-35 Free Communication/Poster - Running
Saturday, June 2, 2018, 7:30 AM - 11:00 AM
Room: CC-Hall B

3144 Board #13
June 2 8:00 AM - 9:30 AM
Longitudinal Comparison Of Polarized Vs. High Intensity Multimodal Training In Recreational Runners
Andrew Carnes. Bellarmine University, Louisville, KY. (Sponsor: Sara E. Mahoney, FACSM)

Empirical endurance training studies support a polarized distribution, i.e., a high volume of low intensity training combined with less at high intensity. Few studies include recreational runners, who typically train with low volume. CrossFit Endurance® (CFE) targets these runners, emphasizing low volume, high intensity intervals and multimodal circuit training. Anecdotally, CFE enhances performance to a similar extent as higher volume run training, but empirical data have not been available. PURPOSE: Longitudinally compare changes in performance and fitness after 12 weeks of CrossFit Endurance® or polarized training in recreational runners. METHODS: Twenty-six (N=21) participants completed 12 weeks of CrossFit Endurance (CFE), n=12, or polarized endurance training (PET), n=9. Both groups trained 5 d·wk⁻¹. PET ran 5 d·wk⁻¹ while CFE ran 3 d·wk⁻¹ and performed CrossFit 3 d·wk⁻¹ (run = 1 d·wk⁻¹). Duration, intensity, and distance were recorded via GPS and HR monitoring. RESULTS: TSH levels peaked at 0.5 hr post intervention (295 ± 67 min · wk⁻¹), predominantly in Z1 (86% in Z1/Z2). CFE emphasized lower volume (110 ± 18 min · wk⁻¹) 23 running (48/52% Z1/Z2). Performance (5-km TT) was assessed at baseline (BL) and at 6 (MID) and 12 weeks (POST). VO₂ max and body composition (BC) were assessed at BL and POST. Two-way ANOVA showed a significant main effect of time on TT (F = 40.1, p < .001, η² = 0.74), VO₂ max (F = 24.0, p < .001, η² = 0.56), and BC (F = 20.2, p < .001, η² = 0.31), and a significant group/time interaction on VO₂ max (F = 4.13, p = .05, η² = 0.18). Both groups (p < 0.01) improved TT from BL-POST (-88 ± 55 s), BL-MID (-57 ± 40 s), and MID-POST (-31 ± 37 s). VO₂ max (46.2 ± 6.8 to 49.1 ± 7.4 ml kg⁻¹ min⁻¹) and BC (15.5 ± 6.7 to 13.0 ± 6.9 %BF) improved. BL - POST (p < .001 for both). However, the VO₂ max increase was larger in PET (4.3 ± 3.6 vs. 1.7 ± 1.9 ml kg⁻¹ min⁻¹). No interaction occurred for TT (F = 0.23, p = .79) or BC (F = 0.02, p = .88). CONCLUSION: Recreational runners achieved similar improvement in 5-km performance and body composition through polarized training or CFE, but PET yielded a greater increase in VO₂ max. Both programs appear efficacious for recreational athletes. Extrapolation to longer distances requires additional research. PURPOSE: Inspiratory muscle training (IMT) is a form of resistance training for the muscles primarily involved in the processes of breathing using a resisted breathing trainer. However, the optimal IMT loading parameters to elicit specific physiological adaptations are unknown. The authors adopted a dose-response design to determine the IMT load most effective for enhancing various inspiratory muscle function characteristics and performance. METHODS: 29 trained runners performed a 1-mile (1609-m) time trial and a series of breathing tests using an inspiratory breathing trainer and software. Runners were then randomly assigned to 1 of 5, six week IMT programs ranging in resistance from 30-80% of peak strength index (S₂₀,peak) in 5 in 6 week increments. Maximal and submaximal inspiratory breathing tests were repeated each week and 1-2 week post training was performed after six weeks. To identify the optimal IMT group (resistance) for each measure, each runner’s percentage change was modeled as a quadratic function of the rank order of the intensity of IMT. Uncertainty in the optimal IMT and in the corresponding effect on the given measure was estimated as 95% confidence limits (CL) using bootstrapping. RESULTS: There was a clear optimum for performance at Group 3.2 (52% of S₂₀,peak) with a possibly beneficial effect of 3.2% (CL = 2.8-3.5%). There was a strong trend toward Groups 2 (3.40-50% of S₂₀,peak) having the optimal IMT resistance to improve S₂₀,peak (mean improvement of 36.5%, CL = 29.2-45.7%), peak inspiratory flow (19.5%, 13.3-24.4%), training load (37.8%, 27.4-46.3%), flow (40.3%, 28.6-54.1%), power (52.3%, 43.5-65.1%), and energy (45.6%, 29.4-60.9%) with very-likely beneficial effects on all measures. Improvements in inspiratory volume (15.3%, 10.7-17.4%) were optimal at Group 4 (60% S₂₀,peak). Correlations between changes in performance and changes in inspiratory muscle function characteristics were trivial-small. IMT training at 2-wk was unlikely or possibly beneficial with the magnitude of effects trivial-small. At 4- and 6-wk, effects were greater and more beneficial than the previous 2-wk with no visual plateau in improvements. CONCLUSION: IMT between 40-50% of S₂₀,peak appears to be optimal for most inspiratory muscle characteristics, while IMT at slightly higher resistances (~52% S₂₀,peak) is optimal for 1-mile performance.
Running economy (RE) determines the difference in distance running performance in highly-trained runners. Studies have highlighted RE importance during high-intensity running. Although RE is related to ground contact time (TC), the relationship between RE at high-intensity running and TC is not elucidated. It is also unclear whether the hamstrings muscle, which contributes to high-intensity running, affect RE and TC. PURPOSE: We aimed to clarify the relationships among RE, TC at intensity below and above the lactate threshold (LT) run, and hamstring muscle’s cross-sectional area in highly-trained long-distance runners. METHODS: We enrolled 11 highly trained male distance runners (IAAF score: 1038 ± 48). They underwent treadmill running test to assess the LT, and RE was evaluated at 270 (RE270) and 360 min (RE360) as the intensity below and above the LT, respectively. TC was calculated as the rate of loading (ROL) was derived. Average peak values were calculated for the right and left legs, and were pooled for all analyses. Simple and multiple linear regression models were used to assess associations between input (body mass, GRF, RoL) and output variables (BMD, VO\textsubscript{max}). In addition, a three-layer feedforward ANN with 20 hidden neurons was trained fifteen separate times to also model the same associations. The prediction function of all models was compared based on their associated correlation coefficients. Further, the root mean squared error (RMSE) of the multilinear regression model and ANN were also compared. RESULTS: Significant simple linear correlations were found between BMD and body mass (r = 0.645, p = 0.008), BMD and GRF (r = 0.534, p = 0.038), and BMD and RoL (r = 0.567, p = 0.025). In addition, a multiple linear regression model (adjusted r = 0.630, p = 0.001, RMSE = 0.161) and ANN (training r = 0.865, p = 0.001; test r = 0.697, p = 0.003; RMSE = 0.161) were also able to fit predict the association between input and output variables. CONCLUSIONS: An ANN can feasibly predict BMD in distance runners, and is able to do so better than standard regression models. While the developed ANN performed well with the inputs of body mass, GRF, and RoL, there are other variables (e.g., stride parameters or calf muscle volume) that should be included in future studies, as they are easier to assess and would provide a more holistic model of known risk factors for stress fractures in distance runners.

Longer tendons have been shown to be related to better running economy because longer tendons can store more energy to produce more force during concentric contraction. Running economy is traditionally defined as having a lower VO\textsubscript{max} at the same submaximal speed. However, studies have not tested if this relationship also occurs in male and female elite distance runners at faster speeds. PURPOSE: To determine if Achilles tendon length influences running economy. METHODS: The researchers used ultra sound technology to measure the right Achilles Tendon length of twenty-two varsity collegiate runners (20.09 ± 1.63 yrs), 12 males (178.44 ± 6.74 cm, 65.21 ± 6.62 kg) and 10 females (167.22 ± 7.73 cm, 54.45 ± 4.80 kg). After the researchers measured Achilles Tendon length, participant completed a VO\textsubscript{max} test and running economy was determined by assessing VO\textsubscript{max} at submaximal speeds. The men ran at speeds of 10.0, 10.4 and 10.8 mph, and the females ran at speeds of 8.4, 8.8, and 9.2 mph. The relationship between tendon length and running economy was assessed using Pearson correlation coefficients. RESULTS: For collegiate male runners, there was a significant negative relationship between Achilles Tendon length and running economy (r = -0.76 ± 0.71, p < 0.01). When tendon length was normalized to height (tendon length/height) the relationship between tendon length and running economy was no longer significant (r = -0.32 ± -0.24, p = 0.32-0.45). For collegiate female runners, there was no significant relationship between Achilles Tendon length and running economy alone (r = -0.17 ± 0.15, p > 0.08). When tendon length was normalized to height (r = -0.35 ± 0.44, p = 0.23-0.40). CONCLUSION: These findings indicate that longer Achilles Tendons in collegiate male runners are related to improved running economy. In collegiate female runners, tendon length is not significantly associated with running economy. However, there was a negative correlation between Achilles Tendon length and running economy for the males and a positive correlation for the females indicating that longer tendon length might be more beneficial for male runners and shorter tendon might be slightly more economical for females. Other factors besides tendon length attribute to running economy, but this study indicates that for male’s tendon length plays a role in running economy.
Competition pants, waist to ankle, have grown in popularity among recreational and athletic populations for improving performance, however, minimal is known about the effects of compression pants on submaximal exercise. PURPOSE: The purpose of this study was to investigate the impact of wearing compression pants on physiological responses to a 12 min run. METHODS: College aged males (n=8) participated in three separate running sessions. Subjects initially performed a graded exercise test to anchor the RPE scale. Thereafter subjects were assigned to run on a treadmill at a set speed of 8 mph for 12 minutes either while wearing or not wearing compression pants, order of tests was randomized. Lactic acid, HR, and RPE were recorded every 3 minutes during the test, and every 3 minutes after the test for 6 minutes. Subjects were instructed to wear the pants for no longer than 30 minutes prior to the running tests. Dependent T-tests were performed on LA, HR, and RPE at each 3 minute measurement of the test and recovery, with an alpha set at p<0.05. RESULTS: Lactic acid levels were significantly lower (p<0.05) with compression pants on at the 12 and 18 minute marks. RPE was significantly higher (p<0.05) with the compression pants on at the 3 and 6 minute marks. No other significant differences (p>0.05) were found in RPE and no significant differences (p>0.05) were found in HR.

### RESULTS

<table>
<thead>
<tr>
<th>Test</th>
<th>With Compression</th>
<th>Without Compression</th>
</tr>
</thead>
<tbody>
<tr>
<td>LA (mmol/l)</td>
<td>9.78 (5.95)</td>
<td>11.18 (6.56)</td>
</tr>
<tr>
<td>HR (bpm)</td>
<td>135 (18.85)</td>
<td>135 (18.85)</td>
</tr>
<tr>
<td>RPE</td>
<td>10.63* (1.4)</td>
<td>9.5* (1.93)</td>
</tr>
</tbody>
</table>

*p<0.05* CONCLUSION: Wearing compression pants was shown to lower your lactic acid levels at the 12 min point and 6 min point after completion of submaximal exercise. RPE was shown to be higher initially but then the differences became non-significant. Compression pants were shown to not make any significant changes in HR.

### PURPOSE:

1. To determine if there are sex differences in critical speed (CS) and D' for both model to predict CS, and 3) to determine the percent of CS various races are run at in elite track and field athletes.

### METHODS:

Inclusion criteria were athletes with personal best times in each of the races are run at in elite track and field athletes.

### RESULTS:

*Table 1:*

<table>
<thead>
<tr>
<th>Test</th>
<th>With Compression</th>
<th>Without Compression</th>
</tr>
</thead>
<tbody>
<tr>
<td>LA (mmol/l)</td>
<td>9.78 (5.95)</td>
<td>11.18 (6.56)</td>
</tr>
<tr>
<td>HR (bpm)</td>
<td>135 (18.85)</td>
<td>135 (18.85)</td>
</tr>
<tr>
<td>RPE</td>
<td>10.63* (1.4)</td>
<td>9.5* (1.93)</td>
</tr>
</tbody>
</table>

### CONCLUSIONS:

As CS represents the greatest wholly oxidative metabolic rate, men's faster CS is likely due to their known ability for greater oxygen delivery and consumption (adjusted for weight). The lack of difference in D' may be due to similar phosphocreatine stores (per kg dry muscle mass) between sexes. Additionally, coaches and athletes that want to know CS for training design or race pacing applications may be able to utilize the prediction equations if data on a full range of performances is not available.

### PURPOSE:

Aging is associated with decreased autonomic balance which could be assessed by Heart Rate Variability (HRV). Exercise training improves autonomic balance, but there is a lack in the literature regarding the HRV profile of middle-aged sprinters and endurance runners. PURPOSE: The effects of lifelong endurance and sprint training on cardiac autonomic balance were assessed in middle-aged master athletes, and compared with age-matched controls and young untrained individuals. METHODS: Participants (n=81) were 8 master sprinters (MS; 51.75±11.08yrs), 8 endurance runners (EN, n=8), 51.14±5.26yrs), 15 age-matched untrained, (CON-matched untrained, 28.72±5.3 yrs). The cut-off of 45 yrs for adults was derived from a lower HR at lower ages. For the acquisition of RR intervals (iRR) (Polar RS800X Heart Rate Monitor®) the participants remained seated for 15-min, with the final 10-min being considered for analysis. HRV was measured using Kubios software. A two-way ANOVA with repeated measures was applied. RESULTS: All studied parameters did not differ between MS and EN. Time domain [HR (bpm) 59.0±6.13 vs. 58.9±4.12.75], [R-R (ms) 1035.43±11.74 vs. 1068.77±20.17] [SDNN (ms) 57.3±20.07 vs. 80.6±67.71], [RMSSD (ms) 40.88±20.07 vs. 38.93±20.44]; Non-linear domain [SD1 (ms) 28.9±14.20 vs. 27.56±14.46], whose demonstrated a reduced HR and elevated mean R-R intervals in comparison to both YC [HR (bpm) 69.64±9.81] and [R-R 88.33±12.11] and age-matched individuals [HR (bpm) 70.56±16.63] and [R-R (ms) 865.17±83.99]. It was observed a lower HRV for middle-aged CON [(RMSSD (ms) 20.3±5.87), [SDNN (ms) 37.79±10.15] and [SD1 (ms) 14.31±14.15] compared to YC [(RMSSD (ms) 43.33±26.41), [SDNN (ms) 67.07±28.77] and [SD1 (ms) 30.66±18.69; p<0.05]]. These last age-related changes were not observed for MS and EN. CONCLUSION: For the master athlete, regardless of being endurance runner or a sprinter, both training modes are similarly beneficial, attenuating the effects of aging on the autonomic balance.

### PURPOSE:

A Comparison of Two VO2max Treadmill CPETs in Highly Trained Distance Runners

RYAN A. VANHOY1, STEPHANIE A. SULLIVAN1, CLAUDIO L. BATTAGLINI, FACSM2. 1University of Mississippi, University, MS. 2University of North Carolina at Chapel Hill, Chapel Hill, NC. (Sponsor: Claudio Battaglini, FACSM)

### METHODS:

Measuring maximal oxygen consumption (VO2max) via treadmill testing is a popular procedure for testing aerobic power and subsequently developing exercise prescriptions. Previous studies have produced conflicting results when comparing horizontal and inclined graded treadmill protocols designed to assess VO2max, and the variability may be due to the heterogeneity of subjects, having different fitness levels and backgrounds. PURPOSE: To prospectively compare the VO2max value attained during a horizontal (increment in speed only) (SOVO2max) and an inclined (speed increment in grade only) (GOVO2max) cardiorespiratory exercise tests (CPETs) in highly trained distance runners. A secondary purpose examined if the ventilatory threshold (VT) determined from the SOVO2max and GOVO2max CPETs occurred at the same percent of VO2max (bpm) and % VO2max (bpm) and % VO2max. METHODS: Healthy, nonsmoking, middle-aged male distance runners (n=8) were evaluated in 16 male distance runners, some who preferred hilly terrain and others who favored running on the flat surfaces. Measurements were performed on each individual during each protocol. Heart Rate Variability (HRV) was assessed during each test, and at the beginning and end of each test. RESULTS: The VO2max values were significantly higher from the GOVO2max CPET in comparison to the SOVO2max CPET (77.5% and 77.2%, p=.825). Non-significant differences were noted between the VO2max values attained on the SOVO2max and GOVO2max CPETs. Dependent samples t-tests were used to compare the VO2max values from the SOVO2max and GOVO2max CPETs occurred at the same percent of VO2max (bpm) and % VO2max (bpm). There was no significant difference between the VO2max values from the SOVO2max and GOVO2max CPETs. Dependent samples t-tests were used to compare the VO2max values at VT results between the SOVO2max and GOVO2max CPETs. RESULTS: VO2max values were significantly higher from the GOVO2max in comparison to the SOVO2max protocol (76.1 and 71.2 mL/kg/min, p=.005); however, the % VO2max @ VT was not significantly different between the GOVO2max and SOVO2max protocols (77.5% and 77.2%, p=.825).

### CONCLUSION:

Higher VO2max values were attain on the GOVO2max CPET, even on those athletes who reported they were track athletes and favored running on the flat surfaces. These results agree with previous research that found athletes who train and compete on an exclusively flat surface or hilly terrain both tend to produce higher VO2max values on CPETs that include changes in treadmill grade. However, due to the non-significant difference in % VO2max @ VT observed between the SOVO2max or GOVO2max CPETs.
It was also revealed that vitamin C intake and hours of sleep did not affect this. Results suggest that as daily mileage increases there is a greater likelihood of URI. Correlations revealed a significant negative relationship between URI and daily mileage for each of the cross country athletes throughout the duration of this study. The incidence of upper respiratory illnesses (URI) within endurance sports is commonplace and often results in decreased athletic performance. For this reason, avoidance of these illnesses is of utmost importance to the athlete. Previous research has identified a positive relationship between running mileage and frequency of URI; however, defining this threshold in terms of intensity and duration of exercise has not been well established. Little is known about underlying factors influencing this relationship. Greater insight into the relationship between mileage and URI will allow for better training and can help establish best practices for creating programs that can reduce the occurrence of URIs. PURPOSE: The purpose of this study was to investigate the relationship between endurance training and immune function.

METHODS: Participants (N = 25, 13 females, 12 males; mean age 19 ± 3 years) were college undergraduate students. A survey consisting of the Wisconsin upper respiratory illness (URI) self-report questionnaire was distributed before, during, and after an 8-week training period. URI symptoms were measured as the number of days lost from training per week due to URI.

RESULTS: An acute (i.e., at baseline testing) effect was observed for URI symptoms (p = 0.04) and FMS (m = -1.28, p = 0.03) and no significant differences in pain. CONCLUSIONS: Hip abductor strength training was observed to reduce hip drop angles and increase FMS scores which may lead to better posterior hip mechanics. These improvements alone however, will not reduce pain in recreational runners with chronic leg pain. Given the limited sample size, further research is warranted to identify what factors contribute to chronic pain reduction in recreational runners.

Highly cushioned shoes (HCS) are a popular choice for road and trail runners. Manufacturers suggested extra cushioning potentially reduces injury rates through superior shock absorption, implying less impact upon foot strike versus standard cushioned shoes (SCS). PURPOSE: To examine the effects of a 4-week HCS intervention on running-related impact forces in adult recreational runners. METHODS: Twenty-nine healthy runners (18-60 yrs of age) who had never worn HCS were randomized to either HCS intervention (INV) or SCS control (CON) groups, and wore HCS or SCS a majority of each training week. During pre and post-tests in a lab, all participants wore SCS first, followed by HCS, while running overground at a self-selected, monitored pace and striking embedded force plates in up to 30 total trials/session, at least 10 trials/shoe, to obtain impact peak (PK1) and active (PK2) forces, instantaneous loading rate (ILR), average loading rate (ALR), and contact time (CT). Runners recorded daily training data for 4-weeks. A repeated measures, mixed ANOVA was utilized to detect differences between shoes and groups. RESULTS: At pretesting, when comparing pooled data in SCS to HCS, no significant differences were found and all effect sizes were small. The acute (i.e., at baseline testing) response to the shoes yielded no statistically significant difference between shoe types. Additionally, there was no statistically significant difference between shoes over time (p >0.05) or between the groups over time (p>0.05). ILR was the variable closest to significance (p=0.066) with a small effect size (0.120). CONCLUSION: HCS do not cause alterations in ground reaction forces over a short-term (4-week) habituation period in recreational runners. Interestingly, there was a high drop-out rate in the HCS group of 18% due to self-reported adverse reactions (e.g., numbness, bruising, pain), but results indicated no differences in loading characteristics between shoe types. Still, transitioning to HCS should be a gradual process; however, more research is warranted in long-term HCS usage.
Acute bouts of prolonged endurance exercise have been found to significantly decrease body mass. Some researchers suggest that a decrease in body mass may improve performance in weight-bearing exercise. Yet, other researchers suggest the decrease in body mass may impair exercise performance. PURPOSE: The purpose of this study was to investigate the association between race time with changes in body mass (BM) and total body water (TBW) in ultramarathon runners. METHOD: 10 ultramarathon runners (age = 36.4 (10.0) years, race time = 5.7 (1.5) hours) were assessed with the InBody 270 bioelectrical impedance analysis (BIA) before and after a 50k race. The InBody 270 BIA measured BM, skeletal muscle mass (SMM), fat mass (FM), and total body water (TBW). Race time was recorded as the runners crossed the finish line. Statistical analysis was performed using paired t-test, multiple linear regression and Pearson’s correlation. RESULTS: BM significantly decreased by 2.15 (1.44) kg (p < 0.001) while TBW showed a nonsignificant increase of 0.93 (1.79) kg (p = 0.134). SMM decreased by 1.1 (1.24) kg (p = 0.023) and FM decreased by 3.67 (1.83) kg (p < 0.001). There was a positive correlation between race time and age (r = 0.676, p = 0.032). Multiple linear regression suggested that change in BM and TBW predicted 10% of the variance in race time. CONCLUSIONS: Change in BM and TBW were not significantly associated with race time. BM was significantly decreased following the ultramarathon race. A limitation of the study is the small sample size. Therefore, additional research is needed to examine the relationship between performance and changes in BM in a larger sample size of ultramarathon runners.

Running economy (RE) is an important component of distance running performance. Recent evidence suggests shorter stance times (ST) are related to superior RE and may help improve performance in weight-bearing exercise. Yet, other researchers suggest the decrease in body mass may impair exercise performance. PURPOSE: To date, 36 runners have been enrolled in a prospective injury for a minimum of 6 months. An average of 1.2 ± 0.8 injuries have been sustained by 19 runners. Weekly running volume (Rvol), running time, non-running exercise time, and RROI were recorded in a weekly online survey. RROI was defined as pain resulting in any reduction or stoppage of planned running. For each week of enrollment, AC ratio was calculated for running mileage (AC-vol), running time (AC-RT), and all-type exercise time (AC-ET) as the current week value divided by the mean of the previous four weeks. The average AC ratio was calculated across weeks from enrollment to date of injury for members of the injured group. AC ratio was calculated for all weeks of enrollment for members of the uninjured group. Univariate tests were used to assess the differences between injured and uninjured groups (α = 0.05). All variables were entered into a stepwise logistic regression model to determine the explanatory variables related to RROI incidence (α = 0.15). RESULTS: Significant differences between injured (I) and uninjured (U) groups were found for Rvol (I = 12.9 ± 8.9; uninjured 19.7 ± 14.4, P = 0.013), AC-vol (I = 0.86 ± 0.26; U = 1.01 ± 0.09, P = 0.001) and AC-RT (I = 0.94 ± 0.46; U = 1.06 ± 0.13, P = 0.036). No other variables were significant between groups (P > 0.05). Stepwise logistic regression identified that number of RROI, age, and mass were significant predictors of AC-vol (P = 0.131) and that years running, height, and BMI were significant predictors of AC-RT (P = 0.030). No significant predictors were identified for AC-ET (P > 0.15). CONCLUSIONS: AC ratio using running time was a better predictor of RROI incidence than average miles/week, years running, and other common training variables. Reducing mileage or infrequent running training may increase the risk of RROI. AC ratio should be above 0.86 to prevent RROI, which is similar to the minimum threshold value for other sports reported in previous studies. Further study is needed to assess a maximum and minimum AC ratio that is considered ‘safe’ to prevent RROI.
MEAN Y-BALANCE SCORE (reach / limb length)

<table>
<thead>
<tr>
<th>Gender</th>
<th>Anterior</th>
<th>Postero-</th>
<th>Postero-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>0.65 ± 0.05</td>
<td>1.13 ± 0.08</td>
<td>1.06 ± 0.09</td>
</tr>
<tr>
<td>Women</td>
<td>0.69 ± 0.07</td>
<td>1.20 ± 0.19</td>
<td>1.10 ± 0.08</td>
</tr>
</tbody>
</table>

FUNCTIONAL MOVEMENT SCREEN (1-3 Scale, % of Athletes Scored In Each Category)

<table>
<thead>
<tr>
<th>FMS SCORE</th>
<th>Deep Squat</th>
<th>Hurdle Step</th>
<th>Inline Lunge</th>
<th>Shoulder Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>33%</td>
<td>8%</td>
<td>0%</td>
<td>14%</td>
</tr>
<tr>
<td>2</td>
<td>67%</td>
<td>75%</td>
<td>100%</td>
<td>50%</td>
</tr>
<tr>
<td>3</td>
<td>0%</td>
<td>17%</td>
<td>0%</td>
<td>30%</td>
</tr>
</tbody>
</table>

| Women     |            |             |              |                   |
| 1         | 0%         | 0%          | 0%           | 0%                |
| 2         | 94%        | 63%         | 28%          | 44%               |
| 3         | 6%         | 38%         | 72%          | 56%               |

<table>
<thead>
<tr>
<th>Sig. Gender Diff.</th>
<th>p&lt;0.05 NS</th>
<th>p&lt;0.05 NS</th>
<th>p&lt;0.05 NS</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMS SCORE</td>
<td>Straight Leg Raise</td>
<td>Trunk Stability</td>
<td>Pushup</td>
</tr>
<tr>
<td>Men</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>6%</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>2</td>
<td>47%</td>
<td>56%</td>
<td>94%</td>
</tr>
<tr>
<td>3</td>
<td>47%</td>
<td>39%</td>
<td>0%</td>
</tr>
</tbody>
</table>

| Women     |            |             |          |                   |
| 1         | 0%         | 22%         | 11%      |                   |
| 2         | 16%        | 44%         | 79%      |                   |
| 3         | 84%        | 22%         | 0%       |                   |

Table 1. Values are presented as means ± SD for Y-balance scores. Y-balance scores represent averaged means of left and right limbs. For FMS scores, the proportion of each gender that scored 1 (worst), 2, or 3 (best) for each test was calculated based on range of motion. Type I error set at α=0.05.
3165 Board #34 June 2 8:00 AM - 9:30 AM

Knee Alignment And Muscle Strength Ratios In Division III Female Soccer Players With Reconstructed Anterior Cruciate Ligament

Nina M. Robinson, Ana B. Freire Ribeiro. Augsburg University, Minneapolis, MN. (Sponsor: Dr. Mark Blegen, FACSM)

(No relevant relationships reported)

RESULTS: There were no differences in KV A between groups in any of the drills. There was a significant difference in quadriceps to hamstring ratio between injured and non-injured athletes (p=0.03), with injured individuals having an average ratio of 0.89 and non-injured 0.71. No significant difference was found in KVA from VDJ between injured and non-injured subjects (p=0.87). No significant relationship was found between KVA and quadriceps to hamstring ratios.

CONCLUSION: There are significant differences in hamstring to quadriceps strength ratios in injured female Division III soccer players compared to non-injured, suggesting it is a better screening than VDJ. KVA cannot be predicted by quadriceps to hamstring ratio and injury history.

3166 Board #35 June 2 8:00 AM - 9:30 AM

Knee Biomechanics in Division III Female Soccer Players With Reconstructed Anterior Cruciate Ligament (ACLR)

Marissa Guilou, Ana B. Freire Ribeiro. Augsburg University, Minneapolis, MN. (Sponsor: Dr. Mark Blegen, FACSM)

(No relevant relationships reported)

PURPOSE: To compare knee valgus angles and the hamstring to quadriceps femoris strength ratio between healthy female Division III soccer athletes and athletes with ACL reconstruction, as surrogates for knee (re)injury risk.

METHODS: Thirteen non-injured and three injured athletes completed a vertical drop jump (VDJ) from a 31 cm box and a Repetition Maximum tests (1RM) using seated knee curl and seated knee extension machines. Baseline and landing knee valgus angles (KVA) were measured using Dartfish software.

RESULTS: There was a significant difference in quadriceps to hamstring ratio between injured and non-injured athletes (p=0.03), with injured individuals having an average ratio of 0.89 and non-injured 0.71. No significant difference was found in KVA from VDJ between injured and non-injured subjects (p=0.87). No significant relationship was found between KVA and quadriceps to hamstring ratios.

CONCLUSION: There are significant differences in hamstring to quadriceps strength ratios in injured female Division III soccer players compared to non-injured, suggesting it is a better screening than VDJ. KVA cannot be predicted by quadriceps to hamstring ratio and injury history.

3167 Board #36 June 2 8:00 AM - 9:30 AM

Sweat Loss In Association With Measures of External Load in Adolescent Soccer Players


Reported Relationships: T.J. Roberts: Salary; This study was funded by the Gatorade Sports Science Institute. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc.

BACKGROUND: The use of technology to track workload and measurements of sweat loss to prescribe hydration strategies are now common practice. No study has explored the association of load variables to sweat loss in soccer athletes.

PURPOSE: To determine the association of load measures (total distance (TD), energy expenditure (EE), body mass (BM), and sweat loss in adolescent soccer athletes during organized practice.

METHODS: Thirty-two adolescent soccer athletes (Male: n=16, 17 ± 1 y, 71.4 ± 6.7 kg; Female: n=16, 18 ± 1 y, 64.0 ± 8.4 kg) had workload measured during 5 in-season practices (21 9-25.4°C WBGT) using GPS/accelerometer technology. Total sweat loss was calculated from pre- to post-exercise change in BM, corrected for fluid/intake (ad libitum), urine output, metabolic mass loss, and respiratory water loss. Practice type was assessed subjectively and categorized as small or large-sided game/drills based on the activities engaged in during the majority (>50%) of the practice time. Girls practice 1 and 2 and boys practice 2 were small-sided. Girls practice 3 and boys practice 1 and 3 were large-sided. Multiple linear regression analyses were used to model the effects of independent variables (BM, EE, and TD) on total sweat losses.

RESULTS: Boys covered 4.7 ± 1.4 km and expended 1595 ± 481 KJ (381 ± 115 kcal) in 81 ± 13 min practices. Girls covered 4.4 ± 0.9 km and expended 1310 ± 299 KJ (313 ± 72 kcal) in 81 ± 7 min practices. Total sweat loss was 1.3 ± 0.3 L in boys and 0.8 ± 0.2 L in girls. Models to predict sweat loss included: 1) BM and EE; and 2) BM and TD. Model 1 was significant in both boys and girls during practice 1 (r²=0.72, p<0.001) and 3 (r²=0.60, p<0.01), but not practice 2 (r²=0.38, p>0.06). Model 2 was significant in girls during practice 3 (r²=0.57, p<0.01), but not practice 1 (r²=0.36, p=0.11) or 2 (r²=0.32, p=0.12). Model 2 (not reported) was largely identical. CONCLUSION: The association between total sweat loss, BM, and workload was inconsistent among practices, which may be explained in part by practice type. Significant prediction models were found during practices that consisted of predominately small-sided game/drill scenarios. This work provides a literature base for the exploration of associations between workload measures and physiological/metabolic variables.

Implementation of an anterior cruciate ligament (ACL) injury prevention program (IPP) has been recommended to coincide with the adolescent growth spurt as risk factors increase during and following this phase of maturation. Physiological responses to load during this stage of growth may result in a differing maximum heart rate (HRmax) due to the differing maximum heart rate (HRmax) due to maximum heart rate (HRmax) due to differing maximum heart rate (HRmax). The study aimed to examine the association of maturation on HRmax during an IPP in adolescent soccer players. PURPOSE: To examine the effects of maturation on HRmax in adolescent soccer players over a six-week training program. METHODS: 34 female soccer players participated in a 6-week training study (age 13.3±1.5y; height 158.7±6.0cm; mass 50.9±10.6kg). Maturation groups were determined based on percent of adult stature (PAS) with 88.4% representing pubertal (n=9, PAS 91.6±2.0%) and 95.4% representing post-pubertal (n=25, PAS 97.7±7.4%). Three 30 minute sessions, separated into plyometric, resistance, and core strength training, were completed each visit for a total training time of 90 minutes three times per week. Participants wore HR monitors during each plyometric session. The initial exercises were adapted from ACL IPP, and intensity of each exercise was progressed weekly following the second week of training (5 total phases). HRmax was calculated for each participant during each session and averaged weekly. A linear mixed model (p<0.05) was used to determine the effects of HRmax on exercise intensity. No study has explored the association of load variables to sweat loss in soccer athletes.

RESULTS: There were significant differences in hamstring to quadriceps strength ratios in injured female Division III soccer players compared to non-injured, suggesting it is a better screening than VDJ. KVA cannot be predicted by quadriceps to hamstring ratio and injury history.

CONCLUSION: The association between total sweat loss, BM, and workload was inconsistent among practices, which may be explained in part by practice type. Significant prediction models were found during practices that consisted of predominately small-sided game/drill scenarios. This work provides a literature base for the exploration of associations between workload measures and physiological/metabolic variables.

Effect of Maturation on Heart Rate During A Six-Week Plyometric Training in Female Soccer Players

Christina M. Mullen, Jeffrey B. Taylor, Michelle A. Aube, Audrey E. Westbrook, Anh-Dung Nguyen, James M. Smoliga, FACSM, Kevin R. Ford, FACSM. High Point University, High Point, NC. (Sponsor: Kevin R. Ford, FACSM)

(No relevant relationships reported)

PURPOSE: To examine the effects of maturation on HRmax in adolescent soccer players over a six-week training program. METHODS: 34 female soccer players participated in a 6-week training study (age 13.3±1.5y; height 158.7±6.0cm; mass 50.9±10.6kg). Maturation groups were determined based on percent of adult stature (PAS) with 88.4% representing pubertal (n=9, PAS 91.6±2.0%) and 95.4% representing post-pubertal (n=25, PAS 97.7±7.4%). Three 30 minute sessions, separated into plyometric, resistance, and core strength training, were completed each visit for a total training time of 90 minutes three times per week. Participants wore HR monitors during each plyometric session. The initial exercises were adapted from ACL IPP, and intensity of each exercise was progressed weekly following the second week of training (5 total phases). HRmax was calculated for each participant during each session and averaged weekly. A linear mixed model (p<0.05) was used to determine the effects of HRmax on exercise intensity. No study has explored the association of load variables to sweat loss in soccer athletes.

RESULTS: There were significant differences in hamstring to quadriceps strength ratios in injured female Division III soccer players compared to non-injured, suggesting it is a better screening than VDJ. KVA cannot be predicted by quadriceps to hamstring ratio and injury history.

CONCLUSION: The association between total sweat loss, BM, and workload was inconsistent among practices, which may be explained in part by practice type. Significant prediction models were found during practices that consisted of predominately small-sided game/drill scenarios. This work provides a literature base for the exploration of associations between workload measures and physiological/metabolic variables.
The Functional Movement Screen (FMS) is a battery of seven tests scored on a 0-3 scale that aims to identify imbalances and asymmetries in the body (Cook, 2014). Within the FMS, the deep squat (DS) and active straight leg raise (ASLR) are good predictors of injury (Hotta et al., 2015, Hammes et al., 2016, and Zaliak et al., 2019); therefore, they were tracked pre and post season, along with shoulder mobility (SM). Given that most soccer injuries occur during pre-season (Hootman et al., 2007, NCAAA, 2017), it is hypothesized that athletes would have lower scores at pre season.

**PURPOSE:** To compare pre and postseason DS, ASLR, and SM scores in NCAA DI female soccer players.

**METHODS:** Sixteen collegiate players were assessed in mid-August and late March. They completed the DS, ASLR, and SM tests and were rated by one athletic trainer certified in FMS. A paired t-test compared the pre and postseason scores.

**RESULTS:** The mean pre season total score was 6.62 (SD=0.89), while the post season mean was 6.88 (SD=1.15). Scores between the two seasons were not different (p=0.21). From pre to postseason, DS scores increased by 21% (p=0.059), ASLR scores increased by 5.8% (p=0.054), but SM scores decreased by 7% (p=0.18).

**CONCLUSIONS:** DS, ASLR, and SM scores did not significantly change from pre to post-season. Sport-specific tests and a more sensitive rating scale could have yielded different results and should be further investigated.

**3170 Board #39 June 2 8:00 AM - 9:30 AM Differences Between the Bilateral and Ipsilateral Strength Asymmetries With Respect to Age, Contraction Velocity and Limb Preferences in Female Soccer Players.**

Lucia Mala, Tomas Maly, Frantisek Zahalka, David Bujnovsky, Mikulas Hank, Michal Dragijsky. Charles University, FPES, Prague, Czech Republic.

(No relevant relationships reported)

During the soccer match, strength and power movements are accumulated on both lower extremities. This occurs in an asymmetrical manner and may gradually lead to higher shifts of myodynamic characteristics and strength asymmetries (SA). There are limited investigations of a combination of muscle SA and different age groups in female soccer players.

**PURPOSE:** To investigate of differences bilateral and ipsilateral SA in female soccer players of four age categories.

**METHODS:** Elite female players (n=67) of 4 age categories (U17=13, U19=18, U18=20 and U19=15) performed isokinetic strength testing (Cybex NORM Elite). Bilateral strength ratios (Q:Q, H:H) and ipsilateral strength ratios (H:Q) were evaluated. Three-way Mixed-design ANOVA with two between subject effect (Age, Limb) and one within subject effect (AV) were used for evaluation. Bonferonni’s post hoc test and partial eta square (η²) were also used for data analysis.

**RESULTS:** We found a statistically significant effect of AV on bilateral (F2,123 = 4.47, p<0.01, Wilk’s Λ = 0.92, η² = 0.08) and ipsilateral (F2,123 = 4.47, p<0.01, Wilk’s Λ = 0.93, η² = 0.07) SA in four age groups. We found a significant higher SA between KE compare to Q (F1,98 = 23.89, p<0.00, η² = 0.16). With increasing AV from 60 to 180°·s⁻¹, significant changes in H:H appeared (H:H = 0.71, p<0.05, η² = 0.03; Ipsilateral: F1,123 = 1.85, p<0.05, η² = 0.04). The interaction between “Age” and “Leg” had not significant effect (p=0.05) for SA on groups. Post hoc analysis showed in dominant leg a significant difference in H:Q = 57.32±0.92 % vs. H:Q = 57.61±1.17 (p<0.01). Totally, 17-25% risk results (20%) of H:H was found in players in comparison to 3-5% risk results in Q:Q.**

**CONCLUSION:** The KE demonstrated a higher degree of the bilateral ratio in comparison to KE. Seventeen players (25%) had SA in KE higher than 20% at least at one AV. More attention should be paid to KE, where a higher percentage of SA was observed. Higher percentage of SA was seen at higher AV. The results may be beneficial for fitness coaches, physiotherapists, doctors and other clinical staff of female soccer players.

**3171 Board #40 June 2 8:00 AM - 9:30 AM High Intensity Interval Training Does Not Improve Cardiorespiratory Parameters In Trained Young Soccer Players.**


(No relevant relationships reported)

Soccer performance is the result of technical, tactical and psychological attributes of the players. **PURPOSE:** The present study investigated the effect of high-intensity interval training (HIIT) and continuous moderate intensity training (CONT) on selected parameters of the cardiorespiratory function in young trained soccer players. METHODS: Thirty Greek amateur soccer players (mean ± sd, age 19 ± 2.11y, Body mass 71.19 ± 2.5 kg) were randomized into a high-intensity interval training group (HIIT, n = 10), a continuous moderate intensity training group (CONT, n = 10) and a control group (Control, n = 10). The intervention for HIIT and CONT groups was 16 more training sessions, 2 per week while CONTROL group continued regular soccer training routine. The HIIT group training sessions consisted either of 15s sprints interspersed by 15s of recovery at 120%VO2max with 8 min total exercise time or they played 4x 4min (min total time) small-sided games (4v4) followed by 2 min recovery interval. The CONT group training sessions consisted either of 40 min continuous running at 70%VO2max or 10v10 full field soccer game for 40min. **RESULTS:** Mean values ± sd pre and post training for Body weight, (HIIT: 69.49 ± 9.39 vs 69.0 ± 8.8 kg; CONT: 71.2 ± 9.93 vs 70.2 ± 11.01 kg), 60°·s⁻¹, (HIIT: 13.02 ± 2.41 vs 12.12 ± 2.49, CONT: 13.75 ± 2.19 vs 13.82 ± 2.21), VO2max, (HIIT: 55.8 ± 4.43 vs 57.75 ± 5.63, CONT: 56.46 ± 5.61 vs 58.41 ± 5.24 mL/kg·min⁻¹), vVO2max (velocity at VO2max), (HIIT: 15.9 ± 0.70 vs 16.5 ± 0.52, CONT: 16.5 ± 1.51 vs 16.7 ± 1.19 km·h⁻¹) and vVT (velocity at ventilatory threshold, HIIT: 11.8 ± 0.87 vs 12.5 ± 0.69, CONT: 12.4 ± 0.83 vs 12.5 ± 1.13 km·h⁻¹). VO2max, vVO2max and vVT improved 4.6, 1.6 and 5.6% only after HIIT training but the difference didn’t pass statistical significance due to large sd of the sample. **CONCLUSIONS:** In conclusion, the combination of the training regimens of this study did not improve cardiorespiratory parameters of endurance performance in already trained young soccer players. There was, though, a tendency for better adaptations favors the time efficient HIIT training.
HR monitoring, accelerometers, and GPS tracking have become popular tools to quantify activity intensity during soccer matches. Limited research has examined differences between men and women collegiate players using these tracking modalities. PURPOSE: To quantify the activity profile of Division I collegiate soccer players during games using HR response and GPS and to examine differences based on gender and position. METHODS: A team HR monitoring system was used to evaluate in-game HR response and quantify match-play movement patterns of 21 men and 21 women NCAA Division I soccer players who played >70 min in each of 3 games. Players were divided into 3 groups based on position (defender, midfielder, forward). Percentage of time spent above 80% of HR max and average %HRmax was calculated. Total distance/time and number of sprints above sprint threshold (men: accelerations >2.1 m/s²; women: accelerations >2.4 m/s²) were also calculated. ANOVA and student’s t-test were used to determine differences. RESULTS: Forwards and midfielders had significantly greater distance/time and sprints/time playing time than defenders (F: 115.2 ± 11.6 min, M: 115.3 ± 7.6 min, D: 103.6 ± 10.4 min). No positional differences were observed in average %HRmax or % of game time >80% of HRmax. Men had a greater average distance/time playing time than women (111.6 ± 8.9 min vs. 105.6 ± 4.1 min). Men had significantly fewer average sprints/min above threshold than women (0.18/ min vs. 0.42/min). No differences were observed in average %HRmax (M: 85.6%HRmax, W: 87.5%HRmax) or % of game >80% of HRmax (M: 80.6%, W: 83.3%) between genders. CONCLUSIONS: HR data illustrate that elite level soccer is a highly aerobic sport. Differences in distance/time playing time and sprints based on position may be explained by positional requirements, with more constant movement required for midfielders and explosiveness for forwards. Men’s soccer moves at a faster pace, explaining the difference in distance/time playing time by gender; however, relative activity intensity (%HRmax) was similar between positions and gender. The gender difference in number of game sprints may be at least partially related to the threshold differences determined by the GPS system.

Inducing fatigue prior to agility training through high intensity interval training (HIIT) has shown to yield greater agility improvements compared to agility training alone. However, high levels of neuromuscular fatigue can impair the ability to implement proper technique and may increase injury risk associated with the explosive nature of the sport. PURPOSE: To investigate the fatiguing effects of HIIT on agility performance, and determine if performance can be recovered within a few minutes. Coaches can safely combine fatigue-inducing drills and planned agility training into same sessions with rest interval.

Acute hypoxic exposures on submaximum and maximum physical performance in soccer players. Runghchai C. chaunchaiyakul1, Panik Avirutakan2, Chusak Pattanamontri2, Somporn Wannasiri2 and Salinee Chaiyakul2
1 College of Sports Science and Technology, Mahidol University, Thailand.
2 Faculty of Allied Health Science, Walailak University, Thailand.

Purpose: This study was aimed to investigate cardiorespiratory and metabolic changes during acute hypoxic exposures on physical performance in soccer players. Materials and method: Male football players, who currently trained, participated. This study was approved by the Human Research Committee of Ethical Reinforcement for Human Research, Mahidol University, Thailand (MU-CIRB 2015/075 1905). A hypoxic chamber was used to simulate normobaric-normoxic (NOR, F O2 = 0.21) and hypoxic (HYP, F O2 = 0.15) condition. Cardiorespiratory and metabolic functions at rest and during exercise were monitored using an impedance cardiography (Physioflow®) and telemetry gas analyser (Oxycon Mobile®). Variables including heart rate (HR) stroke volume (SV), cardiac output (CO), respiratory rate (RR), tidal volume (Vt), ventilation (Ve), oxygen consumption (VO2), carbon dioxide production (VCO2) and respiratory exchange ratio (RER), were monitored. Two separated progressive exercise tests were conducted on a cycle ergometer. Results: At submaximum exercise, no significant different of all resting variables between two groups were detected. HR, SV, VT, RR, VE, SaO2 and VO2 remarkably increased in the stepwise pattern (p<0.05) in parallel with all workloads. EDV, ESV, CO and VCO2 in both groups progressively increased (p<0.05) at the moderate to high workloads (90, 120 and 150 W). HYP showed the significantly higher HR (p<0.05) for all workloads, and significantly lower EDV and ESV at 150 W. At maximum exercise, HYP showed significant reductions in maximum values of HR, SV, EDV, CO, VE, W and VCO2 (p<0.05), with increasing in RR, VE, VCO2, and RER (p<0.05). Conclusion: Hypoxic condition declines performance, VO2 and cardiac function at maximum exercise. Physiologic responses are mostly derived from respiratory compensation for all workloads. Thus, respiratory adjustment plays major role in acute normobaric-hypoxic condition.

Soccer is a moderate contact sport and has a higher injury rate in female adolescent. Previous researches demonstrate the unstable surface training (UST) could improve the body’s stability and movement control, thereby reducing the risk of injury during exercise. PURPOSE: The purpose of this study was to determine the effect of a 6-week unstable surface training program on dynamic balance and lower limb power in adolescent female soccer players. METHODS: Twenty female soccer players (age: 14.9 ± 0.75 yrs, height: 160 ± 6.02 cm, weight: 50.6 ± 6.5 kg) from a local Junior School were randomly divided into control group (n = 10) and exercise group (n = 10). All players underwent a regular soccer training 5 times per week. Participants in the exercise group received extra UST program (6 weeks, 3 times per week, 20 min per session). The training program included core muscle, lower limb strength and balance training by using the BOSU ball as a training tool. Vertical jump, 30 meters dash and the dynamic balance (Star Excursion Balance Test, SEBT) before and after the training program were assessed for all players. Paired sample t-test was used to analyze the differences between pre and post-tests in two groups. The significant level was set at α = 0.05.

RESULTS: In the exercise group, the SEBT scores significantly increased after UST (p < 0.001, pre 295 ± 24% vs. post 332 ± 30%). No significant difference was found in the control group (p = 0.823, pre 301 ± 17% vs. post 299 ± 16%). The time of 30 meters dash in exercise group was significantly improved after UST (p = 0.047, pre 5.38 ± 0.3 s vs. post 5.27 ± 0.27 s). No significant differences were found in control group (p = 0.17, pre 5.45 ± 0.21 s vs. post 5.61 ± 0.38 s). The vertical jump height in exercise group was significant increased after UST (p = 0.008, pre 30.88 ± 3.82 cm vs. post 32.1 ± 4.2 cm), but no significant difference in control group (p = 0.405, pre 31.08 ± 2.12 cm vs. post 30.36 ± 3.19 cm).

CONCLUSIONS: Six weeks UST could improve the dynamic balance, vertical jump and 30 meters dash performance in adolescent female soccer players. Incorporation of UST into the routine training of female adolescent soccer players is important for the development of sports fitness and possibly exercise performance.
Additionally, further research is needed to determine how performance characteristics from an increased emphasis on AP in conjunction with current recommendations are affected by variance in time between courses.

**PURPOSE:** The aim of this study was to examine the effect of intensification weeks (IT) followed by a 1-week tapering (TP) phase leading up to a major competition, on heart rate variability (HRV), stress tolerance (ST) measures, and physical performance in sixteen male U19 soccer players.

**METHODS:** The study comprised 1 baseline week, 2 weeks of intensified training followed by a 1-week taper. Daily measures of HRV, ST (DALDA questionnaire) and internal training load (ITL) were collected through the training phases. Mean values of lnRMSSD (lnRMSSD$_{mean}$) and the coefficient of variation (lnRMSSD$_{cv}$) were determined on a weekly basis for each training phase. At the end of each training phases, the athletes performed the Yo-Yo Intermittent Recovery level 1 (Yo-Yo IR1) test, Counter movement jump, Squat jump, speed tests and a running anaerobic sprint test (Rast test).

**RESULTS:** A decrease in lnRMSSD$_{mean}$ with an increase in lnRMSSD$_{cv}$ were observed during the IT with an opposite response observed during TP. No difference was found for the Rast test among training phases ($p>0.05$). During IT all remaining performance variables decline ($p<0.001$) with a supercompensation during TP ($p<0.001$). A decrease in stress tolerance were found during TP ($p<0.001$) with a reduction during TP ($p<0.001$).

**CONCLUSIONS:** The present results suggest that decreases in vagal-related HRV with greater daily fluctuations during peak volume-based training loads may be a sign that the athletes are not ‘coping’ with the applied training load and may reflect the initial stage of physiological stress.

**G-37 Free Communication/Poster - Training**

Saturday, June 2, 2018, 7:30 AM - 11:00 AM

Room: CC-Hall B

3178 Board #47 June 2 8:00 AM - 9:30 AM

Training Strategies Maintain Performance Characteristics in Mariners Selected for Marine Corps Special Operations Individualized Training Course

Scott D. Royer, Joshua D. Winters, FACSM, Kathleen Poploski, John Ahl, FACSM, Andrejs Zalaiskalns, Scott Lepere, FACSM, University of Kentucky, Lexington, KY.

3United States Marine Corps Forces Special Operations Command, Camp Lejeune, NC. (Sponsor: John Ahl, FACSM)

(No relevant relationships reported)

Marines must complete an intensive Assessment and Selection (A&S) course prior to becoming a United States Marine Corps Forces Special Operations Command (MARSOC) Raider. Following selection, Marines are given training recommendations designed to maintain performance characteristics deemed relevant to successfully complete a rigorous nine-month Individualized Training Course (ITC). However, the time between the two courses is highly variable and training strategies are individually implemented by the Marine. **PURPOSE:** To evaluate the effectiveness of current training strategies following A&S and prior to ITC. **METHODS:** Fat free mass (FFM), fat mass (FM), anaerobic power (AP), anaerobic capacity (AC), aerobic capacity (VO$_{max}$), knee flexion (KF), knee extension (KE), shoulder internal rotation (SIR), shoulder external rotation (SER), trunk extension (TE) and trunk flexion (TF) isokinetic strength were collected on 27 Marines (Age: 25.6 ± 2.9 years, Height: 1.78 ± 0.05 meters, Mass: 83.0 ± 8.4 kg, Post A&S to ITC Start: 183.8 ± 68.2 days) isokinetic strength were collected on 27 Marines (Age: 25.6 ± 2.9 years, Height: 1.78 ± 0.05 meters, Mass: 83.0 ± 8.4 kg, Post A&S to ITC Start: 183.8 ± 68.2 days) following A&S and directly prior to ITC. **RESULTS:** No significant changes were found in Marines between A&S and the start of ITC in FFM ($p=0.592$), FM ($p=0.119$), AP ($p=0.594$), AC ($p=0.588$), VO$_{max}$ ($p=0.594$), KE ($p=0.843$), SER ($p=0.868$), SER ($p=0.710$), TE ($p=0.590$), and TF ($p=0.971$). **CONCLUSION:** Performance characteristics were similar following selection and prior to the start of ITC, suggesting the current training strategies, as implemented and adopted for the varying time gaps post A&S, were effective at maintaining performance between courses. Although effective at sustaining performance levels, Marines still demonstrated deficits in AP (13.0 W/kg vs 12.65 W/kg respectively) compared to previous studies on MARSOC Raiders. Future training strategies may further benefit from an increased emphasis on AP in conjunction with current recommendations.

Additionally, further research is needed to determine how performance characteristics are affected by variance in time between courses.

**3179 Board #48 June 2 8:00 AM - 9:30 AM**

The Influence Of Four-week Of Endurancetraining With Periodic CO Inhalation On Aerobic Capacity

Jun WANG, Yang HU. Beijing Sport University, Beijing, China.

(No relevant relationships reported)

**PURPOSE:** Altitude training is commonly used to enhance aerobic capacity in competitive athletes. The rationale is hypoxic stimulation of EPO to raise blood Hb mass and concentration and therefore also O$_2$ transport capacity. We hypothesized that periodic inhalation of low levels of CO at sea level might be an easier method to achieve the same outcome. **METHODS:** 12 non-smoking male well trained football players volunteered to participate in this study. In a preliminary experiment in resting subjects, the concentrations of CO in exhaled gas and of CO and EPO in venous blood were measured before and then at 1h, 2h, 4h, 6h, 8h after inhaling a bolus of CO (1ml kg BW) through a spirometer. For the main experiment, the subjects were divided into two groups (one group given inhaled CO (INCO) and a control group not given CO (NOCO)). All subjects participated in a four-week treadmill training program, running for 50 minutes at a speed of 90% of that producing each individual's reservation threshold, 3 times a week for 4 weeks. Prior to each training session, INCO inhala a mix of CO (1ml/kg BW) and O$_2$ (4L) over two minutes, while NOCO inhola a bolus of O$_2$ (4L) over two minutes. Before and after 4 weeks of training, total hemoglobin mass (tHb), blood parameters (RBC, Hct, [Hb], MCV), and VO$_2$ max were measured.

**RESULTS:** In the first experiment, HbCO% increased from 0.7% to 5.81% ($p<0.05$) 1 hr after CO inhalation, decreasing gradually to 1.48% after 8 hours (p>0.05). Oxygen uptake at a given submaximal intensity declined significantly 2 hours ($p<0.05$) after CO inhalation, peaking (42.3% higher than pre 1.912 mL/min/kg) at 4 hours, and then decreasing gradually to 6 (2.465 mL/min/kg) and 8 hours (1.759 mL/min/kg). (2) tHb and VO$_2$ max increased significantly after training (5.9% higher and 6.7% respectively, each $p<0.05$). However there were no such changes in NOCO; Oxygen uptake at a given submaximal intensity skelton slightly both in INCO and NOCO, with the changes being more obvious in INCO. At 8, 10 and 12km/h, VO$_2$ decreased by 7.08%, 2.13% and 3.43% respectively in INCO and by 1.56%($p<0.05$), 5.74%($p<0.01$) and 0.66%($p<0.05$) in NOCO.

**CONCLUSIONS:**Circulating EPO increases sharply after a bolus of CO (1ml/kg BW), peaking at 4 hours after inhalation; Endurance training with CO inhalation increases tHb and VO2max and slightly reduced the energy cost of submaximal running.

**3180 Board #49 June 2 8:00 AM - 9:30 AM**


Emmet Crowley, Andrew J. Harrison, Mark Lyons. University of Limerick, Ireland, Limerick, Ireland. (Sponsor: Giles Warrington, FACSM)

(No relevant relationships reported)

**Purpose:** No research to date has investigated the current practice of prescription of dry-land resistance training by elite swimming strength and conditioning (S&C) coaches. The aims of this study were to examine the prescription of dry-land resistance training modalities and exercises among elite swimming S&C coaches and explore coach’s rationale and justification for prescribing dry-land resistance training modalities and dry-land exercises. **METHODS:** Twenty-three (n = 21 males, n = 2 females) elite swimming strength and conditioning coaches from Ireland (n = 7), Great Britain (n = 5), Australia (n = 6) and the United States (n = 5) were recruited through their specific national governing bodies. Coaches completed an online questionnaire consisting of seven sections; participant information, informed consent, coach’s biography, coach education, current training commitments, dry-land resistance training modalities exercises and additional information. **Results:** Results showed that coaches had varying levels of experience, education and worked with swimmers at regional (46.6 %), national (59.1 %) and international (36.4 %) levels. The most popular S&C accreditations were; National S&C Association (29.2 %), United Kingdom S&C Association (22 %) and Australian S&C Association (7.3 %). S&C coaches reported that their primary sources of information were their own experience (52.4 %), S&C coaches (14.3 %) and academic journals (9.5 %). In total four different resistance training modalities were used and these included 95 dry-land resistance training exercises. **Conclusion:** Traditional resistance training was the most commonly practiced dry-land training modality with the pull up and squat reported as the most popular exercises prescribed by elite swimming S&C coaches. Future research should focus on exploring the specificity and transfer of specific exercises to swimming performance. This study highlighted that coaches need to have a clear understanding of the mechanisms that occur during sport specific movements such as a swimming. Furthermore, there is a need for coaches to perform detailed needs analysis before prescribing dry-land resistance training programs as aquatic sports provide a unique challenge to the s & c coach.
PURPOSE: To determine the impact of various resistance training protocols and frequencies on isometric and isokinetic strength and endurance in sedentary and recreationally active females.

METHODS: Forty-six female subjects (age 22.7 ± 4.1) were randomly assigned to one of four groups that trained the knee flexors and extensors for 6 weeks. Training groups included a traditional program (TRAD) [3 sets (10, 10, 10 reps), 3x/wk at 70-80% of one repetition maximum (1RM)], two blood flow restriction groups ([BFR-1] 4 sets (30, 15, 15, failure), 1x/wk at 20-50% 1RM; and [BFR-2] 4 sets (30, 15, 15, failure), 2x/wk at 20-50% 1RM], and a one set to failure group (FAIL) [1x/wk at 75-80% 1RM]. Subjects fasted (at least 8 hours) and were hydrated for pre and post testing sessions that included assessing isometric maximum voluntary contraction (MVC) of the knee extensors (60° of knee joint flexion), 10 repetitions of isokinetic knee extensions at 60°/s (ISO-60), and 10 reps at 180°/s (ISO-180), and 50 maximal knee extensions (50 REP) at 180°/s.

RESULTS: One-way ANOVA found no between-group differences in any of the outcome measures of interest at baseline. Repeated measures ANOVA found a significant main effect for MVC (p < 0.01). There was also a significant time main effect (p < 0.01) and time*condition interaction (p < 0.05) for ISO-60 as well as a significant main time effect (p < 0.01) for ISO-180, with post test values being greater than baseline. There was a significant time*condition interaction (p < 0.04) for percent decline in torque for the 50 REP test. All training groups had increases in strength (peak torque) following each training program, but the TRAD group had greater percent declines in torque from the average of first 3 reps to last 3 reps of the 50 contraction test on the posttest compared to the pretest (58% pre-training vs. 60% post-training) while the BFR-1 groups improved their ability to maintain torque over the 50 reps (63% pre-training vs. 59% post-training).

CONCLUSIONS: Findings indicate that the FAIL, BFR-1, and BFR-2 training programs can be as effective as the TRAD training program to improve isometric and isokinetic strength, but the BFR-1 group appeared to be able to maintain muscular endurance better than the TRAD group.

Abstracts were prepared by the authors and printed as submitted.

SATURDAY, JUNE 2, 2018
Evaluation of the LaxPrep ACL Injury Prevention Program

Kelly Comolli¹, Andrew E. Lincoln², Lisa Hepburn¹, Justin Cooper¹, Carissa Colangelo², Bruce Griffin³, ¹Georgetown University School of Medicine, Washington DC, DC; ²MedStar Health, Baltimore, MD; ³US Lacrosse, Sparks, MD.

No relevant relationships reported

PURPOSE: To characterize respondents who completed and implemented the LaxPrep training, which program phase was reached, and common barriers to implementation.

METHODS: A web-based survey (Tonic Health) was created and sent to 390 trainees who completed the online education course and intended to implement the LaxPrep program with their team.

RESULTS: 64 trainees (16%) responded to the survey. They included coaches, athletic trainers, and others for youth, high school, and college athletes across 27 states. 28% of respondents completed Phase 1, 28% completed Phase 2, 25% completed Phase 3, and 19% did not implement the program. Program instructors for youth teams cited 2 barriers to full implementation: the inability of young athletes to perform some of the exercises in advanced phases, suggesting the need for age-specific programs; and the accessibility and expense of resistance bands. High school and collegiate players were not as willing as youth players to participate and implement the program.

CONCLUSION: Challenges to program implementation were associated with the team’s age group and included finding practice time, athlete willingness, and resistance band expense. These observations support the implementation of age-specific neuromuscular-based warm-up programs, starting at the youth level.

FUNDING: This research was supported by the US Lacrosse Center for Sport Science and the Georgetown University School of Medicine’s MedStar Health Research Scholarship.

3187 Board #56 June 2 8:00 AM - 9:30 AM Salivary Testosterone-to-Cortisol Ratio in Collegiate Gymnasts over a Competitive Season

Scott K. Crawford, Jessica L. Calvi, Jack W. Ransone, FACSM. University of Nebraska-Lincoln, Lincoln, NE.

(No relevant relationships reported)

PURPOSE: To understand the long-term physiological effects of a full competitive season of NCAA Division-I female gymnasts on hormonal responses.

METHODS: Participants were 8 female athletes (ages 18-22) on the active roster of a university women’s gymnastics team. Saliva samples were taken approximately 24 hours pre-competition at approximately the same time of day as schedules permitted. Saliva samples were collected via unsalivatized passive drool. Salivary cortisol (C) and testosterone (T) concentration levels were determined using an enzyme immunoassay kit (Salimetrics, State College, PA, USA). Given the nested nature of the data, hierarchical linear regression models examining individual-level and team-level variables on testosterone:cortisol ratio (T:C) were conducted. RESULTS: The initial, simplified model indicated that T:C decreased over a competitive season (p = 0.003). Specifically, it was observed that T did not change over the competitive season, but C significantly increased. To examine alternative predictors over the season, other variables were examined in a second model, namely the number of events in which an athlete competed and whether the competition was a conference or non-conference competition. Conference competitions predicted significantly higher T:C than non-conference competitions (p = 0.001), and the number of events in which individuals competed predicted significantly higher T:C (p = 0.001). Surprisingly, the interaction between time and conference showed a significant decrease in T:C (p = 0.001), and the main effect of time became non-significant (p = 0.186). CONCLUSION: This is the first study of its kind to examine hormonal changes over a competitive season in female gymnasts. These findings indicate that the athletes had significant increases in cortisol without a corresponding increase in testosterone throughout the season, resulting in a decreased anabolic-catabolic balance. This perhaps contributed to an overtrained state as the season progressed. Further research should be conducted with this athlete population to optimize training and competition stress and recovery periods.

3188 Board #57 June 2 8:00 AM - 9:30 AM The Effects Of The Alchemy Philosophy On Cardiovascular Health, Flexibility, And Strength

Chloe Tuna, Lana Prokop, Mark Blegen, FACSM, Joshua Guggenheimer. St. Catherine University, St. Paul, MN.

(No relevant relationships reported)

PURPOSE: To investigate the effects of a shoulder strengthening and stretching program on shoulder internal rotation (IR) and shoulder external rotation (ER) range of motion, throwing speed, and disability in collegiate softball players.

METHODS: Eighteen Division I softball players (age=19.5±1.3 yrs, height=65.3±2.6 in, weight=148.4±20.8 lbs) completed a four week arm care intervention two to three days per week before practice during the preseason. The intervention consisted of two sets of eight repetitions of five resistance band exercises (shoulder horizontal abduction, shoulder scaption-flexion, shoulder extension, and shoulder IR and ER in abduction) and three sets of a 30 second shoulder ER stretch (sleeper stretch). Bilateral shoulder IR and ER were measured by cell phone inclinometer app, throwing speed was measured by radar gun, and shoulder disability was measured by the Disability of Arm, Shoulder, Hand form. All outcomes were measured at pretest and posttest and significance was established at p≤0.05.

RESULTS: The mean overall compliance rate was 95.3% ±12.4. The maximum compliance rate was 100% (n=14). The minimum compliance rate was 50% (n=1). Dominant shoulder IR significantly increased (54.7±13.6° vs 60.7±12.3°, p=0.011) and throwing speed decreased significantly (53.4±4.4 mph vs 51.8±4.3 mph, p=0.005) from pretest to posttest. There were no changes in non-dominant shoulder IR (76.8±12.8° vs 74.9±15.1°, p=0.052), dominant shoulder ER (90.9±14.8° vs 86.9±16.2°, p=0.481), non-dominant shoulder ER (83.9±12.7° vs 86.1±11.6°, p=0.413), or shoulder disability (9.1±5.7 vs 12.7±10.4, p=0.871) from pretest to posttest.

CONCLUSION: The steeper stretch increased shoulder IR without changing shoulder ER. Four weeks’ time may have been insufficient to increase strength in the newly acquired shoulder range of motion, which may have resulted in a decrease in throwing speed. Disability did not change following the intervention, though disability may have been low at the start of the preseason.

CONCLUSIONS: These results suggest that the participants are in good physical health, which may lead to small changes from an Alchemy-based training intervention. However, there did appear to be a bilateral discrepancy in quadricep and hamstring torque production which may be worth further examination in the future.
Purpose: Rock climbing is a popular sport with very dedicated athletes and fan base. Climbing performance, especially for new climbers, should increase when climbers develop the appropriate muscle strength to execute a variety of different climbing holds.

**METHODS**: This study investigated which of four popular rock-climbing holds caused the greatest recruitment of the Palmaris Longus (PL) and the Flexor Carpi Radialis muscles (FCR). Muscle activation was measured in eleven experienced rock climbers: seven males and four females. Electromyography (EMG) sensors were placed on PL and FCR muscles. Participants performed four different types of rock climbing holds in random order. The PL activation, in all holds, was greater than the FCR activation. Results: The SLOPER hold caused greater PL activation than the JUG, CRIMP, or PINCH holds as well as greater activation for the FCR in the CRIMP and PINCH holds.

<table>
<thead>
<tr>
<th>Muscle Type</th>
<th>Clamping Hold Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palmaris Longus m.</td>
<td>SLOPER</td>
</tr>
<tr>
<td>Flexor Carpi Radialis m.</td>
<td>JUG</td>
</tr>
<tr>
<td></td>
<td>PINCH</td>
</tr>
<tr>
<td></td>
<td>CRIMP</td>
</tr>
</tbody>
</table>

* = p≤.05 compared to SLOPER in Palmaris Longus

**CONCLUSION**: Developing rock climbers should be able to increase their physical capacity to climb more quickly if they supplement their training with exercises that emphasize climbing holds they would use in the sport. Further research is needed to identify which training exercises would be most beneficial for climbers to develop the appropriate muscle strength to execute a variety of different climbing holds.

Abstracts were prepared by the authors and printed as submitted.
Although body weight training is included in the 2017 ACSM Top Fitness Trends, there is relatively little research quantifying the effects of suspension training on health-related fitness and functional movement. **PURPOSE:** To examine the impact of suspension training on selected health-related fitness variables and functional movement. **METHODS:** Fifteen individuals (11 females; 4 males; Age = 22.2 ± 3.2 yrs; Height = 172.0 ± 11.4 cm; Body Mass = 69.8 ± 19.2 kg) in a suspension training course completed 11 workout sessions over a 6-week period. Throughout each 30-minute exercise session, six body positions were utilized across push, pull, rotational, squat and lunge movements. Pre- and post-health-related fitness assessments included body composition, muscular endurance, flexibility, and a functional movement screen. Dependent t-tests were used to determine if there were mean changes in health-related fitness and functional movement. Due to multiple comparisons, Bonferroni correction was used, therefore, alpha level was set at .008. Cohen’s Delta effect size was calculated for functional movement. **RESULTS:** There were no significant changes in mean fat mass, percent body fat, and push-ups. There were, however, positive changes in mean lean body mass (55.5 ± 18.4 kg to 56.3 ± 18.6 kg), sit and reach (42.2 ± 8.5 to 45.5 ± 8.3 cm, p= .004), and functional movement screen score (15.7 ± 2.1 to 17.7 ± 2.0). A large effect size was present for functional movement (Cohens’ Delta = 0.98). **CONCLUSION:** Suspension training had a significant impact on lean body mass, flexibility and functional movement in as few as 11 thirty-minute sessions.
### RESULTS

Our post-hoc 4 (load) ANOVA, with repeated measures for load. Alpha = 0.05 and T-tests served as effort. Average and peak force (AF, PF) data were each analyzed with a 2 (gender) x 2 (load) ANOVA. Men showed higher fluctuation in the high endurance score group, mean systolic blood pressure (BP) (126±8 mmHg) and diastolic BP (84±6 mmHg) were higher for both groups targeting the arm extensor muscles. Work produced during AE and peak concentric power during RE were recorded. RESULTS: The AE bout resulted in a gradual increase in heart rate (126±12 bpm) with a parallel increase in RPE reaching the termination threshold (18±0.5 RPE). The implementation of AE prior to RE led to a 1% decrease (p=0.045) in arm extensor peak concentric power from 98W to 78W, respectively. There was no change in performance from pre- to post in the AE-only arm (94W to 89W). CONCLUSIONS: These results demonstrate that the implementation of AE prior to RE, as compared to RE alone, compromises peak concentric power adaptations of the arm extensors. The noticeable decrement in peak concentric power between pre- and post from the CT intervention (21%), relative to a similar study with the same testing protocol which targeted the lower body (10%), gives credence to the possibility that upper and lower body muscles respond differently to concurrent training.

### METHODS

Subjects (29 women, 15 men) made six laboratory visits. The first two visits entailed familiarization to the knee extension exercise. For their last four visits they did four 3-second knee extension sets with different loads (0, 3.4, 5.7, 8.0 kgs.) added to the Impulse weight sled per set. A Latin Squares design counterbalanced the set sequence, which limited the risk of an order effect and fatigue’s impact on our results. Subjects rested 120 seconds between sets and were told to exert maximal effort. Average and peak force (AF, PF) data were each analyzed with a 2 (gender) x 4 (load) ANOVA, with repeated measures for load. Alpha = 0.05 and T-tests served as our post-hoc.

### RESULTS

AF and PF results (mean ± sem) appear below:

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Force (N)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 kgs.</td>
<td>44.5 ± 2.2</td>
<td>38.4 ± 1.5</td>
</tr>
<tr>
<td>3.4 kgs.</td>
<td>76.2 ± 4.4</td>
<td>70.1 ± 2.8</td>
</tr>
<tr>
<td>5.7 kgs.</td>
<td>85.9 ± 7.3</td>
<td>84.3 ± 3.5</td>
</tr>
<tr>
<td>8.0 kgs.</td>
<td>101.5 ± 6.2</td>
<td>92.8 ± 3.5</td>
</tr>
</tbody>
</table>

Analysis of AF yielded a load effect, while PF produced a two-way interaction, in which men produced higher values than women for each load.

### CONCLUSIONS

Results show significant inter-gender PF, but not AF, values per load examined.
A family history of type 2 diabetes (FH+) is considered a risk factor for insulin resistance and poor cardiorespiratory fitness. However, it is not known if exercise induced improvement in maximal aerobic capacity (VO\(_{\text{max}}\)) is impeded by a FH+.

**PURPOSE:** The purpose of this study was to determine if normoglycemic, sedentary, Hispanic men with FH+ have a lower VO\(_{\text{max}}\) compared to those without a family history of type 2 diabetes (FH-) and if the improvement in VO\(_{\text{max}}\) after 8-weeks of combined exercise training is comparable to FH- and FH+.

**METHODS:** 19 participants (mean ± SEM: age: 23.5 ± 0.6 years; BMI: 26.9 ± 0.98 kg/m\(^2\)) underwent 8 weeks of combined exercise training (35 min aerobic at 60-75% VO\(_{\text{max}}\)) followed by full-body resistance exercises (3x/week). VO\(_{\text{max}}\) was measured using ParvoMedics 2400 metabolic measurement system during a standardized graded exercise test performed on a treadmill. Body composition was assessed by DXA.

**RESULTS:** VO\(_{\text{max}}\) significantly lowered in FH+ compared to FH- at baseline (3.57 ± 1.7 vs. 4.08 ± 0.15 L/min; p=0.04). After 8 weeks of combined exercise training FH+ significantly improved VO\(_{\text{max}}\) (3.57 ± 1.7 to 3.82 ± 0.16 L/min; p=0.002), whereas no improvement was observed in FH- (4.08 ± 0.15 to 4.21 ± 0.17 L/min; p=0.16). There was no difference in VO\(_{\text{max}}\) between groups after 8 weeks of exercise training (p=0.67). Lean body mass significantly increased in both groups (FH+: 5.66 ± 2.1 to 58.5 ± 2.1 kg; p=0.01; FH+: 51.8 ± 1.95 to 53.4 ± 1.79 kg; p=0.01) and fat mass remained unchanged (p=0.38).

**CONCLUSIONS:** A family history of diabetes may negatively impact cardiorespiratory fitness in a normoglycemic, sedentary, Mexican American population. A combined exercise training program (8 weeks) is effective in normalizing this deficit.

**As a personal training aid, a smart exercise application (SEA) has been developed to improve leg function such as balance and endurance.**

**PURPOSE:** The aim of this study was to investigate if stimulating HSP70 by using a sauna (45 ± 5°C, 80% Humidity) three times per week, for 15 minutes, could aid skeletal muscle hypertrophy during six weeks of resistance training in a young (21.38 ± 1.9 yrs.), recreationally trained male population.

**METHODS:** Thirteen subjects were randomly distributed into 3 groups [resistance training + sauna (RT+S, n=5), RT + relaxation (RT+R, n=5) and complete control (CON, n=3) or no training]. Primary dependent variables, observed in a pre- and post-test format, included: lean body mass (LBM), HSP70 concentration, and a 5 repetition maximum (5RM) back squat.

**RESULTS:** When comparing groups (i.e., RT+S, RT+R, and CON), no significant main effects or interactions were observed (p > 0.05) over the 6-week intervention period for LBM, HSP70, and 5RM. The hypothesis that HSP70 would be upregulated to a greater extent with concomitantly larger LBM and 5RM improvements in RT+S vs. the other groups was not supported.

**CONCLUSIONS:** Although HSP70 and LBM were highest in RT+S after 6-weeks of heavy resistance training, RT+R improved the most on 5RM. Sauna use in combination with resistance training does not appear to augment muscle hypertrophy or strength. Despite this, it appears using a sauna post RT does not hinder muscle growth and may be a viable strategy for maintaining muscle mass.
Previous research has shown upper-body muscular strength gains are independent of fat-free mass (FFM) in men. Further, initial strength is typically higher when evaluated with machine weights (MW) than with free weights (FW). Lacking is information comparing the training effects of FW versus MW in men with comparable initial strength levels. 

PURPOSE: To evaluate the effect of resistance training (RT) using different modes on changes in upper-body muscular strength when controlling mode-specific initial strength.

METHODS: College men (n = 1,331) enrolled in a RT course volunteered to participate and initially performed 1RM bench press using free-weights (FW), seated horizontal press (SHP) or supine vertical press (SVP). The FW (n = 218), SHP (n = 270), and SVP (n = 208) groups were matched for mode-specific initial strength. Groups were further divided into low, average, and high strength based on the bottom, middle, and top one-third of mode-specific 1RM. Each participant performed 12 weeks of linear periodization mode-specific RT using progressively heavier loads and reduced repetitions designed to achieve maximum strength improvement. Each participant performed auxiliary upper- and lower-body supplemental exercises in 3 sets of 6-10 repetitions.

RESULTS: A mode x strength level ANOVA noted significantly greater improvement with SHP (12.5 ± 7.0 kg) than with SVP (10.7 ± 7.0 kg) which was greater than FW (6.8 ± 5.9 kg) but did not significantly differ among low (10.3 ± 7.4 kg), average (10.4 ± 6.2 kg), and high (9.8 ± 7.9 kg) strength levels. The interaction was not significant (p = 0.45). The relationships between initial strength and strength change was nonsignificant and similar in SHP (r = 0.01), FW (r = 0.05), and SVP (r = 0.06). 

CONCLUSIONS: Men of differing strength levels gain similar amounts of upper-body strength when training with different RT modes. In participants with equal initial strength, training with one mode does not appear to offer any significant advantage over training with a different mode.

3206 Board #75 June 2 8:00 AM - 9:30 AM Testosterone Response Following Five CrossFit® Open Workouts

Paul Serafini1, Trisha VanDusseldorp1, Yuri Feito, FACSM1, Alyssa Holmes1, Adam Gonzales1, Gerald Mangine1. Kennesaw State University, Kennesaw, GA. 1Hofstra University, Hempstead, NY. (Sponsor: Yuri Feito, FACSM)

(Purposes: No relevant relationships reported)

PURPOSE: To determine the effect of sex and lean mass (LM) on the testosterone (T) responses to five unique CrossFit® Open (CFO) workouts. METHODS: LM was measured via Dual-Energy X-ray Absorptiometry (DXA) within two weeks of the onset of the 2016 CFO in recreationally-trained adults (males-n=5, 34.4±3.8 yrs, 175.5±5.1cm, 80.31±9.7kg; females-n=5, 35.5±7.0yrs, 159.0±7.1 cm, 76.93±21.4kg). During each week of 5-week competition, saliva samples were collected prior to (PRE) the competitors’ warm-up, immediately before (IP), 30- (30P), and 60 min post-exercise (60P) and analyzed for concentrations of T. All workouts were completed at the same gym; mid-day during the first four weeks (WK1-WK4) and on the night of the final challenge’s release (WK5). Separate two-way (sex x time) repeated measures analyses of variance were performed to assess the percent change from PRE-values in each. Pearson’s correlation coefficients were calculated between all LM measures and T responses, quantified as the area under the curve, for each week. RESULTS: Although no (sex x time) interactions were found, significant (p<0.05) main effects for time were observed on WK2-WK4 where T was elevated from PRE to 162.1-191.7%, p≤0.015) and 30P (40.2-59.8%, p≤0.040). T was also elevated at IP (162.1-191.7%, p≤0.015) and 30P (40.2-59.8%, p≤0.040). Additionally, a trend (p<0.01) was noted for elevated T during each week. Pearson’s correlation coefficients were calculated between all LM measures and T responses, quantified as the area under the curve, for each week. 

CONCLUSIONS: Men of differing strength levels gain similar amounts of upper-body strength when training with different RT modes. In participants with equal initial strength, training with one mode does not appear to offer any significant advantage over training with a different mode.
Saturday, June 2, 2018, 7:30 AM - 11:00 AM
Room: CC-Hall B

G-38

Effects Of A Caffeine-carbohydrate Mouth Rinsing On Sprinting Kinetics And Kinematics In Fasted Athletes
Jad-Adrian Washi1, Christopher Martyn Beaven2, National Sports Institute Of Malaysia, Kuala Lumpur, Malaysia. university Of Waikato, Hamilton, New Zealand.

(No relevant relationships reported)

Carbohydrate mouth rinsing during an intermittent fasting has been reported to be advantageous for endurance performance; however, there appears to be no clear effect on repeated sprints. What has not been investigated previously is the effects of combined caffeine and carbohydrate (CAF-CHO) mouth rinsing on sprint-endurance performance commonly performed by track and field athletes during a fasted state.

PURPOSE: To determine the influence of CAF-CHO mouth rinsing on sprinting kinetics and kinematics, as well as subjective exertion during a sprint-endurance bout performed in a fasted state. METHOD: In a counterbalanced, single-blind random order design, eleven (n=11) well-trained National level male sprinters and middle-distance to sprinters performed three all-out sprints on a Woodway nonmotorized force treadmill, interspersed with 2-min active recovery between sprints. Athletes rinsed 25 ml of CAF-CHO (4g carbohydrate, 5 mg caffeine), or a similarly coloured placebo solution (PLA) prior to warm-up (30-min pre-trial), 1-min pre-trial, and the mid-way of each period of active recovery. On one occasion, no mouth rinse (NMR) was administered. The study was conducted within the second and third quarters of Ramadan, and each session separated by at least 72 hours. RESULTS: At the start of each trial, the rating of perceived exertions (RPE), readiness to train, blood glucose, and lactate concentrations were similar (p > 0.05). A significant primary effect of trial (3 x 15 seconds sprint) was observed for the distance (p = 0.019), revealing a longer average distance achieved in the CAF-CHO compared to PLA trial (69.80 ± 3.77 vs. 68.08 ± 3.22, p = 0.026; EF: 0.5), and NMR (69.89 ± 3.82, p = 0.680; EF: 0.2). The difference between NMR and PLA also approached significance (p = 0.073; ES: 0.5). The CAF-CHO intervention also obtained better results in all other sprint measures such as average velocity, peak acceleration, and peak horizontal force, although these differences were not significant. Post-trial RPE was higher during NMR (7.23 ± 1.92) as compared to CAF-CHO (6.54 ± 2.15) and PLA (6.38 ± 1.94) (p = 0.247). CONCLUSION: In challenging metabolic conditions, CAF-CHO mouth rinsing might have potential to improve measures of sprint training performance with a positive ergogenic effect on speed endurance performance.

3210

Association of Performance Physiology Measures with Sports Performance Tests
Therese Wichmann, Marissa Burnsed-Torres, Michael Hahn. University of Oregon, Eugene, OR.

(No relevant relationships reported)

PURPOSE: Common fitness tests such as the Yo-Yo Intermittent Recovery Test and the Beep Test have previously been validated against laboratory-based assessments and shown to be accurate. The purpose of this study was to assess whether the Gauntlet, an unexplored fitness assessment, was an accurate assessment of individual fitness compared to standard laboratory-based physiological tests. The Gauntlet test requires athletes to complete a set of maximal effort runs, with a one-minute break in between each stage (Stage 1: 814.6m, Stage 2: 907.3m, Stage 3: 453.7m, Stage 4: 226.8m, Stage 5: 100m) with the goal of achieving the best overall time. METHODS: Subjects (n=18) first completed a lactate threshold test and VO\textsubscript{2}\textmax test in the laboratory. After four to fourteen days, subjects then completed the Gauntlet on an outdoor track. VO\textsubscript{2\textmax} and heart rate were recorded during the laboratory session, and heart rate, lactate, and time of completion per stage and overall time to completion were recorded during the Gauntlet test. RESULTS: Preliminary correlation analyses showed a positive relationship between VO\textsubscript{2\textmax} (ml kg\textsuperscript{-1} min\textsuperscript{-1}) to Time to Completion of the Gauntlet (r = 0.89, P = 1.29E-15), VO\textsubscript{2\textmax} Maximum Heart Rate to Gauntlet Maximum Heart Rate (r = 0.80, P = 0.0011), and VO\textsubscript{2} 3-min Post Lactate to Gauntlet 3-min Post Lactate (r = 0.66, P = 0.0188). CONCLUSION: These results indicate that the Gauntlet is an accurate estimate of aerobic fitness when compared to laboratory-based physiological tests. Therefore, the Gauntlet could be implemented into common exercise programs or sport specific physiological tests to assess an individual’s level of fitness without the need for laboratory testing.
**Introduction:** Depth jumps (DJ) are popular high-intensity plyometric exercises typically reserved for highly-trained individuals. DIs cause an individual to undergo high amounts of stress during the eccentric and concentric phase. This extreme loading allows individuals to increase lower body strength and power output. Muscular strength and power have a transfer effect to sprint speed; however, few have examined if implementing DIs into training can increase sprint speed.

**Purpose:** The purpose of this study was to determine if the implementation of DIs into a sprint training program would increase sprint speed more so than sprinting alone.

**Methods:** 5 collegiate level and 13 club level athletes participated in this study (6 males and 13 females). Subjects performed 3 maximal 40-yard sprints with 3 to 5 minutes of rest between sprints. Subjects were randomized into either a control group, a sprint training group, or a DJ group. The DJ and sprint group performed 2 training sessions/week, with both groups performing the same sprint training protocol. The DJ group had DIs of varying intensities. Following 6 weeks of implementation, subjects were retested on the 40-yard sprints in the same manner as before.

**Results:** One-way ANOVA were conducted using paired comparisons to determine significance. Significant differences were observed for implementation for the 40-yard sprint (~24.43s) (P<0.01), 20-30 yard split (~3.1s) (P<0.05), and a 20-40 yard split (~2.18s) (P<0.01). No differences were observed between groups. The DJ group changes showed the largest effect size of any group in these measures; 1.2, 1.6, and 2.5 respectively.

**Discussion:** The effect sizes of the changes in sprint speed demonstrate that DIs may benefit sprint speed. It can be concluded from this study that maximal sprint speed was improved more so than acceleration due to the improvements observed from the 20-30 yards and 20-40 yards. These indicate the maximal speed phase of sprinting. Further research is needed to determine if DIs can improve sprint performance in highly-trained athletes.

**Purpose:** A new type of water that uses nanotechnology to alter the physical and chemical properties of water molecules to enhance its bioavailability was compared to other commonly consumed beverages for the effect on physical performance.

**Methods:** Thirty male college athletes (21-23 y) were randomly divided into three groups, nanotechnology structured water (N), Gatorade (G), ordinary water (W)) for a 3-month period each day during the 3-month training period, with other fluids consumed ad libitum. Thirty male college athletes (21-23 y) were randomly divided into three groups, nanotechnology structured water (N), Gatorade (G), ordinary water (W)) for a 3-month period each day during the 3-month training period, with other fluids consumed ad libitum. All participants completed the same set of pre-post physical tests: resting heart rate (RHR), sprinting, jumping, in which participants jumped 10 consecutive times with the difference in height jumped between the first and last jump recorded; obstacle course, which measured for accuracy in completing the course; and peak exercise heart rate on a 60-min steady-state treadmill run (EHR).

**Results:** Post-training test results were analyzed for differences among groups using ANCOVA, with age and BMI as covariates for any baseline differences among groups. All significant results were then subjected to a post-hoc analysis to determine specific differences. For sprinting, the N group (10.6s) was faster than both G (11.5s; p=0.025) and W (13.5s; p<0.001). The N group had lower RHR (112.6bpm) compared to G (138bpm; p<.001) and W (157bpm; p<0.001). The N group had a lower jump differential (25cm) then G (41cm; p<0.001) and W (59cm; p<0.001). In the obstacle course, N had a mean score of 3214 Board #83 June 2 8:00 AM - 9:30 AM Comparison Of The Effects Of A Novel Structured Nanotechnology Water On Physical Performance. ALI K. M. SAMI, Gary Ligouri, FACSM, FACSM. 1College of Medicine/University of Salamanca, Salamanca, Iraq. 2University of Rhode Island/College of Health Sciences, Kingston, RI. (No relevant relationships reported)

**Conclusion:** This is the first known study to measure the effect of structured nanotechnology water magnalite on physical performance, and these results indicate that participants consuming nano-water performed better on a series of physical tests compared to other beverages. However, this study had used a small population of male athletes only. Future studies should be larger and include a variety of populations to gain a better understanding of the possible ergogenic effects of nano-water.
with short distance sprinting which appears to define leg dominance in sprinting. There appears to be a dominant leg during sprinting and 2L jumping, which is not consistent across performance.

3217 Board #86 June 2 8:00 AM - 9:30 AM Acute Effects of Beta-Alanine on Exercise Performance Variables. Emmanuel Lavaras, Zinong Li, Yunae Lee, E. Todd Schroeder, FACSM. University of Southern California, Los Angeles, CA. (No relevant relationships reported)

Beta-Alanine (BA) is converted to carnosine which serves to lower acid levels in the muscle by acting as an intramuscular buffer to H+ ions. BA supplementation may increase carnosine synthesis in muscle, leading to reduced muscle fatigue with exercise. PURPOSE: To determine the effects of an acute dose of BA (4 grams, 30 min before testing) on muscular power, muscular endurance and aerobic performance. METHODS: 21 recreationally active men (24.5±1.9 yrs, 1.81±0.1m, 79.2±9.3kg) and 15 women (25.7±2.2yrs, 1.61±0.1m, 55.1±8.1kg) participated in a placebo controlled, double blind cross-over design study. Subjects were tested on 3 separate days with a 24-hour washout period between test sessions. Subjects consisted of 4 tests done in the following order: vertical jump on a jump mat, repetition of 70% leg press and chest press max until failure, and a 4-kilometer time trial (4km) on a cycle ergometer. The first testing visit established the 1-repetition maximum on the leg and chest press and familiarization with testing procedures. Subjects were randomized to BA or placebo on the 2nd and 3rd visit. Comparisons of the effects of BA and placebo on exercise test values were made using two-way ANOVA with repeated measures (p<0.05). RESULTS: BA showed a significant increase from baseline in the number of reps performed on both the leg press (15.7±5.5 vs. 22.9±7.3 repetitions, p<0.001) and chest press (12.0±5.8 vs. 17.7±5.4 repetitions, p<0.001). Placebo showed a small non-significant increase from baseline in the number of reps performed on both the leg press (15.7±5.5 vs. 17.3±5.3 repetitions, p<0.055) and chest press (12.0±5.8 vs. 12.6±5.6 repetitions, p<0.059). The increases in the BA group were statistically different from the change in the placebo group (leg press, p<0.001 and chest press p<0.001). BA showed a significant increase from baseline in aerobic power (132.0±49.1 vs 144.0±48.8 Watts, p=0.001) during the 4km. Placebo showed a small non-significant increase from baseline in aerobic power (132.0±49.1 vs 134.3±49.4 Watts, p=0.080) during 4km. The increase in aerobic power in the BA group was statistically different from the change in the placebo group (p<0.001). CONCLUSION: A single 4 gram dose of BA improves muscular endurance and aerobic power in recreationally active men and women.

3218 Board #87 June 2 8:00 AM - 9:30 AM The Influence of Different Walking Conditions on Walking Parameters Tomoaki Sakai1, Takahiro Nakano1, Kosho Kasugr1, Kazuo Oguri2,1. Nagoya Gakuin University, Seto, Aichi, Japan. 2. Gifu University, Gifu, Japan. 1. Gifu Shotoku Gakuen University, Gifu, Japan. 2. (No relevant relationships reported)

PURPOSE: This study investigated the relationship between characteristics of walking parameters and walking performance of different walking conditions. METHODS: The participants were 54 university students who had the habit of exercising ( 32 men and 22 women, 19.6 ± 0.7 years). Participants were asked to walk on flat and sloped ground. On the flat ground, they were asked to walk freely with a subjective intensity of “Light (ratings of perceived exertion (RPE) 1)” and “Somewhat hard (RPE 13).” The average slope was 4% for both upward and downward conditions and participants walked freely on both. Participants wore a wearable device attached to the left wrist that measured their walking speed, cadence, stride, and heart rate. RESULTS: On the flat ground, in all walking parameters, RPE 13 showed significantly higher values compared to RPE 11 (walking speed: 5.35 ± 0.49 versus 4.48 ± 0.43 km/h, cadence: 121.9 ± 8.8 versus 133.0 ± 7.3, stride: 73.2 ± 6.8 versus 65.8 ± 6.8 cm, respectively; p < 0.05). On the sloped ground, walking speed on the uphill slope showed significantly lower values compared to that on the downhill slope and the free-walking speed on flat ground (upward slope: 4.85 ± 0.27 km/h, downhill slope: 5.27 ± 0.38 km/h, flat ground: 5.25 ± 0.30 km/h). However, heart rate was significantly higher on the upward slope than in other conditions (118.8 ± 16.9 beats/min, 103.5 ± 14.0 beats/min, 107.8 ± 18.2 beats/min, respectively). Multiple regression analysis was performed with walking speed as the dependent variable and cadence and stride as independent variables. Results showed that for walking on the flat ground, the standardized coefficient for stride was higher than that for the cadence under all conditions. Although the same trend was found for walking on downward slopes, for walking on upward slopes, the standardized coefficient for cadence was higher than that for the stride. CONCLUSIONS: Walking parameters tended to be similar for walking on flat ground even when conditions changed; however, it became clear that characteristics of walking parameters on upward slopes varied from those of other conditions.

3219 Board #88 June 2 8:00 AM - 9:30 AM Physiological Performance Predictions Based on Simple Assessments Lindsie S. Rogers, J. Mark VanNess, Roman Musselfman, Courtney D. Jensen. University of the Pacific, Stockton, CA. (No relevant relationships reported)

Muscular strength and cardiovascular capacity are important determinants of athletic performance. Fundamental assessments include lower body strength (e.g., squat max), upper body strength (e.g., bench press max), and aerobic capacity (VO2 max). For coaches who lack equipment to measure these parameters, it is important to know if there are feasible alternatives to accurately evaluate their athletes. PURPOSE: To determine if simple strength and aerobic assessments can be used in the place of equipment-intensive testing to evaluate college athletes. METHODS: Fourteen collegiate male rugby players were recruited and tested. Independent variables were age, height, weight, vertical jump, and 10-yard dash. Dependent variables were body fat percent (BF%) via hydrostatic weighing, bench press max, squat max, and VO2 max. Data were collected twice during the competitive season, one month apart. Multiple linear regression tested how well the simple assessments predicted the traditional performance measurements. RESULTS: On average, athletes were 19.6 years of age with a BMI of 25.2 kg/m2, 13.4% body fat, VO2 max of 45.5 ml/min/kg, bench press of 186.7lb, squat max of 269.5lb, 10-yard dash of 1.7 seconds, and vertical jump of 22.2 inches. At baseline, BMI (p<0.001) and 10-yard dash (p=0.023) predicted BF% (R2=0.001). Significant was preserved at follow-up (R2=0.751; p<0.001). At baseline, holding age constant, 10-yard dash predicted VO2 max (β=31.4; p<0.002) and was strengthened at follow-up (R2=0.780; p<0.001). Holding age and BMI constant, 10-yard dash predicted bench press (β=222.7; p<0.023); the model was significant (R2=0.732; p<0.001) and retained at follow-up (R2=0.750; p<0.001). At baseline, holding BMI constant, squat max was predicted by vertical jump (β=8.9; p<0.005) and 10-yard dash (β=263.5; p<0.013). The model was significant (R2=0.923; p<0.001) and retained at follow-up (R2=0.913; p<0.001). CONCLUSIONS: In a sample of college rugby athletes, age, height/weight, vertical jump, and 10-yard dash were sufficient predictors of BF%, bench press, squat, and VO2 max. Our results indicate that it may be reasonable for comprehensive athletic evaluation to be simplified to accommodate a lack of equipment.

3220 Board #89 June 2 8:00 AM - 9:30 AM Relationship Between Clock Gene Expression, MEQ Score, and Exercise Performance Karina Ando1, Masaki Takahashi2, Shigenobu Shibata1, Hideyuki Takahashi1, 1. Japan Institute of Sports Sciences, Tokyo, Japan. 2. Waseda University, Tokyo, Japan. (No relevant relationships reported)

PURPOSE: To examine the relationship between human clock gene expression, chronotype, and morning/evening exercise performance. METHODS: Fifteen healthy young males were recruited for this study. The peak time of Period 3 (PER3) expression in hair follicle cells was evaluated as an indicator of the biological circadian rhythm and the Morningness-Eveningness Questionnaire (MEQ) score was used to determine the chronotype (morning, intermediate, or evening). Hair follicle cells were collected over a 24-h period at 4-h intervals from 06:00 hours by firmly holding and pulling the facial hair root. Morning and evening exercise performance was evaluated using a beep test. The tests were performed at least one week apart using a cross-over design at 10:00 and 18:00 hours. As a physiological index, oral temperature was measured before exercise, and heart rate was measured before and during exercise. Partial correlation was used to examine the relationship between MEQ score and the peak time of PER3 expression, exercise performance, and oral temperature. Paired t-tests were used to compare physiological variables between morning and evening performances. RESULTS: There was a moderate positive correlation between the peak time of PER3 expression and RPE (r=0.881, p<0.001). A significant correlation was found between the oral temperature at 10:00 and improvement in performance at 18:00 (evening performance) compared to that at 10:00 (r=0.735, p<0.05). There was no relationship between the MEQ score and performance. There was no significant correlation between the peak time of PER3 expression and the MEQ score. CONCLUSIONS: The present study suggested that the internal clock time evaluated based on gene expression may affect exercise performance. When the peak time of PER3 expression is late, performance may be higher at 18:00 compared to that at 10:00. Higher body temperature at 10:00 may be a good marker for higher performance at 18:00. Further research is required to investigate the relationships among circadian rhythm of clock gene expression, chronotype, and performance in competing athletes.
The relationship between relative intensity and changes in blood pH and ammonia is not well characterized. PURPOSE: The primary aim of the study was to determine how changes in relative intensity following repeat sprint performance affect changes in blood pH and blood ammonia concentrations. METHODS: Healthy college-age males (n = 12) completed one 30 second Wingate cycle sprint test as a familiarization trial. A minimum of 48 hours after the familiarization trial, participants returned to the lab. Resting venous and capillary blood samples were obtained to determine blood ammonia, pH, and lactate levels. Participants then completed 3 Wingate sprint tests, separated by 5 minutes each. Finger capillary blood was immediately obtained after each test to determine lactate and pH values. After the final test, an additional venous blood sample was obtained to determine blood ammonia values. RESULTS: Data are shown as 1st vs. 2nd vs. 3rd tests, respectively. There was a significant effect for time for peak power (750.08 ± 39.55 vs. 675.42 ± 30.01 vs. 615.60 ± 37.72 Watts); F = 4.66; p = 0.05, mean power (632.67 ± 30.71 vs. 561.25 ± 22.16 vs. 524.40 ± 26.46 Watts); F = 5.04; p = 0.04, pH (7.72 ± 0.01 vs. 7.63 ± 0.02 vs. 7.62 ± 0.02); F = 70.18, p < 0.01, and lactate (12.16 ± 1.14 vs. 14.10 ± 1.13 vs. 16.95 ± 2.22 mg/dL); F = 42.02, p < 0.01. Blood ammonia values increased from pre-to-post-exercise (0.33 ± 0.09 vs. 1.07 ± 0.22 mg/dL); t = 3.62, p < 0.01, but there was no correlation between post-exercise ammonia values and change in peak or mean power. There was a weak, but significant correlation between change in peak power and change in pH (R² = 0.34, p = 0.05) and change in mean power and change in pH (R² = 0.44, p = 0.02). CONCLUSIONS: Greater reductions in peak power and mean power correlated with change in blood pH, but not post-exercise ammonia values.

Acute Cognitive Anxiety is Positively Related to Maximal Strength Performance

Joseph P. Carzoli¹, Michael H. Haischer¹, Daniel M. Cooke¹, Amber M. Shiperd², Trevor K. Johnson³, Edward P. Davis¹, Dan J. Belcher¹, Robert F. Zoeller¹, Michael Whitehurst, FACSM®, Michael C. Zourdos¹, Florida Atlantic University, Boca Raton, FL. Texas A&M University-Kingsville, Kingsville, TX.

(No relevant relationships reported)

A flexible program allows the athlete to choose the daily training session based upon their readiness prior to the session. There is no consensus regarding the best pre-training readiness assessment. One proposal has been that elevated acute anxiety would be related to performance, however, there are equivocal findings related to the benefit of high anxiety and strength performance. PURPOSE: Therefore, the purpose of this investigation was to examine the relationship between somatic and cognitive anxiety on acute one-repetition maximum (1RM) back squat performance. METHODS: Eighty-eight resistance-trained males (n=41) and females (n=17) (age: 23±3yrs; body mass: 80.64±16.49 kg) completed the Revised Competitive State Anxiety Inventory-2 (CSAI-2) questionnaire prior to performing a 1RM back squat. Additionally, participants completed a perceived self-efficacy (PSE) questionnaire in which participants stated what they believed they were 100%, 75%, and 50% confident they could squat for a 1RM. Next, following a 5-minute dynamic warm-up, subjects completed an validated 1RM back squat protocol. To provide the dependent variable the difference of each PSE value was taken from the 1RM (1RM-PSE). Pearson’s product moment correlations were then utilized to determine the relationship between the somatic and cognitive anxiety subscales of the CSAI-2 and 1RM-PSE difference at each reported percentage of confidence. RESULTS: Participants squatted more than predicted at the 100% (13.2±1{linear Equation}0.00 kg) and 75% confidence (3.5±15.75 kg) and less than predicted at 50% confidence (-5.00±15.25 kg). Cognitive anxiety was positively and significantly related to 1RM-PSE at all confidence levels: 100% (r=0.43, p<0.01), 75% (r=0.41, p<0.01), and 50% (r=0.37, p=0.01), while somatic anxiety was not significantly related to performance at any confidence level (100%: r=0.16, p=0.23, 75%: r=0.16, p=0.24; 50%: r=0.04, p=0.77). CONCLUSIONS: These results indicate that increased acute cognitive anxiety is associated with better than predicted squat strength, while increased acute somatic anxiety is not associated with acute strength. If utilizing a flexible training template, cognitive anxiety should be one of the pre-training readiness factors which is used to select resistance training load.

Official Journal of the American College of Sports Medicine

Vol. 49 No. 5 Supplement S661

SATURDAY, JUNE 2, 2018

Board #90
June 2 8:00 AM - 9:30 AM
Changes in Blood pH and Ammonia Following Repeat Sprint Performance
Gregory R. Davis, Jordan Perrett, Danielle Rudesill, David Bellar. University of Louisiana at Lafayette, Lafayette, LA.
(No relevant relationships reported)

Depth of pressure on skin mechanoreceptors may affect reaction time. Athletes such as wrestlers that depend on skin proprioception for performance may utilize reaction time differences based on pressure differences. It is unknown whether training could affect this response. PURPOSE: The purpose of this study was to determine whether depth of pressure or athlete status affects reaction time. METHODS: Forty college students (20 wrestlers, 15 non-wrestling athletes, and 5 non-athletes) participated in a reaction time study where three weights (5, 10 g, and 30 g) were dropped from 50 cm onto the bicep while subjects were blindfolded and wearing earplugs. Each weight was dropped three times in a randomized order. All trials were recorded using a high-speed camera (Fastec II-L) at 1200 Hz and calculated as the time from skin deformation until first contact pressures on the upper arm.

RESULTS: There were no main effects for athlete status group or weight (p = 0.38), even though heavier weights elicited a non-significant faster response (5 g = 140.28 ± 16.44 ms, 10 g = 136.75 ± 17.63 ms, 30 g = 128.86 ± 18.02 ms). CONCLUSIONS: There is no evidence to suggest that wrestlers should train to react to a variety of contact pressures on the upper arm.

Board #93
June 2 8:00 AM - 9:30 AM
Acute Cognitive Anxiety is Positively Related to Maximal Strength Performance
Joseph P. Carzoli¹, Michael H. Haischer¹, Daniel M. Cooke¹, Amber M. Shiperd², Trevor K. Johnson³, Edward P. Davis¹, Dan J. Belcher¹, Robert F. Zoeller¹, Michael Whitehurst, FACSM®, Michael C. Zourdos¹, Florida Atlantic University, Boca Raton, FL. Texas A&M University-Kingsville, Kingsville, TX.
(No relevant relationships reported)

Board #91
June 2 8:00 AM - 9:30 AM
Impact of Calf Temperature Changes on Neuromuscular Function in Elite Taekwondo Athletes
Bo Geun Lee¹, Soni Yun¹, Yun Bin Lee¹, Mingi Jung¹, Dahye Lim¹, Ah Reum Jung¹, Woong Hee Lee¹, Eunjin Hwang¹, Ik Jin Kwon¹, Dae Tack Lee¹, Kookmin University, Seoul, Korea, Republic of. Chung-Ang University, Seoul, Korea, Republic of.
(No relevant relationships reported)

Board #92
June 2 8:00 AM - 9:30 AM
No Effects of Skin Pressure Depth on Reaction Time
Taylor L. Curtis, Landyn Van Overbeke, Antonio Meikle, Jeffrey W. Bell. Southwest Minnesota State University, Marshall, MN. (Sponsor: Serge P. van Duvellard, Ph.D., FACSM, FECSS, FACSM)
(No relevant relationships reported)
Women’s division I college basketball is demanding, thus non-contact injury rates are high, and key performance markers such as lower body power may decline at the end of the season due to high chronic training stress. Quantifying and monitoring athlete training loads is fundamental to managing injury risk, explaining acute changes in performance, increasing understanding of training responses, and planning and modifying training. Wearable devices using GPS and accelerometry (i.e., Catapult® OptiMotion SS5) provide new opportunities for advancing sport science in basketball. To date, no research has examined the game demands of women’s division I college basketball using Catapult® technology.

**PURPOSE:** To quantify the game demands of 6 women’s basketball players from a top Division I program (.781% win percentage) over a 3-year period, and to compare the positional differences of guards and posts during regular- and post-season games, and wins versus losses.

**METHODS:** Six female athletes (20.35 ± 1.6 yrs) wore Catapult SS® units in a garment resembling a sports bra during 89% of practices and games (Catapult Sports, Melbourne, Australia). Data were collected in real-time. Data, including Player Load (PL), Player Load per minute (PL/min), Inertial Movement Analysis (IMA), and Jumps (volume and intensity), were analyzed using Catapult OpenField Software (Version 1.14.1).

**RESULTS:** For the 3-year period, average player load ranged from 613-642, and it increased each year. This indicates that athletes were able to continue to increase their average player load each season. Average player load and average player load per minute was higher for wins than for losses. High IMA was similar for wins and losses. When data were examined by player position, guards accumulated higher average player loads, and higher average player loads per minute than posts. Differences in IMA by player position were inconsistent from year to year.

**CONCLUSIONS:** Wearable devices such as Catapult® provide important workload information that can be used to assess and guide player practice and game demands, including differences by player position. Future research should examine how player load relates to specific aspects of game performance (FT %, FG%) and to injury prevention.

**Notes:**
- The broad jump (BJ) test is frequently utilized to evaluate how far a person can jump and what their resulting lower body power will be. Hence, it is important that the BJ test be administered correctly for a person to jump as far as possible. The standard BJ test be administered correctly for a person to jump as far as possible. The standard BJ test be administered correctly for a person to jump as far as possible.
- The FE walked more distance in the 6MWT compared with C (21.8 ± 4.2 vs FE: 27.4 ± 0.8; p = 0.01). The cognitive performance was better in FE with respect to C (C: 21.18 ± 2.8 vs FE: 27.44 ± 0.8; p < 0.01). There was a positive correlation between the distance walked in the 6MWT and the cognitive performance (r = 0.68, p < 0.01). Finally, FE showed lower systemic BDNF levels than C (C: 18.676 ± 2.264 mg/ml vs FE: 15.766 ± 2.064 mg/ml, p < 0.01).

**CONCLUSION:** The data of the present study suggest that FE to long-term improved the cognitive performance in older people. However, the last effect was not accompanied with a higher BDNF concentration in the periphery at least in a Mexican population.

**Notes:**
- The broad jump (BJ) test is frequently utilized to evaluate how far a person can jump and what their resulting lower body power will be. Hence, it is important that the BJ test be administered correctly for a person to jump as far as possible. The standard BJ test be administered correctly for a person to jump as far as possible. The standard BJ test be administered correctly for a person to jump as far as possible.
- The FE walked more distance in the 6MWT compared with C (21.8 ± 4.2 vs FE: 27.4 ± 0.8; p = 0.01). The cognitive performance was better in FE with respect to C (C: 21.18 ± 2.8 vs FE: 27.44 ± 0.8; p < 0.01). There was a positive correlation between the distance walked in the 6MWT and the cognitive performance (r = 0.68, p < 0.01). Finally, FE showed lower systemic BDNF levels than C (C: 18.676 ± 2.264 mg/ml vs FE: 15.766 ± 2.064 mg/ml, p < 0.01).

**CONCLUSION:** The data of the present study suggest that FE to long-term improved the cognitive performance in older people. However, the last effect was not accompanied with a higher BDNF concentration in the periphery at least in a Mexican population.
CONCLUSION: Neither average off-season PL or PL-MIN were able to predict changes in CMJ force-velocity parameters. The average volume and intensity of off-season practice sessions did therefore not affect the jumping ability of female Division I basketball players.

3229  Board #98  June 2 8:00 AM - 9:30 AM  The Relationship Between Lower Extremity Strength and Overhead Squat
Nene Kitabatake, Kelvin Chiu, Karlee Burns, Will Wu, Mimi Nakajima. Center for Sports Training and Research, California State University Long Beach, Long Beach, CA. (No relevant relationships reported)

Impaired lower extremity muscle strength can put athletes at risk of injuries. Assessing the relationship between muscle strength and knee instabilities during overhead squat (OHS) can help prevent injuries of collegiate female athletes. PURPOSE: Examines the relationship between lower extremity muscle strength and the depth and knee wobbling during overhead squat (OHS). METHODS: Eight in-season Division I collegiate women’s tennis athletes and 10 in-season Division I collegiate women’s basketball athletes (age: 18.94 ±3.35 yrs, height: 1.75 ±0.08 m, weight: 71.61 ±14.05 kg) participated. Participants’ knee flexor, extensor, and hip abductor muscle strength were measured with a hand held dynamometer and the average of three trials was normalized by body weight (%BW). Participants then performed three consecutive OHS as low as possible and were video recorded for post processing from the frontal and sagittal planes. Following the assessment, participants were grouped into Above Parallel (AP) or Below Parallel (BP) depth and knee wobbles or no wobbles during OHS. RESULTS: The mean differences of knee flexor, extensor, and hip abductor strength were compared for BP and AP groups. Three participants were grouped into BP and 15 were grouped into AP. An independent t-test showed significant differences of left hip abductor strength of AP (mean=-17.82 ± 4.05 %BW), compared to BP (mean=-21.67 ± 1.41 %BW); t(18)=-2.900, p=0.016. No significant differences were found between muscle strength and knee wobbling. CONCLUSION: Overall, no relationship between knee wobbling and the lower extremity strength was found. However, there was a statistically significant relationship in OHS depth and hip abductor strength on the left side. Previous studies have demonstrated decreased hip abductor strength may cause patellofemoral pain syndrome (PPP) and knee valgus. Future studies should look at increasing hip abductor strength and its effects on PPP and knee valgus during functional movements.

3230  Board #99  June 2 8:00 AM - 9:30 AM  Hypersomnia is Negatively Related to Maximal Strength Performance
Dan J. Belcher1, Michael H. Haischer1, Daniel M. Cooke1, Joseph P. Carzoli1, Amber M. Shipherd2, Robert Varieur1, Trevor K. Johnson1, Edward P. Davis1, Robert F. Zoeller1, Michael Whitehurst, FACSM1, Michael C. Zourdos2. 1Florida Atlantic University, Boca Raton, FL. 2Texas A&M University-Kingsville, Kingsville, TX. (No relevant relationships reported)

Previously, ratings of performance self-efficacy (PSE) have been positively related to athletic performance. However, it has been proposed that sleeping dysfunction may disrupt PSE predictions. PURPOSE: Therefore, the purpose of this investigation was to examine the relationship between insomnia and hypersomnia on self-predicted acute one-repetition maximum (1RM) back squat performance. METHODS: Fifty-eight resistance-trained males (n=41) and females (n=17) (age: 23±3 yrs; body mass: 80.64±16.49 kg) completed the Osiego Sleep Questionnaire (OSQ) prior to performing a 1RM back squat. Additionally, participants completed a PSE questionnaire regarding what they believed they would be 100%, 75%, and 50% confident they could squat for a 1RM. Then following a brief dynamic warm-up, subjects completed a 1RM back squat protocol. The difference of each PSE value was then taken from the 1RM and converted to percentage (1RM-PSE) to assess differences between predicted and actual 1RM outcomes. Next, the 1RM-PSE value was converted to a percentage to determine the percentage difference between actual 1RM and predicted 1RM at each level of confidence. Pearson’s product moment correlations were used between the insomnia and hypersomnia subscales of the OSQ and the percentage 1RM-PSE at each confidence level. RESULTS: Participants squatted a greater amount than predicted at 100% (r=0.22; p<0.05) and 75% (r=0.21; p<0.05) levels of confidence, and less than predicted at the 50% confidence level (r=0.24; p<0.12). Hypersomnia was inversely and significantly related to the 1RM-PSE percentage at 100% confidence prediction (r=-0.71; p<0.001) and 75% confidence prediction (r=-0.65; p<0.001) but was not significantly related to the 1RM-PSE percentage at 50% confidence (r=-0.04; p=0.78). CONCLUSIONS: These results indicate that hypersomnia (i.e. acute excessive sleepiness) is associated with worse than predicted maximal strength performance in the squat at lower PSE confidence level. Therefore, acute sleep patterns should be considered as a readiness assessment.

3231  Board #100  June 2 8:00 AM - 9:30 AM  Acute Anxiety is Not Significantly Related to Repetitions Performed in the Back Squat
Hector G. Paez1, Michael H. Haischer1, Daniel M. Cooke1, Joseph P. Carzoli1, Amber M. Shipherd2, Trevor K. Johnson1, Edward P. Davis1, Robert Varieur1, Robert F. Zoeller1, Michael Whitehurst, FACSM1, Michael C. Zourdos2. 1Florida Atlantic University, Boca Raton, FL. 2Texas A&M University-Kingsville, Kingsville, TX. (No relevant relationships reported)

Flexible resistance training programs allow for athletes to autoregulate daily training variables based upon readiness prior to the training session. Although factors such as physical recovery, anxiety, and sleep can affect acute performance there is no consensus regarding the best training evaluation to assess readiness to train. In fact, somatic and cognitive anxiety have been both positively and negatively related to athletic performance, thus the findings for these factors as readiness indicators are equivocal. The Revised Competitive State Anxiety Inventory-2 (CSAI-2) is a common scale which allows for the acute assessment of both anxiety traits.PURPOSE: Therefore, the purpose of this investigation was to examine the relationship between somatic and cognitive anxiety using the CSAI-2 scale on maximal repetitions performed at 70% of one-repetition maximum (1RM) in back squat. METHODS: Fifty-eight resistance-trained males and females (age: 23±3.3yrs; body mass: 80.64±16.49 kg) completed the CSAI-2 questionnaire prior to performing a 5-minute dynamic warm-up and a 1RM back squat. Following 1RM testing, subjects had a standardized rest period of 10 minutes prior to completing two single-repetition sets on the squat at 30%, 40%, 50%, 60%, 70%, 80% and 90% of the established 1RM for which the data is included elsewhere. After the submaximal single repetition sets, subjects had a 10-minute rest period before completing one set on the back squat to volitional failure at 70% of the established 1RM. Pearson’s product moment correlations were then utilized between the somatic and cognitive anxiety subscales of the CSAI-2 to determine if any relationship existed with the number of repetitions completed at 70% of 1RM. RESULTS: Somatic anxiety (r=-0.20, p<0.01), cognitive anxiety (r=-0.19, p<0.01), and self-confidence (r=0.05, p=0.72) subscales of the CSAI-2 were not significantly correlated with back squat performance during maximal repetitions to failure at 70% of 1RM. CONCLUSIONS: None of the CSAI-2 subscales were related with repetitions performed to volitional failure in the squat. However, we caution that this analysis did not examine maximal strength performance, and should only be applied to repetitions performed to failure at submaximal intensities.

3232  Board #101  June 2 8:00 AM - 9:30 AM  Grit is Not Significantly Related to Repetitions Performed in the Back Squat
Robert J. Pratt1, Michael H. Haischer1, Daniel M. Cooke1, Joseph P. Carzoli1, Amber M. Shipherd2, Trevor K. Johnson1, Edward P. Davis1, Robert Varieur1, Robert F. Zoeller1, Michael Whitehurst, FACSM1, Michael C. Zourdos2. 1Florida Atlantic University, Boca Raton, FL. 2Texas A&M University-Kingsville, Kingsville, TX. (No relevant relationships reported)

Several psychological factors have been linked to acute strength performance through a variety of psychometric analyses. Recent research suggests that the “grittier” a person is, the greater their perseverance and passion for long-term goals. Although grit has shown some promise in predicting long-term performance, the association between grit and acute strength performance is yet to be determined. PURPOSE: Therefore, the purpose of this investigation was to examine the relationship between grit as determined by the Short Grit Scale (Grit-S) and total repetitions performed to volitional failure at 70% of one-repetition maximum in the back squat. METHODS: Fifty-eight resistance-trained males and females (age: 23±3yrs; body mass: 80.64±16.49 kg) completed Grit-S prior to performing a one-rep max back squat (1RM). Following a 5-minute dynamic warm-up, subjects completed a validated 1RM back squat protocol. Following 1RM testing, subjects had a standardized rest period of 10 minutes prior to completing two single-repetition sets on the squat at 30%, 40%, 50%, 60%, 70%, 80% and 90% of the established 1RM for which the data is included elsewhere. After the submaximal single repetition sets, subjects had a 10-minute rest period before completing one set on the back squat to volitional failure at 70% of the established 1RM. A Pearson’s product moment correlation was utilized to determine any relationships between Grit-S total repetitions performed at 70% of 1RM. RESULTS: There was a wide range of repetitions performed to volitional failure (0-28) with an average of 14±4 repetitions. However, grit as determined by the Grit-S was not significantly related to total repetitions performed at 70% of 1RM in the back squat (r=0.11, p=0.42).

CONCLUSIONS: These results indicate that higher levels of grit are not associated
with repetitions performed to failure and submaximal back squat intensities. However, we suggest that the Griit-S should be used to assess long-term commitment to athletic training as well as a possible indicator of chronically improved performance.

3233 Board #102 June 2 8:00 AM - 9:30 AM
Relationship Between Fitness Testing and Performance Statistics in Baseball: A Longitudinal Study
Thejasvi Reddy Antanastasagar1, Vishik Vinod2, Richard A. Karasch1, James G. Disch1, Zacharias Papadakis1. 1Rice University, Houston, TX. 2University of Houston, Houston, TX. (Sponsor: Peter W. Grandjean, FACSM)

(No relevant relationships reported)

Fitness testing (FT) is a contributing factor for success in most sports. Little evidence exists related to baseball FT and performance statistics (PS). PURPOSE: To examine relationships between FT and selected PS in NCAA Division I baseball team. METHODS: We followed the same players for a period of 5 years and we recorded their FT and PS. N = 414 (age 19.8 ± 1.3 yrs; weight 89.9 ± 8.3 kg). Grip strength (GS), vertical jump height (VJ), and squat IRM (SQ) were examined with regards to SATURDAY, JUNE 2, 2018

3234 Board #103 June 2 8:00 AM - 9:30 AM
The Short Grit Scale Does Not Relate to Acute One-Repetition Maximum Back Squat Performance
Trevor K. Johnson1, Michael H. Haischer2, Joseph P. Carzoli1, Robert Varieur1, Michael C. Zourdos1, Trevor K. Johnson1, Robert F. Zoeller1, Amber M. Shipherd1, Cameron S. Mackey3, James G. Disch1, James G. Disch1, Pro Ohio State University, Stillwater, OK. FACSM. (Sponsor: Peter W. Grandjean, FACSM)

(No relevant relationships reported)

An individual’s level of “grit” is determined by their perseverance and passion for long-term goals. Existing data have demonstrated that grit has predicted success above what could be explained by talent alone. However, these existing data are based upon subjective questionnaires, including a recent meta-analysis in which correlations were then utilized between the Grit-S and 1RM-PSE difference of each PSE value was taken from the 1RM (1RM-PSE). Pearson’s product-moment correlations were then utilized between the Grit-S and 1RM-PSE difference. Additionally, participants completed a perceived self-efficacy (PSE) questionnaire in order to assess their level of belief in their ability to perform each test. PS were recorded for each test using an aggregate of 30s of jumping (cadence of 120/min) with 30s of rest; a third set was added to the training protocol during weeks three and four. Repeated-measures analyses of variance were performed on all pre- and post-testing measures.

Purpose: To compare the effects of weighted versus light-rope jumping on maximal upper extremity strength and jump performance. Methods: Twenty-two recreationally active females (Age: 20.27 ± 1.03yrs; height: 165.05 ± 7.17cm; mass: 68.97 ± 16.37kg) participated in a four-week rope-jumping training intervention. Assessment measures were obtained pre-and post-training intervention. Maximal isometric strength of the elbow flexors (EF), elbow extensors (EE), and grip strength (GS) were assessed via dynamometry. Additionally, countermovement jump (CMJ) height, peak power (PP), and peak velocity (PV) values were assessed using a jump mat and linear position transducer. Following pretesting, participants were randomly assigned to either a weighted rope (WR: .91kg; n = 11) or light rope (LR: .11kg; n = 11) group. The training protocol consisted of participants performing two, 4-minute sets of alternating 30s of jumping (cadence of 120/min) with 30s of rest; a third set was added to the training protocol during weeks three and four. Repeated-measures analyses of variance were performed on all pre- and post-testing measures. Results: No time x group interaction was revealed (p > 0.05), however, a main effect of time was observed for both GS and EF (F(1, 20) = 6.25, p = 0.021 & F(1, 20) = 5.78, p = 0.026, respectively), revealing increases in both groups for EF (WR: 6.3%; LR: 7.5%) and GS (WR: 8.7%; LR: 3.2%). CMJ height analysis revealed no interaction (p > 0.05), however, a main effect of time (F(1, 19) = 5.611, p = 0.029) was observed. PP and PV analyses revealed no significant interactions (p > 0.05), however, a main effect of time was observed for both PP and PV (F(1, 19) = 9.54, p = 0.006 & F(1, 19) = 7.33, p = 0.014, respectively). Collectively, CMJ height, PP, and PV values increased in the WR group by 5.5%, 6.5%, and 6.6%, and in the LR group by 1.1%, 1.9%, and 1.25%, respectively. Conclusion: Although no differences were observed between groups in strength nor jump performance, our data suggest that consistent jump rope training, regardless of rope weight, has a significant influence on upper extremity strength and jump performance.
Athletic ability, performance, and motor skills depend greatly on human proportionality. Practicing sports at a high level is associated with a person’s ability to meet the biomechanical demands of a particular sport or playing position. The ideal somatotype of athletes in different sports and within the same sport has been described. However, there is limited evidence regarding the association between the anthropometric characteristics, such as body weight (BW), body height (BH), and body fat (%BF%) of collegiate baseball pitchers and baseball performance statistics (PS). PURPOSE: To compare BW, BH, BF% and selected baseball-specific PS, such as earned run average (era), batting average against (b/avg-a%), and strike-out per innings pitched for 9 innings (so/ip)*9 in NCAA Division I pitchers; to examine the relationship between BW, BH, BF% and baseball-specific PS. METHODS: During a 5-year period, 210 collegiate pitchers (age 19.7±1.2 yr; weight 92.2±8.2 kg) were assessed for body weight (BW), body height (BH), and body fat (%BF%). The following pitchers’ baseball statistics were collected: era, b/avg-a%, and (so/ip)*9. BW, BH, BF% and PS were normalized to z-scores. Missing data were estimated from least squares prediction from non-missing variables. Forward multiple stepwise regression was used to evaluate the relative impact of BW, BH, and BF% on PS (JMP Pro 13).

RESULTS: BH is significantly correlated both with b/avg-a% (r=-0.18, p=0.0104) and era (r=-0.22, p=0.0010). BW is significantly correlated with (so/ip)*9 (r=-0.22, p=0.0016). BF% is significantly correlated with era (r=-0.14, p=0.0472). Strike-out per innings pitched for 9 innings was selected as the independent variable with the highest goodness of fit significantly correlating with BW (p=0.0004), BH (p=0.0004), and BF% (p=0.0022) with adjusted R²=0.12. CONCLUSIONS: The results indicate that BW, BH, and BF% of pitchers correlate with BW (p=0.0004), BH (p=0.0004), and BF% (p=0.0022) with adjusted R²=0.12. The selected anthropometric variables accounted for 12% of the variance in (so/ip)*9. Runs are usually scored by hits. Coaches and trainers want pitchers to prevent runs. Therefore, they may need to account for other factors besides BW, BH, and BF%.

Competitive rifle shooting is rapidly becoming a staple sport in American collegiate athletics. Over 300 universities in the United States now have shooting programs. Accurate shooting requires immense physiological and biomechanical control. PURPOSE: The purpose of this study was to determine physiological (heart rate [HR] and respiratory rate [RR]) and performance differences in three shooting positions (Standing, Kneel, and Prone) during competitive .22 caliber bore rifle shooting. METHODS: 9 Division I collegiate women’s rifle shooters participated in the study. HR and RR data were collected for each participant via a bio-harness. Each participant completed 10 sighting shots and 10 performance shots recorded for accuracy, using an NCAA approved computer scoring system. Each participant shot in the three positions following NCAA competition rotation. A one-way ANOVA was run to determine the impact of positioning on all variables of interest, with post-hoc LSD analysis on all significant omnibus results. RESULTS: A significant difference was noted for Total Score (F(2,25) = 6.258, p = 0.007). Post-hoc analyses revealed that scores were significantly worse in the Stand position (80.0±9.6) compared to Prone (92.5±5.1, p = 0.002). Kneel score (86.8±6.6, p = 0.066) compared to Stand approach, but was not statistically different. Significance was approached with RR (p = 0.059), with RR being highest in Prone (4.6±2.1 breaths), compared to Stand (4.4±2.1 breaths) and Kneel (3.9±1.3 breaths). No significant differences were noted for HR (p = 0.862).

CONCLUSION: The data suggest that the Prone position yielded the highest scores, and a potentially elevated RR. This suggests that the ground-assisted positioning of the rifle, and slightly elevated RR, aid in scoring accuracy in collegiate women’s .22 caliber bore rifle shooters. Conversely, lowest scores were recorded in the Stand position. This could be due to the weight (~17lb) of the rifle needing to be held steady in this position.

Individuals new to triathlon may have difficulty accurately predicting their finish time. Equations (Schabort et al., Hue et al.) have been developed that predict Olympic distance triathlon finish time. However, triathletes were elite level with a sample size of 10 or fewer, making it uncertain if these findings are relevant to a larger sample of amateur triathletes. An online calculator (QT2) is also available to predict triathlon times, but it has not been validated. PURPOSE: To assess the criterion and convergent validity of two statistical equations and the QT2 in predicting actual finish time of an Olympic distance triathlon for amateur triathletes. METHODS: Participants were collegiate, amateur triathletes. The purpose of the study was to determine the criterion and convergent validity of two statistical equations and the QT2 calculator in predicting the Olympic distance triathlon during 2017. Participants performed six exercise tests, as close to their race as possible, either before or after, and all tests were performed on separate days. Body composition was assessed via BodPod. Three of the exercise tests (peak treadmill speed, 4 W/kg cycle, 30-minute bike/20-minute run) were used in the scientific equations. For these, participants visited the laboratory at Michigan State University or Eastern Michigan University on three separate occasions. Blood lactate was measured for each test. The remaining three exercise tests, which participants completed on their own (400y swim, 20-minute cycle, 5k run), were used in the QT2. Pearson correlations evaluated relationships for criterion and convergent validity. Eight amateurs could not complete the 4 W/kg cycle, so analyses were also run with their data removed.

RESULTS: Twenty-seven triathletes (20.6±2.0 years, 37.0% female, actual finish time 2:54:00±0:34:32) have completed testing. The QT2 (r=0.865, p=0.0011), Hue (r=0.883, p<0.001), and Schabort (r=0.392, p<0.05) were associated with actual finish time. The QT2 and Hue (r=0.859, p<0.001) and Schabort and Hue (r=0.394, p<0.05), were associated with each other. When athletes who modified the 4 W/kg cycle were removed from the analyses, relationships with Schabort disappeared.

CONCLUSIONS: The QT2 and Hue equation were closely associated with actual finish time. The QT2 involves easily accessible tests, unlike both scientific equations, which require blood lactate testing. Because of this, the QT2 may be preferred by amateurs.
Oxygen-dependent exercise at altitude has demonstrated ability to increase maximal oxygen uptake over a time. Traditional means of altitude training can be time-consuming and expensive, so alternative methods that simulate altitude exposure have been developed. These masks maintain that they induce the same cardiorespiratory fitness changes that an athlete training at altitude would experience. They also claim that these improvements occur in a shorter training period than typical altitude training protocols. However, there is little research to support these claims.

**PURPOSE:** The purpose of this study is to measure the potential effects of training at a simulated altitude on aerobic endurance using a two-week YMCA cycle ergometer protocol. **METHODS:** Based on subjects' VO2 max scores, 17 subjects were put into one of three groups, a control group (CG), a group training without the mask (No-mask), and a group training with the mask (Mask). Each training session had the participants cycle for twelve minutes, at 50-60% of their heart rate reserve (HRR), followed by a 3-minute cool-down. Eight training sessions were completed within two weeks. **RESULTS:** Using a 3X2 mixed ANOVA, for within subjects, there was no significant increase in VO2 max (F(1,2,14)=.873, P>.05). Means ± SD for CG were pre 44.72±9.69 and post 45.07±8.96ml/kg/min. Means ± SD for No-mask group were pre 42.70±8.83 and post 44.10±11.47ml/kg/min. Lastly, the means ± SD for mask group means were pre 45.50±8.72 and post 47.91±8.96ml/kg/min. There were no significant differences in VO2 max between the control and experimental groups (F(1,2,14)=170, P>.05) either. Although the between groups data was not statistically significant, there was a greater increase in the mask group’s aerobic endurance compared to the two other groups. **CONCLUSION:** When looking at the increase in VO2 max in response to a leg ergometer protocol, all three groups demonstrated an increase in VO2 max at the completion. Those who trained with simulated altitude masks showed the greatest improvement from pre- to post-testing, which could be a result of the mask use, in addition to the participant’s outside training. The improvement shown in the other two groups may be a result of the participants’ continued training outside of the study, as well as other factors.

**3242**

**Board #111**

**June 2 8:00 AM - 9:30 AM**

**Dynamic Strength Following Focal Knee Joint Cooling**

Joo-Sung Kim. University of Miami, Coral Gables, FL.
(Sponsor: Perry, Arlette C, FACSM)

**No relevant relationships reported**

**Dynamic Strength Following Focal Knee Joint Cooling**

Focal knee joint cooling (FKJC) has been found to increase quadriceps strength during isometric contraction. It is unknown, however, if a similar response will occur with dynamic modes of muscle contraction such as concentric and eccentric.

**PURPOSE:** To determine the effects of FKJC on isometric, concentric and eccentric modes of muscle contraction in the quadriceps muscle. **METHODS:** Twenty-one subjects (age=22.7±3.1 year, height=170.4±10.8cm, weight=74.2±16.4kg) without lower extremity injury participated. All subjects received 20 minutes of FKJC for a leg ergometer protocol, three groups demonstrated an increase in VO2 max at the completion. Those who trained with simulated altitude masks showed the greatest improvement from pre- to post-testing, which could be a result of the mask use, in addition to the participant’s outside training. The improvement shown in the other two groups may be a result of the participants’ continued training outside of the study, as well as other factors.

**3243**

**Board #112**

**June 2 8:00 AM - 9:30 AM**

**Longitudinal Correlation of Sleep Time, Strength Gains, and Performance in Collegiate Baseball Players: A Pilot Study**

Delmas Bolin, FACSM1, James Buriakład, John Creasy2, Gabrielle Deucher2, Emily Whitaker2, Adam Childers2. 1Performance Medicine of Southwestern Virginia, Roanoke, VA. 2Roanoke College, Salem, VA.

(No relevant relationships reported)

**Objective:** The purpose of this study was to measure the potential effects of training at a simulated altitude on aerobic endurance using a two-week YMCA cycle ergometer protocol. METHODS: Based on subjects’ VO2 max scores, 17 subjects were put into one of three groups, a control group (CG), a group training without the mask (No-mask), and a group training with the mask (Mask). Each training session had the participants cycle for twelve minutes, at 50-60% of their heart rate reserve (HRR), followed by a 3-minute cool-down. Eight training sessions were completed within two weeks. RESULTS: Using a 3X2 mixed ANOVA, for within subjects, there was no significant increase in VO2 max (F(1,2,14)=.873, P>.05). Means ± SD for CG were pre 44.72±9.69 and post 45.07±8.96ml/kg/min. Means ± SD for No-mask group were pre 42.70±8.83 and post 44.10±11.47ml/kg/min. Lastly, the means ± SD for mask group means were pre 45.50±8.72 and post 47.91±8.96ml/kg/min. There were no significant differences in VO2 max between the control and experimental groups (F(1,2,14)=170, P>.05) either. Although the between groups data was not statistically significant, there was a greater increase in the mask group’s aerobic endurance compared to the two other groups. CONCLUSION: When looking at the increase in VO2 max in response to a leg ergometer protocol, all three groups demonstrated an increase in VO2 max at the completion. Those who trained with simulated altitude masks showed the greatest improvement from pre- to post-testing, which could be a result of the mask use, in addition to the participant’s outside training. The improvement shown in the other two groups may be a result of the participants’ continued training outside of the study, as well as other factors.

**3242**

**Board #111**

**June 2 8:00 AM - 9:30 AM**

**Dynamic Strength Following Focal Knee Joint Cooling**

Joo-Sung Kim. University of Miami, Coral Gables, FL.
(Sponsor: Perry, Arlette C, FACSM)

**No relevant relationships reported**

**Dynamic Strength Following Focal Knee Joint Cooling**

Focal knee joint cooling (FKJC) has been found to increase quadriceps strength during isometric contraction. It is unknown, however, if a similar response will occur with dynamic modes of muscle contraction such as concentric and eccentric.

**PURPOSE:** To determine the effects of FKJC on isometric, concentric and eccentric modes of muscle contraction in the quadriceps muscle. **METHODS:** Twenty-one subjects (age=22.7±3.1 year, height=170.4±10.8cm, weight=74.2±16.4kg) without lower extremity injury participated. All subjects received 20 minutes of FKJC for a leg ergometer protocol, all three groups demonstrated an increase in VO2 max at the completion. Those who trained with simulated altitude masks showed the greatest improvement from pre- to post-testing, which could be a result of the mask use, in addition to the participant’s outside training. The improvement shown in the other two groups may be a result of the participants’ continued training outside of the study, as well as other factors.

**3243**

**Board #112**

**June 2 8:00 AM - 9:30 AM**

**Longitudinal Correlation of Sleep Time, Strength Gains, and Performance in Collegiate Baseball Players: A Pilot Study**

Delmas Bolin, FACSM1, James Buriakład, John Creasy2, Gabrielle Deucher2, Emily Whitaker2, Adam Childers2. 1Performance Medicine of Southwestern Virginia, Roanoke, VA. 2Roanoke College, Salem, VA.

(No relevant relationships reported)
Previous research has evaluated the quality of recovery from bouts of athletic events. Various measures have been used to assess recovery, yet most methods were somewhat problematic for rapid data collection. When costs are a limitation, it may be best to seek less expensive alternative methods of evaluating recovery. PURPOSE: To evaluate potential fatigue of collegiate ultimate frisbee athletes over two days of tournament play (TP) utilizing the perceived recovery status scale (PRSS) and ratings of perceived exertion (RPE). METHODS: Nineteen college-aged males participated in the study. Occurring over two days of TP, PRSS and RPE were recorded during 5 frisbee matches with each match separated by 30min. Two minutes prior to the first and second half, PRSS was recorded for each athlete and 2 minutes after each half, RPE was recorded. RESULTS: Significant differences occurred in PRSS with a decrease in values from the 2nd to the 5th matches (p = 0.006) and within the 2nd half of comparable matches (p = 0.031). RPE was recorded. CONCLUSION: The results suggest that much of the variance in fatigue and fatigue-related measures occur between the 2nd and 5th matches of TP. The cumulative effects of fatigue during TP may have been a result of several potentially uncontrollable factors. Note, decreased perceived recovery could be related to the increased stress levels that occurred because of the amplified significance of the final match. Future research may evaluate other quantifiable recovery data (i.e. HRV and GPS) during tournament play.

The vertical jump (VJ) test is often used to assess an individual’s lower body peak power. The standard recovery time between subsequent jumps is typically 30 seconds (secs) with a completion of 3-6 jumps. Prior studies have reported no significant difference between 30 vs. 60 seconds recovery on VJ performance. However, it may be possible that a shorter passive recovery (PR) period may allow for maintenance of performance. To the best of our knowledge, this is the first study to examine the effect of varying recovery periods on VJ performance. PURPOSE: To investigate potential differences between 15 vs. 30 seconds recovery period on VJ performance. METHODS: To investigate potential differences between a 15 vs. 30 seconds PR period on VJ performance has not been assessed. PURPOSE: To investigate potential differences between a 15 vs. 30 seconds PR period on VJ performance in no less than averagely fit college-age males. METHODS: After measuring descriptive data (Ht., Wt., BFT%, age), 31 averagely fit college-age males completed an 8 minute (min) dynamic warm-up on a cycle ergometer. Subjects were given a 4 min PR during which their reach height was measured. Following the PR, four familiarization jumps were completed using a VJ measurement device. After another 4 min PR, the subjects completed 2 series of jumps, with 6 trials each, in a counterbalanced order with either 15 (FIF) or 30 (THI) secs of recovery between each jump. The FIF and THI jump series were separated by 6 min of PR. Excluding the first jump, the highest jump for FIF and THI were compared using Paired-Samples t-Tests with significant differences occurring at p ≤ 0.05. RESULTS: Significant differences (p = 0.016) occurred between FIF (69.64 ± 8.61 cm) and THI (70.35 ± 8.99 cm). CONCLUSION: The current results suggest that 30 secs of PR between jumps is optimal recovery for performance during the VJ test, while 15 secs of PR may hinder peak VJ performance in averagely fit college-age males. Although THI was less than a centimeter above FIF, a sufficient number of subjects had improved performance during THI. Future research may assess the impact of 15 vs. 30 secs PR on VJ performance using highly fit collegiate athletes that use vertical jump as a sport specific movement.

Self-myofascial release (SMR) treatments appear to enhance joint range of motion (RoM) and restore movement function but the effects of different SMR durations on athletic performance have yet to be examined. PURPOSE: To investigate the effects of different SMR treatment durations (1 minute and 5 minutes) on joint RoM, power, and agility. METHODS: Twenty-four volunteers participated with ankle and knee joint RoM assessed using modified weight-bearing (WBL) and kneeling lunge (KL) tests. Vertical jump (VJ) performance and pro-agility (PA) sprint performance were also examined. All tests were conducted before and immediately after one-minute (SMR_1) and five-minutes (SMR_5) of SMR and immediately following a control (CON) condition. SMR was done on the quadriceps and triceps surae muscle groups using a standardized protocol and foam roller. Differences in dependent variables (VJ height, PA run time, WBL distance, KL angle) between treatment groups (SMR_1, SMR_5, CONTR) at two time-points (pre- and post-treatment) were analyzed using a 3 x 2-way repeated measures analysis of variance (ANOVA). Alpha = 0.05. Effect sizes (ES) were calculated to clarify the magnitude of the effect of differences between means from pre- to post-treatment for each treatment condition. RESULTS: KL angle increased following SMR_5 (16.4 %; ES = 0.85) when compared with SMR_1 (12.5 %; ES = 0.58). WBL distance showed little change following SMR treatments and the CONTR condition exhibited little effect on RoM tests. VJ height increased following SMR_1 (5.1 %; ES = 0.26) but changed little following CONTR (1.9 %; ES = 0.10). PA run time improved slightly following SMR_1 (1.1 %) but deteriorated following CONTR (1.2 %) and SMR_5 (0.5 %). Effect size calculations for changes in PA, however, were trivial across all conditions (0.06 – 0.15). CONCLUSION: Extended periods of SMR may be recommended should improvements in joint RoM be required. If power output is a critical requirement of subsequent tasks, prolonged SMR treatment (i.e., 5-min) should be avoided.

The strength training is the most efficient modality to improve muscle volume and strength in health and disease. Recently, a new method of training including static stretching named Fascia Stretch Training (FST-7) has emerged. It is argued that the FST-7 could induce greater muscle swelling, known as an important hypertrophic stimulus. However, the acute responses to FST-7 have not been established. PURPOSE: To compare mechanical and metabolic responses from FST-7 with traditional strength training protocols. METHODS: Twelve resistance-trained men (age: 29.0 ± 6.1 years; weight: 84.4 ± 10.3 kg; height: 1.78 ± 0.06m) participated of the study. The volunteers attended to the laboratory in four non-consecutive days. The first session was used to familiarization with the testing procedures. On the following sessions, volunteers performed randomly one of the three training protocols: 1) FST-7: seven sets of 10 isokinetic knee extension with a passive 40-sec rest-interval; 2) Control (CON): seven sets of 10 isokinetic knee extension with a passive 40-sec rest-interval; and 3) Traditional (TRA): seven sets of 10 isokinetic knee extension with a passive 120-sec rest-interval. Total work (TW) of each protocol was recorded. Muscle swelling (MS) and blood lactate (BL) was measured before and after each exercise protocol. Repeated measures multifactorial ANOVA was used to analyze data.

RESULTS: On TW, there was a significant main effect for protocol (F = 23.843; p < 0.001). FST showed a lower TW (11823 ± 1735.06) than CON (13976.08 ± 2378.07) and TRA (15510.77 ± 2250.55). On MS, there was no significant protocol and time interaction (F = 0.380; p = 0.69). All protocols showed a similar increase in MS after treatment session (p < 0.001). On BL, there was no significant protocol and time interaction (F = 2.186; p = 0.14). All protocols showed a similar increase in BL after training session (p = 0.001).

CONCLUSIONS: FST, CON and TRA induce a similar increase in metabolic responses. However, FST produce lower mechanical stress than CON and TRA. These results suggest that FST may not be a superior stimulus than previous traditional strength protocols to induce muscle hypertrophy.
The better CMJ performance when players wore PCM cooling shorts post game is evidence of accelerated recovery. This inertial sensor provides a portable and practical means of assessing recovery in elite soccer players.

3251 Board #120
June 2 8:00 AM - 9:30 AM
Effect Of Cold Water Immersion On Skin Temperature: A Thermography Study
Braulio Sánchez-Ureña1, Daniel Rojas-Valverde2, Randall Gutiérrez-Vargas3, Juan Carlos Gutiérrez-Vargas3, Christopher T. Minson, FACSM4. 1National University of Costa Rica, Heredia, Costa Rica. 2University of Oregon, Oregon, OR. (Sponsor: Christopher Todd Minson, FACSM)

Cold water immersion (CWI) is a recovery method in sports, acting through a reduction in body temperature and improved muscular function by limiting post-exercise inflammation. Infrared Thermography (IRT) is a non-invasive technique to measure skin temperature, and has been used in the diagnosis of hyperthermic muscles, such as occurs with delayed onset muscular soreness. To our knowledge, there are no studies using IRT to analyze the skin temperature in the recovery process following fatiguing exercise. PURPOSE: To compare the effect of two CWI protocols as a recovery treatment on skin temperature. METHODOLOGY: 40 healthy male subjects (age 21.8 ± 2.76 yrs, body mass 73.15 ± 8.15 kg, height 176.6 ± 5.3 cm, and body fat 13.5 ± 3.4%). Subjects went through a fatiguing protocol: 8 sets/30 sec countermovement jumps with 90 second pauses between series. Subjects were randomized in three conditions: control group (CG), 12 min passive recovery (seated room); continuous CWI (CnCWI) (12 min in water at 12 ± 0.4 °C); and intermittent CWI (InCWI) (2 min CWI at 12 ± 0.4 °C, 1 min in a controlled environment at 23°C, until the 12 min of CWI were completed). Maximal lower limb skin temperature (MST) was measured at pre, post24 and post48 hours via IRT camera (FLIR T450). Repeated measurement ANOVA were used. Significance was set at p < 0.05.

RESULTS: No between group interaction effects were found in the dominant limb in the frontal plane (F(4,74)= 0.89, p = 0.47): post24 (CG: 33.5 ± 0.8°C vs. CnCWI: 33.4 ± 1.1°C, InCWI: 33.7 ± 0.8°C); post48 (CG: 34.2 ± 0.9°C vs. CnCWI: 33.9 ± 0.8°C, InCWI: 33.6 ± 0.9°C), or in the posterior plane (F(4,74)= 0.54, p = 0.70): post24 (CG: 33.9 ± 0.8°C vs. CnCWI: 33.7 ± 0.9°C, InCWI: 33.5 ± 0.8°C); post48 (CG: 34.1 ± 0.9°C vs. CnCWI: 33.9 ± 1.0°C, InCWI: 34.0 ± 1.0°C); or for the posterior plane (F(4,74)= 0.70, p = 0.59): post24 (CG: 33.1 ± 0.9°C vs. CnCWI: 33.2 ± 0.7°C, InCWI: 33.1 ± 0.7°C); post48 (CG: 33.0 ± 0.9°C vs. CnCWI: 33.1 ± 0.7°C, InCWI: 33.6 ± 1.1°C). CONCLUSIONS: Neither CWI protocol reduced mean or maximal lower limb skin temperature at 24 or 48 hours post fatiguing protocol.
Self-efficacy (SE) is defined as an individual’s belief in their ability to successfully complete a task. According to SE theory, physiological and affective states can exert influence on efficacy beliefs, thereby affecting performance outcomes. Additionally, fluctuation in daily readiness can also impact performance outcomes due to factors such as stress, sleep problems, or poor physiological recovery from previous bouts of training. To evaluate daily readiness through the assessment of these performance factors, a variety of scales and questionnaires exist. One such assessment, the Perceived Recovery Status (PRS) scale, asks individuals to indicate how well recovered they feel on a 0-10 Likert scale. However, despite widespread usage of the PRS scale, no study has examined if pre-training recovery is indeed related to increased SE. PURPOSE: To investigate the relationship between recovery as indicated by the PRS scale and SE in resistance trained individuals prior to a one-repetition maximum (1RM) back squats test. METHODS: Fifty-eight resistance-trained males (n=41) and females (n=17) (age: 23.3±3 yrs, body mass: 80.64±16.49 kg) completed the PRS scale and a modified version of the Self-Efficacy Questionnaire for Athletes (mSEQ-A), prior to a 1RM back squats test. The mSEQ-A required participants to rate, on a 0-100 Likert scale, how confident they were that they could beat their previous back squats personal record by any load. Next, following a 5-minute dynamic warm-up, subjects completed a validated 1RM back squat protocol. A Pearson’s product moment correlation was used to determine any relationships between PRS ratings and SE beliefs. RESULTS: Mean PRS ratings was 7.7±1.5, while mean mSEQ-A rating was 52.0±5.7. Regression analysis revealed that the PRS scale was significantly related to SE as determined by the mSEQ-A (r=0.39, p<0.05). CONCLUSIONS: The PRS scale was significantly related to SE. These findings reflect the fact that individuals who perceived themselves to be more well-recovered, also perceived themselves to be more likely to succeed in a 1RM test.

Both passive and active recovery after maximal exercise in young men. Therefore, it can be used as a reliable index to evaluate cardiac parasympathetic reestablishment after maximal exercise. Supported by CNPq (process #433631/2014-2) and CAPES.
Individuals are often instructed to use a foam roller as a warm-up (WU), despite a lack of evidence supporting performance enhancement claims attributed to foam rolling. Self-massage, or self-myofascial release (FR-SMR), is a form of self-administered pressure applied to the muscles to increase circulation and decrease tightness. The effects of FR-SMR on recovery, however, are not well understood. The purpose of the current study was to examine the effects of FR-SMR on recovery in athletes.

METHODS: A total of 32 athletes, divided into 4 groups (FR-D, FR, and noFR-D), performed a weight training exercise to induce muscle damage. The exercise included a 6-second sub-maximal eccentric contraction of a 12-second series of eccentric contractions. The performance of FR-SMR was assessed across various exercise modes.

RESULTS: The results indicated that FR-SMR significantly increased recovery compared to noFR-D. The FR-D group had the highest recovery, followed by FR and noFR-D. The improvements in recovery were statistically significant across all modes.

CONCLUSIONS: The findings of this study illustrated that the performance of FR-SMR significantly improved recovery compared to noFR-D. The effects of FR-SMR on recovery are promising and warrant further investigation.

Previous research demonstrates the benefits of compression exercise garments as it relates to performance and recovery. For instance, compression garments have attenuated delayed onset of muscle soreness and increased the rate of muscle hypertrophy. In vivo contractile kinematics were restored. However, the overall body of research related to the use of compression garments has failed to evaluate the full complement of potential applications in sport and exercise. Physiologic with their Pro Resistance Technology has innovated a new line of compression garments that may apply added resistance to physical movements ranging from everyday activities to high intensity athletic training. In turn, the purported benefits include facilitated performance and body composition adaptations due the added metabolic demand and musculoskeletal stress. There is limited empirical information regarding the effects of such class of compression garments on energy expenditure across various exercise modes.

PURPOSE: The purpose of this investigation is to examine the effects of Physio compression garments on exercise and recovery energy expenditure in NCAA collegiate athletes.

METHODS: In a randomized, cross-over design study, 16 healthy male (n=8) and female (n=8) athletes were used. Each participant performed a series of exercise including warm-up (5 min), main exercise (in vivo contractile function - 10 repetitions of a jump squat on a force platform), and recovery (10 min of recovery). The exercise included a 6-second sub-maximal eccentric contraction of a 12-second series of eccentric contractions. The performance of FR-SMR was assessed across various exercise modes.

RESULTS: The results indicated that FR-SMR significantly increased recovery compared to noFR-D. The FR-D group had the highest recovery, followed by FR and noFR-D. The improvements in recovery were statistically significant across all modes.

CONCLUSIONS: The findings of this study illustrated that the performance of FR-SMR significantly improved recovery compared to noFR-D. The effects of FR-SMR on recovery are promising and warrant further investigation.

Muscle hypertrophy induced by functional overload (FO) provides an in vivo model to study muscle growth. Glutamine has been shown to improve muscle function, maintain contractile protein levels, and reduce inflammation; however, its effects during muscle growth is unclear. PURPOSE: These experiments tested the hypothesis that glutamine supplementation positively impacts the skeletal muscle response to a growth stimulus as evidenced by greater hypertrophy, increased growth factor levels, and improved contractile function compared to placebo. METHODS: Mice underwent FO of the plantaris or sham surgery. In vivo plantaris force and fatigue resistance (% of maximal force after 10 contractions) were measured 14 days after FO or sham in mice receiving daily glutamine (1 g/kg body mass) or placebo (n= 7-9/group). Insulin-like growth factor 1 (IGF-1) was measured in the plantaris by ELISA after 14 days of FO or sham. Results: There were no significant differences in maximal strength or power between FR-D, FR, and noFR-D (relative maximum power: FR-D=54.93 ± 3.92 W/kg, FR=59.63 ± 3.94 W/kg, noFR-D=53.98 ± 3.92 W/kg) relative muscle strength or power. However, females experienced more SD than their male counterparts (SD, 3.77 [1.17, 6.37], p<0.01). The female athletes also experienced less SWS than males on COMP (SWS, 0.41h [-0.76, -0.06], p=0.02). The female athletes also experienced less SWS than males on COMP (SWS, 0.41h [-0.76, -0.06], p=0.02). CONCLUSION: The findings of this study illustrated that the female athletes were more resistant prior to competition, which could be related to the men’s team having midweek games and less sleep continuity. Future investigation is warranted to determine the potential causes of the differences on COMP. Increased sleep duration and quality could positively affect performance on the field and in the classroom, which is important for the collegiate cohort. Future studies should standardize the sleep quality metrics relative to SleepHrs.
Muscule cross sectional area (CSA) has historically been used as a measure for skeletal muscle size, however, functional cross sectional area (FCSA), defined as the area of muscle isolated from adipose tissue within the CSA, is more closely associated with muscular health. The visible adipose tissue beneath the muscle fascia, defined as intramuscular adipose tissue (IMAT), has also been linked to metabolic abnormalities at increased levels in clinical populations. In contrast, in some healthy populations IMAT may be used as a fuel source for physical activity (PA) and dietary intake may influence IMAT.

**Purpose:** This study examined factors that predicted FCSA and IMAT in the knee extensors (KE) of younger and older men and women. **Methods:** Ninety-eight participants (46 male, 52 female) were classified as younger (20-35 yr) and older (50-65 yr) as well as sedentary (<2 days per week) and active (3+ days per week) based on self-reported age and concurrent resistance and aerobic exercise training status. All participants completed anthropometry measurements, lower body muscle function testing, a 3-day dietary intake log, and wore an accelerometer for seven days. Participants then completed magnetic resonance imaging (MRI) scanning of the lower limbs. Muscle CSA was determined by manually tracing the KE and FCSA and IMAT were derived through color thresholding. Independent samples t-tests were conducted and two separate stepwise regression analyses were performed to predict FCSA and IMAT. **Results:** IMAT (cm$^2$) was significantly higher in the sedentary (3.74 ± 1.93) vs. active (1.85 ± 0.56) as well as older (3.14 ± 2.05) vs. younger (2.74 ± 1.25) (P < 0.05). Protein intake (g·kg·day$^{-1}$) was also significantly higher in active (1.63 ± 0.55) vs. sedentary (1.19 ± 0.40) (P < 0.05). Gender, age, concurrent exercise training status, and protein intake significantly predicted 70% of the variance in FCSA (P < 0.01), while concurrent exercise training status and light PA predicted 33% of the variance in IMAT (P < 0.01). **Conclusion:** Concurrent exercise, protein intake, and light PA are major determinants of skeletal muscle health and may require further investigation to mitigate aging and activity related loss of muscle quality. Funding: Sanford Health/NDSU Collaborative Research Seed Grant Program.

Resistance training (RT) increases the skeletal muscle mass and strength. It has been reported that activation of the mammalian target of rapamycin (mTOR) signaling, which is important for skeletal muscle protein synthesis, is attenuated by increasing exercise bout. However, the effect on proteolytic response is unclear. **Purpose:** The present study aimed to investigate the changes in proteolytic responses to repeated bouts of resistance exercise. **Methods:** Male Sprague-Dawley rats were randomly assigned into four groups: Sedentary (SED), resistance-exercised with 1bout (1B), 2bouts (2B), 3bouts (3B). RT protocol consisted of 50 repetitions of maximal isometric exercise (40% of 1 repetition maximum) for 1B, 2B, 3B groups. SED group performed PoWeR, while another cohort performed PoWeR followed by 12 weeks of detraining. Age-matched ambulatory controls were used for baseline comparisons. Following training and detraining, the soleus and plantaris muscles underwent immunohistochemical analyses. **Results:** Wet weight of the soleus muscles, when normalized to body weight (mg/g), was greater in the PoWeR trained mice when compared to the in the controls, 0.48 ± 0.05 and 0.36 ± 0.02, respectively (P < 0.05). Similarly, normalized plantaris muscle mass was increased following PoWeR training (0.51 ± 0.04) when compared to the controls (0.58 ± 0.05, P < 0.05). This resulted in a 32% and 14% increase in normalized wet weight after PoWeR training in the soleus and plantaris muscles, respectively (P < 0.05). Fiber cross-sectional area (CSA) was 22% greater in the soleus and 15% greater in the plantaris (P < 0.05), while myonuclei per fiber increased by 32% and 41% in the soleus and plantaris, respectively (P < 0.05). Additionally, there was a fiber-type shift toward a more oxidative phenotype in the soleus and plantaris. After detraining, normalized muscle wet weight and muscle fiber CSA are returning towards baseline, while the fiber-type distribution shifted from slow-to-fast. Myonuclear density following detraining is currently being quantified. **Conclusion:** PoWeR provides a methodological advantage over exercise models currently used in mice since it is non-surgical, and elicits oxidative and hypertrophic adaptations in both slow-twitch and fast-twitch muscles. Moreover, the data gathered in this study will provide new insight into the plasticity of myonuclear number following detraining of hypertrophied muscles.
that the muscle protein proteolytic response was activated by RT. In addition, the activation of mTOR signaling attenuated with the increase in RT bouts, but the level of activation of proteolytic response did not change.

3265 Board #134 June 2 9:30 AM - 11:00 AM
Elevating Protein Synthesis: Turn it Down a Notch
(No relevant relationships reported)

PURPOSE: Notch signaling is thought to be crucial in regulating skeletal muscle regeneration, however, the impact Notch signaling has on other skeletal muscle processes (e.g. protein synthesis) remains unclear. The purpose of this project was to determine the effects of Notch inhibition on protein synthesis during the myogenic program.

METHODS: C2C12 cells were treated with or without a β-secretase inhibitor (GSI) to determine the effect of Notch inhibition on anabolic signaling and protein synthesis during myoblast proliferation and differentiation. Samples were collected and analyzed for components of Notch, anabolic signaling (PTEN/akt/mTOR pathway), and protein synthesis (via puromycin incorporation).

RESULTS: GSI treatment reduced Notch signaling: c-myc (P < 0.05) and Hes1 (P < 0.01). GSI treatment elevated protein synthesis via the PTEN/AKT/mTOR pathway.

CONCLUSIONS: These results demonstrate that Notch signaling may regulate protein synthesis via the PTEN/akt/mTOR pathway.

3266 Board #135 June 2 9:30 AM - 11:00 AM
Apoptosis In Recovering Human Skeletal Muscle after High Intensity Cycling In Men Receiving Ergogenic Rg1 Compound
Chia-Hua Kuo, FACSM, Jin-Fu Wu. University of Taipei, Taipei, Taiwan.
(No relevant relationships reported)

PURPOSE: To examine the impact of high intensity exercise on cell death in human skeletal muscle during recovery with Rg1 supplementation, which has been shown to increase endurance performance. METHODS: Using randomized double blind placebo controlled crossover design, twelve young men were studied on three occasions: Placebo, Rg1 (1 mg) and Rg1 (5 mg) supplementation 1 hour prior to a high-intensity exercise. Biopsied samples were taken from vastus lateralis before, immediately after and 3 hours after 1-h cycling exercise at 75% VO2peak. RESULTS: Apoptotic and necrotic cells in vastus lateralsus increased immediately after 1 h cycling (80-140% and 80-120%, P < 0.05), concurrent with macrophage infiltration (both CD68+ and CD163+). Increases in iNOS and myogenic factor Myf5 mRNA levels after exercise were further increased during Rg1 supplemented trial. Rg1 (5 mg) significantly increased high intensity endurance performance and accelerates the disappearance of apoptotic and necrotic cell number occurred 3 hours after exercise during recovery. CONCLUSION: High intensity exercise increased cell death in human skeletal muscle after high intensity aerobic exercise. The ergogenic compound Rg1 accelerates phagocytosis to remove unhealthy muscle cells in exercised skeletal muscle.

3267 Board #136 June 2 9:30 AM - 11:00 AM
Systemic Effect On Myotube Size After Sprint Exercise Combined With Nutrients
'School of Health and Medical Science, Örebro University, Örebro, Sweden.
(No relevant relationships reported)

PURPOSE: To study systemic effects of sprint exercise combined with nutrient ingestion on muscle cell hypertrophy. It was hypothesized that the size of human muscle cells increases when they are exposed to post-exercise serum in nutrient but not in placebo condition. Previously studies have shown that oral ingestion of essential amino acids (EAA) and carbohydrate results in higher activation of Akt/mTOR signalling and higher rate of muscle protein synthesis following sprint exercise in humans. Both local and systemic factors may contribute to these effects. Moreover, if the nutrient-induced effects on signalling and muscle protein synthesis result into muscle hypertrophy is not known. In this study we “isolate” the systemic effects by exposing cultured muscle cells for post sprint exercise serum from either nutrient ingestions or placebo.

METHODS: This study is based on a previous study, were healthy subjects performed three 30-s sprints with 20 minutes rest in between. Subjects ingested a flavoured drink containing EAA and maltodextrin (nutrient) or only flavoured water (placebo) during the sprint exercise session up to 15 min after the last sprint in a randomized order with one month interval. Blood samples were collected before during and up to 200 minutes after the last sprint and were analyzed for EEA, insulin lactate and glucose. Human myoblasts were isolated from vastus laterals and differentiated into multinucleated myotubes, which were cultured supplemented with EEA serum collected from 3 subjects from the sprint exercise study described above. Blood samples, obtained at 80 min after the last sprint, were chosen since the peak values for the accumulation of insulin and EAA occur approximately at that time point.

RESULTS: Both serum insulin (f<0.05) and plasma lactate levels (f<0.05) were higher after nutrient compared to placebo 80 min post-exercise. Plasma lactate and glucose levels did not differ between the conditions. Myotube size was 16% larger after exposure to post sprint exercise serum obtained during nutrient as compared to placebo (P<0.05).

CONCLUSIONS: Systemic factors may stimulate muscle hypertrophy after sprint exercise when combined with nutrient ingestion. If such a systemic effect may be counteracted by intracellular metabolic perturbations after sprint exercise is not known.

Comparison of resistance training (RT) methodologies is a critical component of determining appropriate and specific recommendations for health and human performance. Repetition maximum (RM) training typically consists of performing each exercise to momentary failure, thus providing a RM each day of training. Relative intensity based on sets and repetitions (RIM) conversely uses a percentage of a maximum or estimated maximum, typically not leading to failure. PURPOSE: To compare 10-weeks RIM or RM resistance training on skeletal muscle fiber size and protein accretion in well-trained subjects. METHODS: Fifteen well-trained males (age = 26.9±3.9yrs, body mass = 86.2±12.1kg) participated in the study (RIM group, n=7; or RM group, n=8). Muscle biopsies of the vastus lateralis were sampled 72 hours before beginning the intervention and again 72 hours after the final training. The 10-week RT program consisted of several phases: strength-endurance, maximum strength, a planned overreach, and a taper. The RM group achieved a daily maximum in each lift while the RIM group used a variety of submaximal training loads not leading to muscular failure. Workloads measured by volume load were similar between groups (p=0.05). A 2x2 mixed design ANOVA and effect size using Hedge’s g were performed for Type I cross-sectional area (CSA), Type II CSA, myosin heavy chain (MYH11), MYH12, and MYH7. RESULTS: RIM significantly increased: Type I CSA (p = 0.018) and Type II CSA (p = 0.012). None of the MYH proteins reached statistical significance for either group (p>0.05). Between-group effect sizes favored the RIM group for all variables: Type I CSA (g=0.48), Type II CSA g=0.50, MYH11 g=0.31, MYH12 g=0.87, and MYH7 g=0.59. CONCLUSIONS: These results suggest RT utilizing a RIM approach may provide superior intramuscular outcomes compared to RM training in higher level lifters.

Anterior cruciate ligament (ACL) injuries induce quadriceps muscle maladaptations that contribute to protracted weakness. We have previously shown negative morphological and cellular changes in the quadriceps following an ACL injury that promote a pro-fibrotic muscle environment. There are many unknown initiators and contributors to fibrotic pathways and understanding the mechanisms, cell types, and factors involved in the progression of fibrosis is critical for developing treatment strategies.

PURPOSE: To determine the contribution of myostatin to the development of a pro-fibrotic muscle environment following an ACL injury.

METHODS: We obtained muscle biopsies from the injured and non-injured vastus lateralis of young adults (n=23±4y). Expression of myostatin, transforming growth factor-β and other regulatory factors were investigated. Immunohistochemical analyses were performed to assess fibrogenic cell expansion, and primary fibroblasts were isolated from muscle biopsies and subsequently treated with myostatin in vitro.

MEDICINE & SCIENCE IN SPORTS & EXERCISE®
RESULTS: Injured limb skeletal muscle demonstrated an approximate 100% increase in myostatin gene (p < 0.005) and protein (p < 0.0005) expression, which correlated (p < 0.05) with fibroblast abundance in the injured limb. Human fibroblasts expressed the activin type IIIB receptor, underscoring the regulatory ability of myostatin. Treatment with myostatin induced a 70% increase in the proliferative rate of primary human muscle-derived fibroblasts (p < 0.05).

CONCLUSIONS: These findings support an integral role for myostatin in promoting fibrogenic alterations within skeletal muscle following an ACL injury. Supported by NIH grants: K23 AR062069 and P30 AG028832 and the John Sealy Memorial Endowment Fund.

Table 1. Strength performance different between Sarcoopenia and normal elderly

<table>
<thead>
<tr>
<th>Test</th>
<th>ASG</th>
<th>ENG</th>
<th>ESG</th>
<th>NG</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS (times)</td>
<td>10.62 ± 4.05*</td>
<td>13.87 ± 3.24</td>
<td>11.78 ± 4.28</td>
<td>13.76 ± 3.22</td>
</tr>
<tr>
<td>AC (times)</td>
<td>13.31 ± 7.00 *</td>
<td>18.30 ± 6.94</td>
<td>14.71 ± 6.64*</td>
<td>18.29 ± 5.09</td>
</tr>
<tr>
<td>EW (second)</td>
<td>7.63 ± 3.23 *</td>
<td>6.08 ± 1.68</td>
<td>7.55 ± 2.87*</td>
<td>5.94 ± 1.61</td>
</tr>
<tr>
<td>GS left (kg)</td>
<td>21.52 ± 6.75*</td>
<td>29.82 ± 7.00</td>
<td>22.82 ± 4.17*</td>
<td>30.24 ± 7.19</td>
</tr>
<tr>
<td>GS right (kg)</td>
<td>21.28 ± 2.90*</td>
<td>30.71 ± 6.64</td>
<td>23.34 ± 4.57*</td>
<td>30.94 ± 6.69</td>
</tr>
<tr>
<td>KS extension (kg)</td>
<td>20.23 ± 8.34</td>
<td>23.55 ± 6.10</td>
<td>22.29 ± 7.89</td>
<td>23.04 ± 6.25</td>
</tr>
<tr>
<td>KS flexion (kg)</td>
<td>12.52 ± 5.18</td>
<td>13.46 ± 3.57</td>
<td>13.83 ± 5.01</td>
<td>13.02 ± 3.43</td>
</tr>
</tbody>
</table>

POSSIBLE DETERMINATION OF SKELETAL MUSCLE PPARα PROTEIN CONTENT TO SKELETAL MUSCLE LIPID PROFILE

Coefficient of Determination of Skeletal Muscle PPARα Protein Content to Serum Lipid Profile

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Before Training</th>
<th>After Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triglyceride (mg/dL)</td>
<td>0.023</td>
<td>0.086</td>
</tr>
<tr>
<td>Total Cholesterol (mg/dL)</td>
<td>0.027</td>
<td>0.534 *</td>
</tr>
<tr>
<td>HDL (mg/dL)</td>
<td>0.025</td>
<td>0.033</td>
</tr>
<tr>
<td>LDL (mg/dL)</td>
<td>0.012</td>
<td>0.557 *</td>
</tr>
</tbody>
</table>

* P<0.05, significant correlation. Data are R-square (R²).

POSSIBLE DETERMINATION OF SKELETAL MUSCLE PPARα PROTEIN CONTENT TO SKELETAL MUSCLE LIPID PROFILE

Coefficient of Determination of Skeletal Muscle PPARα Protein Content to Serum Lipid Profile

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Before Training</th>
<th>After Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triglyceride (mg/dL)</td>
<td>0.023</td>
<td>0.086</td>
</tr>
<tr>
<td>Total Cholesterol (mg/dL)</td>
<td>0.027</td>
<td>0.534 *</td>
</tr>
<tr>
<td>HDL (mg/dL)</td>
<td>0.025</td>
<td>0.033</td>
</tr>
<tr>
<td>LDL (mg/dL)</td>
<td>0.012</td>
<td>0.557 *</td>
</tr>
</tbody>
</table>

* P<0.05, significant correlation. Data are R-square (R²).

POSSIBLE DETERMINATION OF SKELETAL MUSCLE PPARα PROTEIN CONTENT TO SKELETAL MUSCLE LIPID PROFILE

Coefficient of Determination of Skeletal Muscle PPARα Protein Content to Serum Lipid Profile

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Before Training</th>
<th>After Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triglyceride (mg/dL)</td>
<td>0.023</td>
<td>0.086</td>
</tr>
<tr>
<td>Total Cholesterol (mg/dL)</td>
<td>0.027</td>
<td>0.534 *</td>
</tr>
<tr>
<td>HDL (mg/dL)</td>
<td>0.025</td>
<td>0.033</td>
</tr>
<tr>
<td>LDL (mg/dL)</td>
<td>0.012</td>
<td>0.557 *</td>
</tr>
</tbody>
</table>

* P<0.05, significant correlation. Data are R-square (R²).
affects the pathophysiology of cachexia. **PURPOSE:** To compare the effects of Nexrutine® (Nex; a natural bark extract of the Amur cork tree) and exercise in modulating the pathophysiology associated with cachexia in treatment naive transgenic adenocarcinoma of mouse prostate (TRAMP) model. **METHODS:** Forty-five, 10-week old male TRAMP mice were randomized to control (Con), Nex (600 mg/kg pelleted into chow) or exercise (Ex; voluntary wheel running). At 4, 8, 12 and 20 weeks, gastrocnemius muscle was collected to quantitate intramuscular IGF-1, myostatin, TNF-α, protein synthesis inducing factor (PIF) and ubiquitin (Ub). An ANOVA with Tukey’s post hoc test was done with significance set at p<0.05.

**RESULTS:** Analysis of gastrocnemius mass revealed significant group differences (F=4.159, p=0.02) with both Nex and Ex groups having greater mass compared to Con (p<0.05). A treatment response was observed for myostatin (F=4.762; p=0.01), PIF (F=8.633, p=0.001) and Ub (F=19.55, p=0.001). Specifically, Ex mice had significantly lower concentrations of myostatin, PIF and Ub compared to Con (p<0.01). Group comparisons at 20 weeks showed significantly lower concentrations of PIF (F=22.85, p<0.001) with Ex (p<0.01) and Nex (p<0.03) significantly lowering PIF concentrations compared to Con. Time point comparisons for Ub revealed significant differences at weeks 4 (F=32.35, p=0.001) and week 8 (F=16.24, p=0.002), respectively, with Ex mice having significantly lower concentrations of Ub compared to Con mice (p=0.004) at both time points. **CONCLUSION:** The results of this study suggest that Nex and Ex similarly maintain muscle mass in treatment naïve TRAMP mice by reducing tumor specific cachectic protein PIF. Exercise was capable of reducing downstream Ub; however, the mechanisms by which Nex elicits a protective effect require further study.

### 3274 Board #143 June 2 9:30 AM - 11:00 AM Dietary Protein Intake and Muscular Health with Aging: Countermeasures for Sarcoopenia and Dynapenia

Kara A. Stone1, Christopher J. Kotarski1, Nathan D. Dickens1, Daniel M. Streeter1, Allison M. Barry1, Jill Keith1, 3, Allison M. Barry1, Jill Keith1, 3

**University of Wyoming, Laramie, WY.**

**University of Utah, Salt Lake City, UT.**

(No relevant relationships reported)

Protein intake and aerobic and resistance exercise have been suggested as effective stimuli for muscle growth and function in the young and old. However, the magnitude of these stimuli combined is not completely understood. **PURPOSE:** To examine relationships between total protein intake and combined aerobic and anaerobic training on muscle size and strength in sedentary and active adults. **METHODS:** A total of 98 subjects were divided into the following groups: active younger females (AYF), sedentary younger females (SYF), active older females (AOF), sedentary older females (SOF), active younger males (AYM), sedentary younger males (SYM), active older males (AOM), and sedentary older males (SOM). Subjects completed an assessment of knee extensor peak torque (KEPT), a 3-day dietary intake log, and magnetic resonance imaging (MRI) scan for muscle cross-sectional area analysis of the right quadriceps (CSAq). Two stepwise regression models were used to examine the relationship of these stimuli combined is not completely understood.

**RESULTS:** A total of 98 subjects were divided into the following groups: active younger females (AYF), sedentary younger females (SYF), active older females (AOF), sedentary older females (SOF), active younger males (AYM), sedentary younger males (SYM), active older males (AOM), and sedentary older males (SOM). Subjects completed an assessment of knee extensor peak torque (KEPT), a 3-day dietary intake log, and magnetic resonance imaging (MRI) scan for muscle cross-sectional area analysis of the right quadriceps (CSAq). Two stepwise regression models were used to examine the relationship of these stimuli combined is not completely understood.

**CONCLUSION:** The results of this study suggest that Nex and Ex similarly maintain muscle mass in treatment naïve TRAMP mice by reducing tumor specific cachectic protein PIF. Exercise was capable of reducing downstream Ub; however, the mechanisms by which Nex elicits a protective effect require further study.

### 3276 Board #145 June 2 9:30 AM - 11:00 AM Amino Acid Transport and Metabolism Alterations Following 12 Weeks of Resistance Training with Supplementation

Paul A. Roberson1, C. Brooks Mobley1, Cody T. Haun1, Petey W. Mumford1, Matthew A. Romero1, Wesley C. Kephart1, Shelby C. Osburn1, Christopher G. Vanni1, Christopher M. Lockwood1, Michael D. Roberts1,1

Auburn University, Auburn, AL.

1Lockwood, LLC, Draper, UT.

(No relevant relationships reported)

**Purpose:** To determine the effects of progressive (PR) and constant (CO) loading induced by resistance exercise (RE) on anabolic signaling, myofibribal damage and selective type I and II myofibiber hypertrophy when RE is prolonged and interrupted over time.

**METHODS:** 15 healthy male subjects (24 ± 3 years) conducted six weeks of progressive (PR) (n=8) or constant (CO) (n=7) RE on a leg extension and leg press machine. Subjects conducted in sum 14 training units with 3 training sessions per week. Each session consisted of 3 sets with 10-12 repetitions on each machine. At baseline (T0) after the 1st (T1), 3rd (T2), 7th (T3), 10th (T4), 13th (T5) and 14th (T6) RE session, skeletal muscle biopsies from vastus lateralis muscle were collected at 45 min post RE. Subjects of PR increased RE load by 5% each week while in the CO group RE load was constant. Continuous training was performed up to T5 and stopped for 10 days followed by a final T14. **RESULTS:** In PR and CO increases in p70S6k and rpS6 phosphorylation (P<0.05) were detected at all time points (T1-T6) compared to T0. However, rpS6 and p70S6k was decreased from T1 to T4 in PR (p<0.05) but not in CO. Reduced signaling recovered after pausing RE in PR with an increase from T5 to T6 (p<0.05). Myofibrial damage was increased in PR and CO (p<0.05) at T1 but gradually decreased up to T5 in both groups. There was a tendency for lower myofibrial damage in PR at T4 and T5. Type I myofibres showed increased myofibber diameter (8%) at T3 (p<0.05) with no group differences. Type II fibers increased (12%) in both groups (p<0.05) but more in PR than CO at T5 (p<0.05).

**CONCLUSIONS:** While PR offers increased potential for type II myofibiber hypertrophy and increases sarcomeric stability over the time course of repeated RE compared to CO, it is associated with decreased anabolic signaling upon repeated RE stimulation. Anabolic signaling does not reflect structural adaptability but its decreased sensitivity towards loading.

<table>
<thead>
<tr>
<th>AOM</th>
<th>SOM</th>
</tr>
</thead>
<tbody>
<tr>
<td>185.8± 48.2e</td>
<td>74.6± 254.3</td>
</tr>
<tr>
<td>214.3± 39.6*</td>
<td>101.9± 28.4</td>
</tr>
<tr>
<td>195.1± 35.1</td>
<td>57.8*</td>
</tr>
<tr>
<td>254.3± 48.2</td>
<td>21.7*</td>
</tr>
<tr>
<td>122.5± 32.9</td>
<td>8.6</td>
</tr>
<tr>
<td>138.6± 32.9</td>
<td>101.9± 28.4</td>
</tr>
<tr>
<td>152.1± 32.9</td>
<td>25.1± 48.2</td>
</tr>
<tr>
<td>55.8± 7.3</td>
<td>50.1± 6.0</td>
</tr>
</tbody>
</table>
There is substantial inter-individual variability in resistance exercise training (RET)-induced skeletal muscle hypertrophy. PURPOSE: To determine if systemic circulating and/or intramuscular hormones were related to the RET-induced hypertrophy. METHODS: Resistance-trained young men (n=16). SEM: 23.1 ± 1 yr, 86.2 ± 8 kg, 181.1 ± 1 cm, previously performing RET ≥2 times per wk for 4 ± 2 yr undertook individually supervised RET four times per week for 12 wk. Fat- and bone-free (lean) body mass (LBM) and individual fibre type cross sectional area (CSA) were evaluated by dual x-ray absorptiometry and immunohistochemistry, respectively. Backwards elimination and principal component regression were used to evaluate shared variance between systemic proposedly anabolic hormones and RET-induced changes in muscle mass (n=49). Intramuscular free testosterone levels, dihydrotestosterone levels, 5α-reductase expression, and androgen receptor content were evaluated in the highest- (HIR; n=10; ΔLBM = 2.1 ± 0.8 kg) and lowest- (LOR; n=10; ΔLBM = 0.6 ± 0.9 kg) responders to RET. RESULTS: No hormone measured before exercise, after exercise, pre-intervention, or post-intervention, using adjusted or principal component regression, shared significant common variance with the change in type 1 CSA, type 2 CSA, or LBM. No hormone, in blood- or muscle, was different between HIR and LOR. The steroidogenic enzyme 5α-reductase increased following RET in the HIR (p<0.01) but not the LOR (p=0.32). Androgen receptor content remained unchanged with 12 wk of RET, but was higher in HIR versus LOR both pre- and post-intervention. CONCLUSION: Neither systemic nor intramuscular hormones are related to RET-induced skeletal muscle hypertrophy in resistance-trained young men. Instead, these data demonstrate that intramuscular androgen receptor content may be an important component of the individual variation between high- and low-hypertrophy responders to RET. Supported by NSERC of Canada grant to SMP and trainee award to RWM.

Ghrelin Attenuates Muscle Atrophy In Tumor-bearing Mice

Haiming Liu, Jose M. Garcia. University of Washington, Seattle, WA.

Cachexia is a multi-organ syndrome characterized by muscle and fat wasting. Ghrelin is a hormone known to release growth hormone and to stimulate appetite by binding to its receptor to release growth hormone secretagogue receptor (GHSR)-1a. However, recent data suggest that not all effects of ghrelin are mediated through this receptor. PURPOSE: To investigate if ghrelin attenuates cancer-induced muscle atrophy in a GHSR-1a-independent manner. METHODS: 5-6-month-old male C57BL/6J GHSR-1a wildtype (WT) and knockout (KO) mice were inoculated with 1×10^7 heat-killed (HK, control) or live Lewis Lung Carcinoma (LLC) cells in the right flank. When the tumor was palpable (1 wk), tumor-bearing mice were injected with vehicle (saline solution, TV) or ghrelin (0.8 mg/kg, TG), IP twice a day, while HK mice were injected with vehicle (n = 8–10). Body weight, lean body mass and fat mass were measured by NMR before tumor implantation and 2 weeks after tumor noted. Gastrocnemius (GAS) muscles were harvested for analysis 2 weeks after tumor noted. RESULTS: Tumor implantation induced a significant decline in body weight and fat mass in both strains. As expected, ghrelin attenuated the fat loss in WT (TV vs. TG: -52% vs. -23% body fat mass loss, p = 0.02); however, GH was not equally efficacious in KO (KO TV vs. TG: -56% vs. -60%, p = 0.05). Tumor-induced muscle loss was attenuated by ghrelin from 16% to 8% in WT (p = 0.004) and from 25% to 19% in KO (trend in significance, p = 0.06). Similarly, the decrease in fiber cross-sectional area of GAS muscles was prevented by ghrelin in WT (TV vs. TG: -p = 0.08); HK vs. TG: -p = 0.47) but this difference did not reach significance in KO. In addition, the mRNA levels of ‘atrogenes’ atrogen1 and MuRF-1 in GAS muscle significantly increased in response to tumor implantation in both strains. With ghrelin treatment, the increase of atrogen1 and MuRF-1 in WT was decreased by 5-fold (p = 0.02) and 7-fold (trend, p = 0.058), respectively. In KO tumor-bearing mice, the attenuation of atrogen1 and MuRF-1 by ghrelin was 5-fold (p = 0.009) and 6-fold (trend, p = 0.07), respectively. CONCLUSION: Ghrelin mitigates cancer-induced muscle atrophy at least in part through GHSR-1a-independent mechanisms. This work was funded by the U.S. Dept of Veterans Affairs (MERIT grants BX002807 and CX000174) and NIH Grant AG040583 to JMG.

Our recent study has shown that reduction of aging-induced elevation of serum C1q level by resistance training was involved in muscle hypertrophy in old adults. C1q activates Wnt/β-catenin in aged muscle, resulting in enhancement of muscle protein degradation-related genes, such as MuRF-1 and Atrogin-1. Although resistance training attenuates muscle protein degradation, it is still unclear that resistance training-induced decrease in serum C1q level is associated with attenuation of muscle protein degradation. PURPOSE: The purpose of this study was to investigate whether resistance training-induced decrease in circulating C1q level affects muscle protein degradation in senescent mice. METHODS: Male 13-week-old SAMP1 mice (Young) and 38-week-old SAMP1 mice (Aged) were randomly divided into three groups; young-sedentary control (Young-Con), aged-sedentary control (Aged-Con) and aged-resistance training (Aged-RT) groups (n=10 each group). Resistance training was performed 3 days a week for 12 weeks using a climbing ladder with 70% of 1 repetition maximum weight. RESULTS: Muscle strength, mass and cross-sectional area (CSA) of tibialis anterior muscle in the Aged-Con group significantly decreased as compared with the Young-Con group (p=0.05), whereas those in the Aged-RT group significantly increased as compared with the Aged-Con group (p=0.05). Serum C1q level and expression levels of muscle β-catenin, MuRF-1 and Atrogin-1 proteins significantly increased in the Aged-Con group as compared with the Young-Con group (p=0.05), whereas those expression levels in the Aged-RT group significantly decreased as compared with the Aged-Con group (p=0.05). Additionally, serum C1q level was positively correlated with protein expression levels of muscle β-catenin, MuRF-1 and Atrogin-1 (r = 0.713, p<0.05) and Atrogin-1 (r = 0.384, p<0.05), but was negatively correlated with muscle mass (r = -0.469, p<0.05) and CSA (r = -0.595, p<0.01). CONCLUSIONS: These results suggest that resistance training-induced decrease in serum C1q level is associated with attenuation of muscle protein degradation thereby leading to muscle hypertrophy in senescent mice. Supported by Grants-in-Aid for Scientific Research (17H01218 and 16K13059, M. Iemitsu) and Sasakawa Scientific Research Grant (R-29-628 for N. Horii).
The studies with handgrip strength have been using the protocol of American Society of Hand Therapists (ASHI), in which the elbow is maintained flexed at 90°. However, people with Parkinson’s disease (PD) show general loss of strength and the contraction of the muscles used to sustain this position may not be possible and may reduce the value of handgrip strength. PURPOSE: To analyze cortical hemodynamics of the prefrontal cortex (PFC) during DTW in individuals with PD. METHODS: 11 individuals with PD (aged 72.8 ± 5.53) and 10 controls (71 ± 10.56) participated in this cross-sectional study. All participants completed a series of walking trials under three test conditions (aged 72.8 ± 5.53, 4 males). Electromyograms (EMG) were recorded from the anterior (TA), and rectus femoris (RF) of the dominant leg during recumbent bicycling. Subjects cycled at 60, 80, and 100 revolutions per minute (RPM) at the lowest resistance setting. EMG was rectified and normalized to the peak EMG during the 80 rpm condition in each muscle. A 2x3 repeated measures analysis of variance was used to compare the timing of EMG activity for each muscle between the 60 and 100 rpm conditions among the groups. Significance was set at p < 0.05. RESULTS: There were no significant group by cadence interactions. Cadence effects were observed in burst duration of TA (F(2,30)=9.33, p<0.01), SO (F(2,30)=12.98, p<0.01), FL (F(2,30)=10.97, p<0.01), RF (F(2,30)=6.21, p<0.01), and GA (F(2,30)=7.89, p<0.01). Compared to YA, people with PD had 86.6° longer burst durations in TA (F(2,30)=6.34, p<0.01), 69.1° in FL (F(2,30)=8.73, p<0.01), and 65.7° in GA (F(2,30)=5.57, p<0.01). CONCLUSION: Although preliminary, these results suggest that increased burst durations in key muscles during cycling after coordination in people with PD.

Dynamic balance is often impaired in people with Parkinson’s Disease (PD). Control leading to and during a turn for people with PD further challenges dynamic balance and is a common contributor to a loss of balance. During a task with a turn, people with PD can do handgrip strength with elbow in extension if will be more comfortable.

### RESULTS

**CONCLUSIONS**: There are no differences between elbow positions, people with PD can do handgrip strength with elbow in extension if will be more comfortable.
CONCLUSIONS: Individuals with faster TUG times demonstrated increased SL, SW, and reduced R FA during straight-line walking. Individuals with decreased SW may have compensated for impaired stability by decreasing SL. When walking included a turn, individuals with faster TUG times increased SW in the IN leg and increased the FA of the OUT leg compared to those with a slower TUG time, suggesting that people with PD who have functional impairments may utilize different strategies than those with without. Increased understanding of spatiotemporal aspects including during a turn is critical to optimize treatment.

INTRODUCTION: Regulation of balance requires intentional involvement inversely proportional to efficacy of postural control system. Sample entropy (SE) of center of pressure (CoP), a non-linear measure, reflects complexity of postural control system indicating intentional involvement. Parkinson patients (OAP) may require more attention during balance than healthy controls (OAH). Due to internal perturbations during standing, respiration may affect balance in individuals with deteriorated postural control systems.

PURPOSE: To investigate 1) effects of breathing and visual conditions on attention and balance 2) group effect on respiratory complexity, attention, & balance between OAP & OAH.

METHODS: 12 subjects, OAH (n=6) & OAP (n=6), were recruited and instructed to stand on force plate, feet oriented 15° apart and look at 5cm-diameter spot eye level on wall 1.5m away. Subjects were asked to maintain balance for 2 minutes under eyes open and eyes closed conditions and thoracic (Th), abdominal (Ab), & neutral breathing conditions. Meanwhile, Th and Ab motion was recorded through Biocapture system, all equipment synchronized. CoP was calculated in Matlab for CoP in anteroposterior (X) and mediolateral (Y) directions and Th (SampEnX) and Ab (SampEnY) motion. CoP-related measures were calculated in Bioanalysis software for average velocity (v), average standard deviation of mean square (CoPx), and average standard deviation of mean square (CoPY) directions (cm).

RESULTS: Group, breathing, & visual effects were examined on non-linear and CoP-related measures via Factorial MANOVA with later application of ANOVAs as needed. Significant group and visual effects were seen in CoP-related measures, Wilks’ Lambda (p-value: 0.000) and 781 (p=0.034), respectively. OAP showed greater D (.536±.241 vs. 2.963±1.424), SA (10.7677±1.6078 vs. 4.8564±3.6306), and V (3.1264±1.1616 vs. 2.4184 ± .9371) than OAH, while EC showed greater V than EO (1.904±1.2207 vs. 2.3343 ± .7770).

CONCLUSION: OAP showed similar intentional involvement and respiratory complexity with OAH during standing balance, though OAP displayed worse balance performance than OAH. Breathing condition did not significantly affect attentional involvement or balance performance. Visual condition significantly affected balance performance.

Bilateral asymmetry in peak crank torque has been observed in both cyclist and non-cyclist. However, the relationship between exercise intensity, cadence rates, and bilateral asymmetry is not fully understood. Additionally, a need for establishment of normative values for bilateral asymmetry still exists.

CONCLUSIONS: The findings of the current study suggest that torque is unaffected with cadence selection at IS, OBLA, and PPO. The current study also showed that significant differences did not exist between the CE and NCE in torque asymmetry until PPO. This finding suggests that at PPO cyclist may be altering their kinematics in order to maintain desired cadences or power outputs more so than non-cyclists. Therefore, further research is needed to understand the potential effect on cycling performance.
CONCLUSION: The heel strike was found to induce the knee VL+IR combined with hip AD+IR moments, which forced the joints to move toward the “position of no return”, implying that the heel strike may increase the risk of ACL injury. Decelerating with footsoft is therefore recommended for a safety multi-articular biomechanics.

3289 Board #158 June 2 9:30 AM - 11:00 AM Motor Unit Discharge Characteristics And Walking Performance Of Individuals With Multiple Sclerosis. Leah A. Davis¹, Awad M. Almuklass², Hamilton Landon³, Taiai Vietor¹, Alberto Botter¹, Roger M. Enoka⁴. ¹University of Colorado Boulder; Boulder, CO; ²King Saud bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia; ³Politecnico di Torino, Torino, Italy.

(Please review the body of the text for more details.)

No relevant relationships reported

PURPOSE: To examine the associations between strength, force steadiness, and motor unit discharge characteristics of lower leg muscle with assessments of walking performance and disability status in individuals with multiple sclerosis (MS).

METHODS: Persons with MS (n=23, 9 men, 53 ± 7 yrs) attended 1 to 3 evaluation sessions that were performed before, immediately after, and 4 wks after a clinical trial of neuromuscular electrical stimulation. Outcomes included 3 questionnaires (Patient Determined Disease Steps [PDDS], Modified Fatigue Impact Scale [MFIS], and MS Walking Scale-12 [MSWS-12]) and 3 performance-based OLT for chronic motor incomplete SCI. This pilot demonstrates improvements in balance and some gait characteristics using a novel task-specific, performance-based OLT for chronic motor incomplete SCI.

The process of aging is typically associated with a general decline in sensorimotor and neuromuscular function that become apparent during different movements including gait. Spatiotemporal measures at preferred walking speed have been used to quantify functional capacity of a person’s walking ability and, clinically, to assess the impact neurological disorders have on gait. For example, persons with multiple sclerosis (MS) and Type 2 diabetes (T2DM) often present with gait and balance problems which can lead to increased risk of falling. PURPOSE: This study was designed to assess differences in falls risk and falls risk for healthy individuals compared to persons diagnosed with MS or T2DM. METHODS: Twenty three healthy adults (controls), 23 persons diagnosed with MS, and 23 individuals with T2DM participated in this study. Falls risk was assessed using the Physiological Profile Assessment (PPA). For gait, participants performed 3 trials at their preferred gait speed while walking across a pressure sensitive mat. Measures of velocity, step length, stride length, and step time were used to assess gait. A within-subject, repeated-measures generalized linear model was used to analyze the data. RESULTS: The results revealed significant differences in falls risk between the three groups with the MS persons exhibiting the greatest risk score (MS 2.51±1.4, T2DM 0.84±0.7, control 0.22±0.6). There was significant group difference between the three groups with the MS persons exhibiting the greatest risk score (MS 168% [0.30 to 0.81 m/s], step length increased 104% [0.33m to 0.68m], and mean center of pressure to center of mass (CoP-CoM) distance in the sagittal plane increased 132% [2.55cm to 5.91cm] after training. Conclusion: This pilot demonstrates improvements in balance and some gait characteristics using a novel task-specific, performance-based OLT for chronic motor incomplete SCI.
Method: Twelve male college students (age: 20.9±0.7, height: 172.0±2.1 cm, body mass: 63.0±3.4 kg) were tested. Four sole thickness (original commercial shoe, 1, 2, and 3 cm increased outside thickness) were tested using a universal testing machine (Instron-5544, US). The running tests were performed on a treadmill with a fixed speed (3.33 m/s) and continued for 8min. Walking tests were performed on a force platform (AMTI, US, 400 x 600mm). A motion capture system (VICON, Oxford, UK) was used to obtain kinematic data. Wireless surface electromyography testing system (Noraxon, US) was used to obtain the surface electromyography (sEMG) data. One-way analysis of variance with repeat measures (ANOVA) was used to compare differences in muscle activity, kinematic, and kinetic outcome variables. Statistical significance was set at α = 0.05.

Results:
The 1 cm sole thickness has the highest elastic modulus (0.80MPa) and the 3cm is the lowest (0.25MPa). The co-contraction index value of 1cm group was significantly less than the others in both initial (0.55±0.14, P<0.05) and final (0.53±0.13, P<0.05) stage of running. At the toe off, the knee angle of 2 cm (131.0±9.5 deg, P<0.05) and 3 cm (132.7±4.6 deg, P<0.05) group increased significantly comparing to 0cm (125.0±5.4 deg) group in walking test.

Conclusion: The outside thickness of 1cm reduced muscle co-contraction during running. Knee joint increased with the increasing of sole thickness at the time of toe off when walking.

3293 Board #162 June 2 9:30 AM - 11:00 AM How Pain Management for Osteoarthritic Knee Influences Gait: A Case Study Jason V. Slack, Michael J. Bohne, Chris Killpack, Tyler Davids, Valley City State University, Orom, UT. (Sponsor: Scott Drum, FACSM)

(No relevant relationships reported)

Osteoarthritis (OA) is the most common joint disorder in the US. Pain management has been a commonly investigated treatment for knee OA, little is known about the effects pharmacologic interventions have on gait. PURPOSE: To investigate the effects of pharmacologic interventions on gait. METHODS: A 47-year-old male (1.7 m, 75 kg) with a diagnosed left knee medical compartment OA with severe bone on bone joint space narrowing with marginal osteophytes and subchondral sclerosis participated in this study. Three medication regimens (no medication, (NM), over the counter NSAID (NSAID), and a prescription pain medication (PnP)) were used for this study. Trials were randomized and data was collected at the end of the week with a 7 day wash out period before the next trial. Testing consisted of a 5-minute walk at a self-selected pace on an instrumented treadmill. Data was collected using Vicon Nexus and sagittal plane kinematics and kinetec were analyzed using Visual 3d. RESULTS: At the ankle the PPM led to a peak plantarflexion moment that was two times greater at push-off (0.66 Nm/kg) compared to the NM condition (0.31 Nm/kg) in the affected limb. At the knee, the NM condition had more flexion at both foot contact and flexion during loading compared to both the PPM and NSAID in the affected limb. The loading knee extension moment of the affected limb was elevated in the NM condition (2.3 Nm/kg) compared to the PPM condition (1.5 Nm/kg). When comparing the affected limb to the unaffected limb, the loading knee extension moment was more symmetrical between the two sides in the PPM condition compared to both the NM and the NSAID condition. The affected knee experienced greater loading in the sagittal plane in both of these conditions. CONCLUSION: The results of this case study suggest that medications alter lower extremity biomechanics of both the affected and unaffected limb during gait. In the sagittal plane it appears that at the knee the use of prescription medication leads to more symmetrical gait in loading and reductions in knee loading moments. At the ankle the prescription pain medication appears to allow for the push-off moment to be increased and more similar to healthy gait. When considering the sagittal plane at the ankle and knee the prescription pain medication appears to restore normal and healthy gait patterns in a subject with knee OA.

3294 Board #163 June 2 9:30 AM - 11:00 AM The Effect of Change on Stride Length on Muscular Activity and Energy Cost during Walking Hae Ryong Chung1, Travet Witherspoon Jr, Mornoni de Moors2, Jin hee Jeong3, Chris Pitsikoulis1, 4Clayton State University, Morrow, GA 4Augusta University, Augusta, GA 4Aurora University, Aurora, IL. (No relevant relationships reported)

Human bipedality is the most unique locomotive form in the terrestrial environment and can be performed for a prolonged period of time. To maintain this form of locomotion humans have adopted physiological and mechanical strategies to minimize and conserve energy. PURPOSE: To study the effects of stride length change on the electromyographic (EMG) activity of the quadriceps and hamstring muscle groups and oxygen consumption. METHODS: Male (n=6) subjects (age = 23.25 ± 0.93 years) were recruited for this study. Height, weight, body composition (bioelectrical impedance analysis), and stride length (SL) were measured. Surface EMG activity of the right quadriceps and hamstring muscle group, heart rate, and oxygen consumption (VO2) were measured during walking at self-selected (SS) speed at the following stride lengths: (1) SS, (2) 10% below SS, (3) 20% below SS, (4) 10% above SS, (5) 20% above SS, and (6) 30% above SS. Repeated measures ANOVA were used to determine serial patterns and paired t-tests for differences between different SL. RESULTS: VO2 was significantly lower at SS SL than 20% below SS SL and VO2 of 20% below SS SL was lower than 10% below and 10% above SS VO2. 10% and 20% above SS SL was lower than 30% above SS SL (P < 0.05). Heart rate was significantly lower at SS SL than 20% below and 10% and 30% above SS SL. Heart rate of 10% and 20% above SS SL was lower than 30% above SS SL (p=0.05). EMG activity in the quadriceps muscle was significantly lower at SS SL than 20% below SS SL and EMG activity of 20% below SS SL was significantly lower than 10% below SS SL. EMG activity of 10% above SS SL was lower than SS SL (P<0.05). There were no differences in the EMG activity of the hamstring muscle group. CONCLUSION: Preliminary results from this ongoing study demonstrate that energy costs increase at values above and below self-selected stride length at a SS speed, resulting in a U-shape curve in oxygen consumption and muscle activity in quadriceps muscle. SS SL appears to be optimal in terms of walking energy efficiency compared to shorter and longer SL. These results suggest that the SS locomotive pace in humans is that at which the most efficient energy cost can be maintained. Further studies are necessary to investigate the effect of stride length alteration training on the energy cost and efficiency of walking.

3295 Board #164 June 2 9:30 AM - 11:00 AM Does Music-Based Rhythmic Auditory Auditory Cueing Alter the Correlation Structure of Stride Times? Scott W. Ducharme, Dylan C. Perry, Colleen J. Sands, Elroy J. Aguiar, Christopher C. Moore, Catrine Tudor-Locke, FACSM. University of Massachusetts, Amherst, Amherst, MA. (Sponsor: Catrine Tudor-Locke, FACSM) (No relevant relationships reported)

The time interval from heel strike to subsequent heel strike (i.e., stride time) has been shown to be statistically persistent, i.e., long or short stride times are likely to be followed by subsequent stride times of similar magnitude. This persistence is thought to represent complex, adaptive locomotor behavior. Rhythmic auditory cueing (RAC) entails instructing participants to synchronize their foot strike timing to an auditory metronome. While RAC reduces stride time variability, it also eliminates stride time persistence, which may indicate reduced adaptability. Alternatively, matching foot strike timing to the tempo of an external rhythm may yield less precise temporal synchronization, thereby preserving the correlation structure of the time series. PURPOSE: To determine if music-based RAC reduces the persistence of stride time variability. METHODS: Nine young, healthy adults (mean±SD age 22.9±2.0 years, height 171.0±11.7 cm, mass 75.4±14.9 kg) walked along an oval course (40 m) for six 5-minute trials. Three of the trials consisted of walking at self-selected slow, normal, and fast walking speeds. The remaining three trials entailed participants walking while matching their foot strike timing to the tempo of a song. Using a commercially available app, the tempo of a single song was altered to 80, 100, and 125 beats per minute. Participants performed separate, randomly ordered trials while matching each song tempo. Stride times were obtained via an ActiGraph accelerometer at the right heel. Detrended fluctuation analysis was used to quantify the extent of statistical persistence of stride times. A repeated-measures ANOVA was used to test for effects of RAC on stride time persistence. RESULTS: There was a main effect of RAC on stride time persistence (F (1, 63) = 5.26, p = 0.05), as persistence decreased when participants entrained to music, compared to self-selected walking. However, this effect was not consistent across all participants, as 3 of the 9 individuals exhibited greater persistence during RAC trials. CONCLUSION: Similar to reports of metronome entrainment, synchronizing step timing to music resulted in an overall modified correlation structure closer to random, which is associated with less adaptive bipedal gait. Future studies may consider testing RAC to more complex songs with various beats.

3296 Board #165 June 2 9:30 AM - 11:00 AM Does Arm Swing Frequency Match Alterations in Stride Frequency during Treadmill Walking? Sarah M. Garcia, Jacqueline T. Brine-Doyle, Marcella J. Myers. St Catherine University, St. Paul, MN. (Sponsor: Mark Blegen, FACSM) (No relevant relationships reported)

PURPOSE: To determine whether arm swing frequency matches alterations in stride frequency above and below preferred stride frequency while walking on a treadmill at a range of speeds. METHODS: At each of 4 self-selected speeds, 10 female participants (mean age: 27.6 yr, range: 20-47 yr) walked on a treadmill while attempting to match their stride frequency to the beat of an audio metronome beating at one of three different

Abstracts were prepared by the authors and printed as submitted.
for soldiers, falling while carrying heavy loads can lead to serious injury. Nonlinear analyses, such as local dynamic stability (LDS), can quantify gait stability. LDS can be affected by both load and speed. Studies on soldier-relevant torso loads at multiple speeds are lacking.

**PURPOSE:** To determine if soldier-relevant loads at 3 speeds affect LDS of the trunk and pelvis during gait.

**METHODS:** 10 healthy adults (5M, 5F) walked at 3 speeds (1.15, 1.35, and 1.55 m/s) under 3 loaded vest conditions (1.3, 15, 27 kg). Trunk and pelvis marker data were collected for 2 min. Short-term local divergence exponents (LDE) of marker velocity data in the mediolateral, anteroposterior and vertical directions (ML, AP, V) were calculated to quantify LDS by measuring the rate at which each stride changes from the prior stride. Larger LDE values indicate decrease LDS. Linear regressions were calculated to quantify LDS by measuring the rate at which each stride changes from the prior stride. Linear regressions were calculated to quantify LDS by measuring the rate at which each stride changes from the prior stride.

**RESULTS:** LDS decreased with increased load in all directions at the trunk (LDE Mean±SD: ML: 0.44±0.02, 0.45±0.02 for L2 and L3 respectively, p = 0.001; AP: 0.39±0.02, 0.41±0.01, 0.43±0.01 for L1, L2 and L3, p ≤ 0.009; V: 0.68±0.04, 0.72±0.04, 0.77±0.04 for L1, L2 and L3, p ≤ 0.021) and in the vertical direction at the pelvis (0.55±0.04, 0.58±0.04, 0.62±0.04 for L1, L2 and L3, p ≤ 0.049). Conversely, ML and AP LDS increased with increasing speed at the trunk (ML: 0.48±0.02, 0.44±0.02, 0.41±0.02 for S1, S2 and S3, p < 0.001; AP: 0.43±0.01, 0.41±0.01, 0.39±0.02, p < 0.001 for S1 vs S2 and S1 vs S3) and pelvis (ML: 0.32±0.02, 0.30±0.01, p = 0.004 for S1 vs S2; AP: 0.42±0.02, 0.37±0.03, p = 0.062 for S1 vs S2 and S1 vs S3). However, vertical LDS decreased with increasing speed at the trunk (0.71±0.04, 0.71±0.05, 0.75±0.04, p ≤ 0.012 for S1 vs S2 and S2 vs S3) and pelvis (0.57±0.04, 0.57±0.05, 0.61±0.02, p ≤ 0.006 for S1 vs S2 and S3 vs S3). 

**CONCLUSIONS:** Preliminary results suggest that increasing speed with a heavier load increases stability. However, the decrease in vertical LDS with increased speed indicates that more energy may be required to control the vertical motion of the trunk and pelvis, and may lead to earlier fatigue. Inclusion of more participants may reveal interaction effects of load and speed not yet detected.

Funding: BU’s Dudley Allen Sargent Research Fund and the DoD SMART Scholarship.
established a priori at alpha = 0.05. RESULTS: There were no significant differences between the gait application and video for gait speed (1.694 ± 0.352 vs. 1.693 ± 0.347 m/s, respectively) or turn duration (4.165 ± 0.761 vs. 4.171 ± 0.762 s, respectively). There was, however, a small but significant difference between the gait application and video for cadence (129.9 ± 14.0 vs. 129.1 ± 13.6 steps/min, respectively).

CONCLUSION: For middle aged adults across a broad spectrum of gait speeds, the gait application is a valid method to evaluate steady-state gait speed and turn duration of a 400 m walk test. Although there was a significant difference between the gait application and video for cadence, the one step per minute difference is not likely to be clinically meaningful.

### Non-linear Lower Extremity Joint Torque Changes Observed during Preparation for Walk-to-run Gait Transition

#### Purpose:
To investigate lower extremity torque components changes in preparation for gait transition with increased walking speed.

#### Methods:
11 male and 3 female college students (age: 22.6 ± 1.9 years, body mass: 75.4 ± 12.8 kg, height: 1.73 ± 0.09 m) were obtained at sampling rate of 1000 Hz and 200 Hz, respectively. The Miniature Triaxial Load Cells (Chesapeake, USA) were obtained at sampling rate of 1000 Hz and 200 Hz, respectively.

#### Results:
For middle aged adults across a broad spectrum of gait speeds, the gravitational torque (GTT), motion-dependent torque (MDT), contact torque (EXT), and video for cadence (129.9 ± 14.0 vs. 129.1 ± 13.6 steps/min, respectively).

#### Conclusion:
The significant differences in gait transition with gait transition with increased walking speed.

#### Abstracts were prepared by the authors and printed as submitted.

---

Location: Official Journal of the American College of Sports Medicine

Volume: 49

Number: 5

Supplement: S681

Date: SATURDAY, JUNE 2, 2018

---

Tibia stress fracture (TSF) is common in military recruits. Female soldiers experience a higher rate than their male counterparts. TSF occurs most frequently in Basic Combat Training (BCT) and has been partially attributed to repetitive impact loading from tasks such as load carriage. Tibia mechanical properties could be improved as a result of training with multi-directional loading (MDL) (e.g. soccer). However, it has yet to be determined whether the improved tibia strength observed with MDL could result in resistance of bone deformation (lower strains) due to load carriage.

**Purpose:** To examine the effects of a 18-month sprint and incremental load carriage on tibia bone strain.

**Methods:** 20 female soccer players (20±1 yrs) and 20 match- and height-matched healthy women (21±1 yr) participated in this study. They completed four walking tasks with 0kg, 10kg, 20kg, and 30kg loads on a force instrumented treadmill at 1.67 m/s. Participants’ tibia CT models were combined with subject-specific musculoskeletal models for forward-dynamic computer simulations and finite element analyses. Strains from the middle third of the bone shaft were analyzed. One-way ANOVAs were performed. α = 0.05.

**Results:** Significant differences in strains were found among walking conditions and between the two groups (All p<0.0001). The mean ± SE strains during load carriage (0kg, 10kg, 20kg, and 30kg) were 562±3 µs, 634±3 µs, 736±7 µs, and 849±5 µs, respectively. The mean ± SE strains during incremental load carriage (0kg, 10kg, 20kg, and 30kg) were 562±3 µs, 634±3 µs, 736±7 µs, and 849±5 µs, respectively. The mean ± SE strains during incremental load carriage (0kg, 10kg, 20kg, and 30kg) were 562±3 µs, 634±3 µs, 736±7 µs, and 849±5 µs, respectively. The mean ± SE strains during incremental load carriage (0kg, 10kg, 20kg, and 30kg) were 562±3 µs, 634±3 µs, 736±7 µs, and 849±5 µs, respectively. The mean ± SE strains during incremental load carriage (0kg, 10kg, 20kg, and 30kg) were 562±3 µs, 634±3 µs, 736±7 µs, and 849±5 µs, respectively. The mean ± SE strains during incremental load carriage (0kg, 10kg, 20kg, and 30kg) were 562±3 µs, 634±3 µs, 736±7 µs, and 849±5 µs, respectively.

**Conclusion:** Participants with a soccer history benefited from significantly lower strains than healthy controls during incremental load carriage. Lower tibial strains during load carriage may be protective from TSF in those with a history of soccer, although this has yet to be demonstrated experimentally. These findings suggest that physical training involving MDL may be an ideal exercise modality for preconditioning prior to BCT for female recruits. US ARMY #W81XWH-15-1-0006.
Exercise is known to impart transient blood lipid responses that appear consistent with reduced cardiovascular disease risk; yet, it is unclear how short, disrupted sleep (SDS) modifies post-exercise fasting and postprandial lipid and lipid-related antioxidant responses to a single episode of exercise. PURPOSE: To determine the influence of a single night of SDS on fasting and postprandial lipid and lipid-related antioxidant responses after HIIE. METHODS: Fifteen male participants (age 31.1 ± 5.3 yr; weight 83.5 ± 11.4 kg; BMI 25.5 ± 2.7 kg/m²; VO2 max 49.1 ± 8.5 ml/kg/min) completed a non-exercise control trial after 9 to 9.5 hrs of reference sleep (REF), and then a non-exercise control trial after 16 to 23 minutes completed this randomized, double-blind, placebo-controlled trial. Blood samples were obtained by the same technician under standardized conditions just before, immediately after (IPE), 1 hr after exercise (1 HR) and just before a high-fat meal - (ref), exercise transiently increased fasting HDL cholesterol (+6.3%, p = 0.0023) and paraoxonase-1 concentration (+10.8%, p < 0.0001) and triglyceride (-18.5%, p < 0.0001) decreased after REF+EX and SDS+EX; TAUCt and AUCi remained refractory to exercise effects. SUMMARY: Exercise transiently increased fasting HDL cholesterol and related antioxidant concentrations and reduced triglyceride levels, but did not modify total or incremental triglyceride AUC in response to a post-exercise high-fat meal. Short, disrupted sleep did not influence these responses.
exercise in promoting acutely enhanced glycemic control. Future investigations into post-exercise glycemic control should be expanded to include a larger sample size and varied resistance exercises.

CONCLUSION: When squats were performed with 2sec CON or ECC muscle actions and 50% of IRM, the energy cost of ECC was 2/3 to 3/4 that of CON exercise, whereas peak torque studies have reported CON > ECC > BOTH. A possible explanation may be that slower muscle actions used in our study resulted in elevated energy cost of eccentric muscle actions due to increased time under tension.

**RESULTS:**

<table>
<thead>
<tr>
<th></th>
<th>CON</th>
<th>ECC</th>
<th>BOTH</th>
<th>CON vs ECC</th>
<th>CON vs BOTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set 1</td>
<td>4.40 ± 0.44</td>
<td>3.60 ± 0.27</td>
<td>4.20 ± 0.59</td>
<td>0.027</td>
<td>1.75 ± 0.16</td>
</tr>
<tr>
<td>Set 2</td>
<td>4.55 ± 0.48</td>
<td>3.85 ± 0.31</td>
<td>4.20 ± 0.59</td>
<td>0.027</td>
<td>1.75 ± 0.16</td>
</tr>
<tr>
<td>Set 3</td>
<td>4.30 ± 0.30</td>
<td>3.00 ± 0.33</td>
<td>3.50 ± 0.38</td>
<td>0.027</td>
<td>1.75 ± 0.16</td>
</tr>
<tr>
<td>Set 4</td>
<td>4.55 ± 0.48</td>
<td>3.60 ± 0.27</td>
<td>4.20 ± 0.59</td>
<td>0.027</td>
<td>1.75 ± 0.16</td>
</tr>
</tbody>
</table>

**Values are MEAN ± SD**. *p < 0.05 vs corresponding ECC value; *p < 0.05 vs corresponding BOTH value; significance for this study was set at p ≤ 0.05.

**REFERENCES:**


**Abstracts were prepared by the authors and printed as submitted.**
Previous research has indicated that early life undernutrition increases the risk of cardiovascular disease later in life. It is hypothesized that exercise training could mitigate the cardiovascular impairments of early life undernutrition. PURPOSE: To evaluate the effects of early life undernutrition on changes in exercise capacity after 8 weeks of treadmill (TM) training in a mouse model. METHODS: Using a cross-fostering model, pups were undernourished during gestation (GUN, lactation (PUN), or both (GUN+PUN) by feeding FVB mouse dams a low protein (8%) diet. The control (CON) group was fed an isocaloric diet (20% protein) during all windows of development. At PN21 (21 days post-natal), all mice were weaned and fed the control diet. Thus, all physiological effects of undernutrition were isolated to early life. To evaluate exercise capacity, maximal work on a TM was performed at PN39 (baseline), PN67 (midpoint), and PN95 (post). Starting at PN41, 28 mice were trained on the TM 5 days/week for alternating 8 mins at 85% and 2 mins at 55% of their max workload for 1 hour. The sedentary group of 30 mice ran on the TM 3 days/week for 15 mins at 10% max/min. Data were analyzed using a repeated measures ANOVA to detect change in exercise capacity over time and an ANOVA with Tukey post-hoc test (alpha level p=0.05) to detect differences in exercise capacity between groups. RESULTS: After 4 weeks of TM training, there was a significant difference in exercise capacity change over time between the TM trained (+5.0 ± 3.9 J) and sedentary groups (+2.5 ± 1.6 J) (p=0.03). Differences in exercise capacity change over the first 4 weeks were trending toward significance between groups (GUN: 2.8 ± 1.4 J, PUN: 1.7 ± 1.2 J, GUN+PUN: 6.0 ± 1.2 J, CON: 4.6 ± 1.4 J) (p=0.057). No significant changes were observed from weeks 4 to 8 between or within groups. CONCLUSION: Results indicate that 4 weeks of exercise training can improve exercise capacity in mice who were undernourished during gestation and gestation plus lactation, but not undernutrition during lactation only. PN21 is associated with cardiac growth and the nutrient restriction could potentially limit cardiac growth factors preventing stroke volume adaptations with training.

High-fat-low carbohydrate (HFLC) diets are increasingly considered by endurance athletes to enhance their performances and overall health. Total macronutrient contents in plasma may be affected by diets and exercise. PURPOSE: To examine the effects of HFLC diet and an acute bout of exercise on total plasma macronutrient contents in trained males. METHODS: Eight trained distance runners (age = 39.5 ± 9.9 years and VO2max = 47.9 ± 7.6 ml/kg/min) that were on high-carbohydrate (HC) diets adopted the HFLC diet for 3 weeks, which consisted of 70% of overall caloric intake from fats and no more than 50g of carbohydrates. At the end of each diet trial, the nutrient restriction could potentially limit cardiac growth factors preventing stroke volume adaptations with training.

Physical activity can influence absorption and excretion of fluoride (F). However, the evidence is still limited and often contradictory; studies in rats showed a significant reduction in plasma F concentration at light exercise intensity, while a study with healthy human adults had an increase in plasma concentration and a decline in renal clearance rate of F, with increasing exercise intensity. PURPOSE: To investigate recruitment and acceptance of an experimental protocol (phase I) and the development of methodological procedures (phase II). METHODS: Parents of children (5 to 8 years) were recruited from schools in Brazil. In phase I, parents were asked to complete socio-economic, physical activity (Netherlands Physical Activity Questionnaire) and feasibility questionnaire. The latter explored parents’ willingness for their child to participate and reasons for refusing consent. In phase II, children participated in two test conditions: high intensity exercise and resting with blood collection in urine and saliva samples collected before and after the exercise trial. RESULTS: Only 77 out of 350 parents approached agreed to participate. The majority (54.6%) of the families were from middle socio-economic class. Seventy percent of the children were considered predominately inactive according to an established cut-off point. Fifty-five percent of the parents who responded, would consent their child to participate in the study. The main reason for refusal of consent was collection of blood samples from children (62% and 69% said “no” for finger prick and vein blood collection respectively). In phase II, four children were recruited and one provided assent for blood collection. F concentration of parotid saliva from this participant was 0.01 µg/ml, both at rest and after exercise. Blood lactate concentration and mean F concentration increased from before (Pre) to after (Post) exercise (Lactate Pre: 4.3 mmol/l vs. Post: 14.4 mmol/l; Mean F concentration urine Pre: 0.58 µg/ml vs. Post: 0.63 µg/ml). CONCLUSIONS: Some of the questions related to recruitment rate and acceptability of measurements were answered in this study. However, participants’ willingness to be randomized and their acceptance of and compliance with a high intensity exercise protocol still needs to be explored in a randomized feasibility trial.

A number of fatigue thresholds have been developed to describe fatigue-induced changes in various physiological factors including muscle activation, blood lactate, and gas exchange. These fatigue thresholds, however, may correspond to different exercise intensities depending on the variable from which they were derived as well as their underlying mechanisms. PURPOSE: The purpose of the present study was to examine the relationships and compare power outputs among fatigue thresholds derived from neuromuscular, metabolic, and ventilatory parameters. METHODS: Fifteen college-aged males (mean age ± SD = 22.1 ± 1.7 years, 78.0 ± 9.4 kg, 176.5 ± 5.6 cm) volunteered to perform an incremental test to exhaustion on an electronically-braked cycle ergometer for determination of their physical working capacity at the fatigue threshold (PWC1), lactate threshold (LT), ventilatory threshold (VT), and gas exchange threshold (GET). The incremental test involved recording electromyographic (EMG) signals from the vastus lateralis, as well as measurements of blood lactate from the fingertip and gas exchange using open circuit spirometry. RESULTS: The results of the one-way ANOVA with repeated measures and follow-up paired samples t-tests indicated that the LT (132 ± 14 W) occurred at a significantly (p < 0.05) lower power
output than the PWC<sub>170</sub> (153 ± 33 W), GET (155 ± 33 W), and VT (177 ± 27 W). In addition, the VT occurred at a higher output than the LT, PWC<sub>170</sub>, and GET, whereas there was no significant difference in power outputs between the PWC<sub>vt</sub> and GET. Furthermore, there were no significant inter-correlations among any of the fatigue thresholds (r = -0.03 - 0.35), except between the GET and VT (r = 0.70). CONCLUSIONS: Based on the significant mean differences in power outputs and non-significant correlations, the findings of the present study indicated there were no relationships among indicators of fatigue identified through changes in muscle activation (PWC<sub>vt</sub>), blood lactate (LT), and measurements of gas exchange (VT and GET). These findings suggested there is a dissociation among the exercise intensities associated with the PWC<sub>vt</sub>, LT, VT, and GET, and thus, each originate from separate physiological mechanisms.

Despite a paucity of information regarding the hemodynamic changes associated with moderate fluid ingestion, the popular, unsubstantiated recommendation for most adults to consume 8 ounces of water daily (1800 mL) remains prevalent. PURPOSE: The purpose of this study was to determine the hemodynamic and body fluid changes associated with consuming water at temperatures of 4° C & 37° C and two volumes of 7 & 21 mL/kg. METHODS: 10 subjects (age 22.3 ± 1.3 yr, ht. 1.74 ± 0.15 m, body mass (bm), 75.1 ± 18.5 kg, 4d) were randomized to either sit and drink either water at a cold temperature (4°C) or room temperature (21°C) in four trials. CONCLUSION: Significant reductions in body mass were observed in the hot condition relative to cold conditions. The influence of environmental temperature on hemodynamic and body fluid response to water ingestion is significant. Fluctuations in hemodynamic parameters such as heart rate and HRV are important in the evaluation of cardiovascular health. Understanding the impact of temperature on these parameters can help inform recommendations for fluid intake in different environmental conditions.
high exercise period, maximal fat oxidation (AMFO), and where MFO occurred along the exercise intensity spectrum (AMFatmax) were analysed via whole-body indirect calorimetry.

RESULTS
No statistical differences in fat utilization during CO exercise when compared to TN as indicated by ARER (0.05 ± 0.02 vs. 0.05 ± 0.02; p = 0.584), AMFO (0.21 ± 0.18 vs. 0.16 ± 0.13 pmol/min; p = 0.133) and AMFatmax (13.3 ± 19.0 vs. 0.6 ± 21.3 %VO2max; p = 0.060) were seen between CO and TN, respectively.

CONCLUSION
A cold environment increases lipid contribution as metabolic fuel during exercise, and may be considered in training and health-intervention strategies. In the present study, an acute glucose ingestion causing a shift in carbohydrate utilization, was similar in both the cold and thermoneutral environment, indicating that exercising in a cold environment does not compromise metabolic flexibility. Future exercise studies should investigate the metabolic influences of high-fat diets and acute lipid overload in cold and warm environments.

3320 Board #189 June 2 9:30 AM - 11:00 AM
Attenuated Fat Oxidation Rates in ME/CFS Patients
Jeff Cournoyer, Graham Salmin. Nova Southeastern University, Miami, FL.

(No relevant relationships reported)

Chronic Fatigue Syndrome (CFS) is a condition characterized in part by inexplicable severe fatigue, and post-exertional malaise (PEM), which is defined by crippling exhaustion coupled with flu-like symptoms resulting from physical and/or mental exertion. Fear of severe PEM in CFS patients often leads to extended inactivity periods and as a consequence, the disease state is characterized by a highly sedentary lifestyle with activity levels far below those typically observed in sedentary healthy controls (HC). Prior studies on CFS have observed impairments in aerobic capacity (VO2 max) coupled with increased rates of perceived exertion during a GXT; however, no study to date has examined if these impairments in aerobic capacity are correlated with a reduced fat oxidative capacity at increasing exercise intensities. PURPOSE The purpose of our study is to identify changes in fat oxidation patterns during increasing exercise intensities as a result of the CFS disease state. METHODS Twenty male patients (39.6 ± 12.4 yrs) were divided into two groups: CFS (N=14) and HC (N=6). Participants were asked to perform a maximal exercise test on a cycle ergometer, with an initial resistance of 60 Watts and increasing by 30 Watts until volitional fatigue was reached or a pedalling cadence of 55-65 RPM was no longer maintained. VO2 Max, time to exhaustion (TE), Maximal Fat Oxidation (MFO) and Total Fat Oxidation (TFO) were recorded for all participants and 2-tailed T-tests were used to determine significant differences between the two groups. RESULTS MFO (HC mean: 617 g/day; CFS mean: 339.5 g/day; p<0.05) and TFO (HC mean: 10 kcal; CFS mean: 2.8 kcal; p<0.05) were lower in CFS patients, but no significant difference was observed in TE (HC mean: 11.2 minutes; CFS mean: 9.1 minutes; p>0.05). VO2 Max (HC: 27.9 ml/kg/min; CFS mean: 26.3 ml/kg/min; p=0.06) or FatMax (CFS: 41.2% of VO2 Max; HC: 48.9% of VO2 Max; p=0.05). CONCLUSION Patients diagnosed with CFS displayed significantly lower capacity for fat oxidation than HC, though their TE was not significantly less. This might indicate a propensity for CFS patients to spend more time in an anaerobic state.

3321 Board #190 June 2 9:30 AM - 11:00 AM
High Doses Of Branched-chain Amino Acids Supplementation Associated To Sprint Interval Training Improves Metabolic Profile
Elias de França, Ana Paula Xavier, Eriko Chagas Caperuto. Universidade São Judas Tadeu, São Paulo, Brazil.

(No relevant relationships reported)

High doses of BCAA supplementation have unclear effects on cardiovascular diseases (CVD) biomarkers and energy metabolism in humans, even more when its associated metabolic flexibility. PURPOSE: The aims of this study was to evaluate the effects of BCAA supplementation associated with SIT on energy metabolism and CVD biomarkers. METHODS: 40 overweight and sedentary volunteers (height: 169 ± 8cm; age: 32 ± 7 yrs; weight: 74.5 ± 10.7 Kg) were randomly distributed into 4 groups: S-PLA= sedentary + placebo; S-BCAA= sedentary + BCAA; SIT-PLA= SIT + placebo and, SIT-BCAA= SIT + BCAA. Patients diagnosed with CFS, diabetes, and chronic obstructive pulmonary disease were excluded from the study. All participants were asked to perform a maximal exercise test on a cycle ergometer, with an initial resistance of 60 Watts and increasing by 30 Watts until volitional fatigue was reached or a pedalling cadence of 55-65 RPM was no longer maintained. VO2 Max, time to exhaustion (TE), Maximal Fat Oxidation (MFO) and Total Fat Oxidation (TFO) were recorded for all participants and 2-tailed T-tests were used to determine significant differences between the two groups. RESULTS: VO2max increased (p>0.05) significantly in the SIT-PLA (95% CI: 2.0 to 7.6 ml/kg/min; Cohen’s d=0.41) and SIT-BCAA (1 to 7.7, -0.50) groups only, with no difference between them; There was no treatment effect (p> 0.05) in % BF, TC and PCR in any groups; However, in the SIT-BCAA group only, there was a decrease (p<0.05) in Hba1c (-5.03 to -0.89%), LDL (-42.90 to -1.03 mg/dl, 0.51) and an increase in HDL (2.91 to 18.85 mg/dl, -1.24), while triglycerides decreased (p<0.01) in both S-BCAA (-185.96 to -7.95 mg/dl, 1.09) and SIT-BCAA (-119.68 to -27.84 mg/dl, 1.19) groups only; Treatment effect was observed on PCR which decreased in SIT-BCAA group only (p<0.01, η=0.218) and tend to decrease in SIT-PLA group only (p=0.09, η=0.069); [G] decreased in S-BCAA (p<0.01, η= 0.440), SIT-PLA (p<0.01, η=0.287) and SIT-BCAA (p<0.001, η=0.460) groups only, with no difference between them; [La] decreased in SIT-PLA group only (p= 0.02, η=0.220).

CONCLUSIONS: BCAA supplementation associated with SIT promotes some synergistic changes on CVD biomarkers and energy metabolism.

3322 Board #191 June 2 9:30 AM - 11:00 AM
L-glutamine and L-alanine Improve Energy Status and Skeletal Muscle Cytoprotection in Rats Submitted to Heavy Resistance Exercise
Julio - Tirapegui, Raquel Raizel, Audrey Coqueiro, Andrea Bonviní, Thais Hypólito, Amanda Garcia, Rafael Lara. University of São Paulo, São Paulo, Brazil.

(No relevant relationships reported)

Strenuous exercise results in muscle damage and low cellular energy levels, which activates the AMP-activated protein kinase (AMPK), a sensor of energy status, as well as induces the expression of forkhead box O1 (FOXO1), linked to delayed skeletal muscle regeneration. Glutamine and alanine are the most important gluconeogenic and cytoprotection-related amino acids, and have been demonstrated to attenuate exercise-induced muscle damage and inflammation. However, whether these amino acids have a role in regulating energy status and muscle damage during heavy resistance exercise (HRE) remain largely unknown. PURPOSE: To evaluate the effects of chronic oral supplementation with L-glutamine and L-alanine in their free form (GLN+ALA, ALA) or as the dipeptide L-alanyl-L-glutamine (DIP) on energy status, muscle damage and cytoprotection markers in skeletal muscle of rats submitted to heavy resistance exercise (HRE). METHODS: Forty adult male Wistar rats (n=8/group) were submitted to 8-week HRE, which consisted of climbing a ladder with progressive loads (25 to 100% of body weight), and to supplementation delivered in a 4% solution in drinking water, in the last 21 days of HRE. Phosphorylation of AMPK and FOXO1, as well as the expression of apoptosis-inducing factor (AIF) and the 27 kDa heat shock protein (HSP27) were assayed in tibialis anterior muscle by western blotting. RESULTS: HRE promoted skeletal muscle damage by increasing AIF and HSP27 contents in muscle of CTRL (by 85%) and ALA (by 158%) groups (p<0.05 vs. sedentary). Conversely, GLN+ALA and DIP attenuated these effects. Additionally, supplements containing L-glutamine decreased the exercise-induced phosphorylation of AMPK by 24% (p<0.05 vs. CTRL and ALA groups) and of FOXO1 by 55% in muscle of rats treated with GLN+ALA and DIP (p<0.05 vs. SED, CTRL and ALA groups). CONCLUSION: Chronic oral supplementation with L-glutamine (given along with free L-alanine or as dipeptide) improved muscle energy status by decreasing AMPK phosphorylation and promoted muscle protection by decreasing FOXO1 phosphorylation and HSP27 and AIF contents in response to HRE. Supported by FAPESP 2012/21087-4.

3323 Board #192 June 2 9:30 AM - 11:00 AM
Effects Of A Liquid Breakfast With Varying Doses Of Whey And Soy On Appetite, Energy Intake And Hormone Response
Svetlana Nepocatych, Caroline E. Melson, Takudzwa A. Madzima. Elon University, Elon, NC. (Sponsor: Eric Hall, FACSM)

(No relevant relationships reported)

PURPOSE: The study examined the effects of a liquid breakfast meal containing varying doses of whey (WP) and soy protein (SP) on appetite, subsequent energy intake, and hormone response.

METHODS: Seventeen participants (age: 27 ± 7 yrs; body fat: 21.5 ± 6.9%, basal metabolic rate: 1741 ± 91 kcal/day) in randomized order consumed one of five isonenergetic liquid breakfast meals (~500kcal) including control (CHO), low WP (LWP, 21.5 g), high WP (HWP, 43 g), low SP (LSP, 25 g) and high SP (HSP, 50 g) followed by an ad libitum lunch 3 hours later. Appetite profile was measured before, immediately after and hourly during the 3 hour postprandial period. Plasma concentrations of leptin and insulin were measured before, at 30 and 180 minutes after the meal and were analyzed via ELISA. A 5 x 3 (meal x time) repeated measures ANOVA were used to analyze data. Significance was accepted at p < 0.05.

RESULTS: Energy intake at lunch per kilogram of body weight was significantly higher after CHO (11 ± 3.6 kcal/kg) compared to LWP (9.5 ± 2.9 kcal/kg), HWP (9.1 ± 3.0 kcal/kg), and HSP (9.1 ± 3.0 kcal/kg) but not compared to LSP (10.2 ± 2.7 kcal/kg). Participants hunger, desire to eat, and estimated amount of food to be consumed
were higher, whereas, satiety and fullness were lower after CHO (p < 0.05) compared to LWP, HWP and HSP but not compared to LSP. There were no significant differences (p > 0.05) observed in postprandial leptin or insulin responses between meals, however, a significant change over time was observed for insulin (p = 0.02) but not leptin (p > 0.05). Insulin increased by 293 ± 89 ng/ml at 30 min and decreased by -291 ± 92 ng/ml at 180 min post meal, whereas, leptin decreased by -37 ± 29 ng/ml and -10 ± 5 ng/ml at 30 and 180 min, respectively.

CONCLUSIONS: Liquid breakfast meals with higher doses of whey and soy protein reduced subsequent energy intake at lunch and were rated as more satiating compared to an isonenergetic CHO meal. In addition, postprandial levels of leptin and insulin did not differ between meals suggesting that acute changes in energy intake and satiety perception may not be influenced by circulating leptin levels.

3324 Board #193 June 2 9:30 AM - 11:00 AM Dietary Amino Acid Availability and Anabolic Signaling Molecule Phosphorylation is Blunted in Maintenance Hemodialysis Patients

Nicholas A. Burd, Stephan van Vliet, Sarah K. Skinner, Joseph W. DeBals, Hsin-Yu Fang, Alexander V. Ulyanov, Scott A. Paluska, FACSM, Kenneth R. Wilund. University of Illinois at Urbana-Champaign, Urbana, IL. (Sponsor: Scott A. Paluska, FACSM) (No relevant relationships reported)

Skeletal muscle mass loss is a common feature in patients with renal failure receiving maintenance hemodialysis (MHD) therapy. Dietary protein (amino acids) is one of the main anabolic stimuli to skeletal muscle tissue in humans, and impairments to anabolic stimuli over time may lead to muscle mass loss. However, there are major gaps in our knowledge of how muscle mass is regulated by protein intake in MHD patients.

PURPOSE: To compare dietary protein digestion and absorption kinetics and phosphorylation of anabolic signaling proteins after mixed meal ingestion in MHD patients and age- and BMI-matched controls. METHODS: 8 MHD patients (age: 56±5 y; BMI: 32±1 kg/m²) and 8 controls (age: 50±2 y; BMI: 31±1 kg/m²) received primed continuous infusions of L-[1-13C]leucine and ingested a mixed meal (546 kcal, 20 g protein, 59 g carbohydrate, 26 g fat) with protein provided as intrinsically L-[5,5,5,5-2H₄]leucine labeled EAA. Breath, blood, and muscle biopsies were collected to determine amino acid concentrations, leucine enrichments, and phosphorylation of mTORC1 on Ser2448 during a 5 postprandial period. RESULTS: Postprandial release of dietary leucine into circulation over 5 h was reduced in MHD patients (41±5% vs. controls (61±4%; P<0.03). The feeding-mediated increase in mTORC1 phosphorylation was blunted in MHD patients (0.6-fold above basal) vs. controls (1.1-fold above basal; P=0.006) at 5 h of the postprandial period. CONCLUSION: Our data demonstrated impaired kinetics of digestion/absorption of dietary proteins and reduced postprandial plasma amino acid availability in circulation after mixed meal ingestion in MHD patients when compared to age- and BMI-matched controls. This diminished dietary amino acid availability may have partly contributed to the blunted anabolic signaling mechanisms in MHD patients.

Supported by the Egg Nutrition Center (ENC)

3326 Board #195 June 2 9:30 AM - 11:00 AM Concussion History Predicts Reduced Cortical Thickness in Special Operations Forces Personnel

Jason P. Mihalik, Cassie B. Ford¹, Michael J. Cools¹, Stephen M. DeLellis², Shawn F. Kane, FACSM³, Robert H. Lutz², James H. Lynch, FACSM.¹ The University of North Carolina at Chapel Hill, Chapel Hill, NC. ²United States Army Special Operations Command, Fort Bragg, NC. 

Reported Relationships: J.P. Mihalik: Contracted Research - Including Principle Investigator; UNC received funding from the United States Army Special Operations Command to conduct this work.

Special Operations Forces (SOF) personnel are at high risk for repetitive blast and head impact exposure. Non-invasive neuroimaging techniques, such as magnetic resonance imaging (MRI), have identified concussion-related structural differences even when observable behavioral and cognitive deficits are absent. The relationship between injury history, neuroimaging, and standard clinical tests has not previously been defined in the SOF population.

PURPOSE: To compare cortical morphology, symptom scores, and neurocognition in SOF personnel with and without concussion history. METHODS: SOF personnel completed an assessment battery including 3T high-resolution MRI and the Immediate Post-concussion Assessment and Cognitive Test (ImPACT). We examined symptom reporting and the ImPACT composite scores for verbal and visual memory, visual-motor processing speed, reaction time, and impulse control. The SOF personnel were categorized by self-reported concussion history (no history vs. 1+ concussions). We used FreeSurfer (v6) to reconstruct and segment the cerebral cortex. Cortical thickness was regressed on concussion history controlling for estimated total intracranial volume. The symptom reporting and ImPACT composite scores were regressed on concussion history. RESULTS: We imaged 166 SOF personnel (160 males; 65 self-reported concussion history) using MRI. Of these, 155 completed the ImPACT during a healthy baseline testing session. Two brain regions had reduced cortical thickness associated with concussion history, controlling for the total intracranial volume: left pericalcarine (tₓ=-2.00, p=0.04); and left parahippocampal (tₓ=-2.81, p=0.006). One region had larger cortical thickness in those with a concussion history: right transverse temporal (tₓ=-2.35, p=0.02). Concussion history did not predict symptom or ImPACT composite score differences (p>0.05). CONCLUSIONS: Concussion history predicted cortical thickness in brain regions associated with vision and memory, which are cognitive functions affected following concussion injury. The ImPACT composites were not sensitive to concussion history.

Supported by the United States Army Special Operations Command (USASOC)

G-44 Free Communication/Poster - Behavioral Aspects and Correlates of Concussions

Saturday, June 2, 2018, 7:30 AM - 11:00 AM
Room: CC-Hall B

3325 Board #194 June 2 9:30 AM - 11:00 AM Concussion History Moderates Relationships Between Neural and Clinical Outcomes in Special Operations Forces Personnel

Cassie B. Ford¹, Michael J. Cools¹, Stephen M. DeLellis², Shawn F. Kane, FACSM³, Robert H. Lutz², James H. Lynch, FACSM.¹ The University of North Carolina at Chapel Hill, Chapel Hill, NC. ²United States Army Special Operations Command, Fort Bragg, NC. 

Reported Relationships: C.B. Ford: Contracted Research - Including Principle Investigator; UNC received funding from the United States Army Special Operations Command to conduct this work.

Computerized neurocognitive tests such as Immediate Postconcussion Assessment and Cognitive Test (ImPACT) evaluate athletes at baseline and post injury in clinical and research settings. Visual and sensory performance (VSP) assessments evaluate and improve performance in both healthy and post-injury populations. These assessments are differentially sensitive to concussion history. The relationship among injury history, neurocognitive testing, VSP assessments and structural neuroimaging within the Special Operations Forces (SOF) population is unknown.

PURPOSE: To test whether cortical thickness (CT) mediates, and concussion history moderates, relationships among cognitive and visual-sensory tests. METHODS: SOF personnel completed 3T high-resolution MRI, ImPACT, and VSP tests (Nike SPARQ or Senaptec Sensory Station). The SOF personnel were categorized by self-reported concussion history (none, 1+). We used FreeSurfer to reconstruct and segment the cerebral cortex. After examining bivariate correlations between all variables, path analyses tested whether CT mediated select relationships between ImPACT composites and VSP outcomes, with concussion history as a moderator. RESULTS: 155 SOF personnel (149 males; 54 self-reported concussion history) were imaged and completed ImPACT; 147 also completed VSP tests (127 Nike SPARQ; 20 Senaptec) during healthy baseline testing. There was a significant total effect of ImPACT Verbal Memory and CT (for regions associated with motor function and semantic responses) on Perception Span for those with a concussion history. Conversely, we found significant effects of ImPACT Motor Speed and CT on Go/No-Go, but only for those without concussion history. Although we found significant relationships between variables, there was no evidence that the effect of ImPACT composites on VSP outcomes was due to differences in CT. CONCLUSIONS: Concussion history differentially moderated the relationship among clinical outcome variables and neural structure, but neural structure did not mediate relationships between clinical outcomes. Understanding these relationships may help us better understand the effects of concussion and direct research towards tracking specific outcomes of clinical importance.

Supported by USASOC
Concussion is one of the most common sports-related injuries in the United States and is especially prevalent in youth sports such as football, ice hockey, and soccer. While all stakeholders are concerned about head trauma in youth sports, parents have an especially strong influence on their children’s participation in organized sports. However, few studies have analyzed how parents’ knowledge of concussion in sport may affect their decisions regarding youth sport participation.

**PURPOSE:** To explore parental perceptions regarding concussion risk in football and how these perceptions influence subsequent advice offered to other parents concerning their child’s participation in football.

**METHODS:** A mixed-methods approach was employed using an online questionnaire distributed to 100 parents of current NCAA Division II football players at a small Midwestern university. The questionnaire included items related to their son’s football participation and concussion history as well as their own awareness and perception of concussion risk. Several items included open-ended follow-up questions to allow for qualitative responses, which were coded through inductive analysis and grouped into thematic categories.

**RESULTS:** Thirty-four parents of collegiate football players completed the questionnaire (34% response rate). Thirteen (38%) respondents believed their son had experienced a concussion and nine (26%) reported their son had been diagnosed with a concussion. The questionnaire was used to assess groups for: (1) general concussion knowledge and (2) the demonstration of safe behaviors in situational decision making (“safe” or “unsafe”).

**CONCLUSIONS:** HSS and CS are knowledgeable about concussion. Age is positively associated with increased knowledge. HSS participating on sporting teams are more knowledgeable, especially males. HS students make more unsafe situational decisions compared to their collegiate counterparts and female CS demonstrate the safest behavior.
Official Journal of the American College of Sports Medicine

Vol. 49 No. 5 Supplement S689

Saturday, June 2, 2018

Abstracts were prepared by the authors and printed as submitted.
Exercise has been identified as a potential tool to mediate anxiety and improve self-efficacy and body image, however, the effectiveness of college physical education (PE) courses on psychological health needs further evaluation. PURPOSE: To examine the effects of 8-week PE courses on body image, anxiety, and exercise self-efficacy. METHODS: Seventy-five females (mean ± SD; Age: 20.8 ± 3.6 y; Height: 164.7 ± 7.0 cm; Weight: 68.5 ± 16.3 kg, Body fat percentage (BF%): 27.3 ± 8.7 %) enrolled in college PE courses of Kickboxing (n=14), Beginning Jogging (n=8), Intermediate Jogging (n=22), Strength Training (n=14), and Conditioning (n=15) volunteered to participate in this study. Each course met 3 times a week for 50 minutes each class period during the 8-week long course. At the start and completion of each course, participants completed the Body Shape Questionnaire, Exercise Self-Efficacy (ESE), and Social Physique Scale, and height, weight, and BF%, measured by bioelectrical impedance analysis, were recorded. RESULTS: There were no significant differences pre- to post-testing in weight or activity levels outside of PE in any of the 5 courses (p>0.05). BF% significantly decreased pre- to post-testing in Intermediate Jogging (p<0.03), but not in the other courses. Social physique anxiety decreased in Beginning Jogging (p=0.024) and Strength Training (p=0.05), but not in the other courses. All courses had a significant improvement in body image (p<0.05) and ESE (p<0.05). BF% had a significant negative correlation with body image (R= -0.53, p<0.05) and ESE (R= -0.24, p<0.02), and a positive correlation with anxiety (R=0.53, p<0.05). Individual height rating had a significant positive correlation with body image (R=0.47, p<0.05) and ESE (R=0.44, p<0.05), and a negative correlation with BF% (R= -0.26, p<0.05) and anxiety (R= -0.42, p<0.05). ESE had a significant positive correlation with body image (R=0.40, p=0.003) and anxiety (R=0.32, p=0.03). CONCLUSIONS: Lower BF% was associated with better body image, exercise self-efficacy, and lower anxiety. However, these results indicate regular exercise through 8-week PE college courses may aid in improving body image and exercise self-efficacy and decreasing anxiety even if there are no changes in weight or body fat percentage.

G-46 Free Communication/Poster - Endocrinology/Immunology II
Saturday, June 2, 2018, 7:30 AM - 11:00 AM
Room: CC-Hall B

3335 Board #204 June 2 9:30 AM - 11:00 AM
Effects Of 8-week Physical Education Courses On Body Image, Anxiety, And Exercise Self-efficacy
Erica J. Roelofs, Sarah R. Du Bose. Meredith College, Raleigh, NC.

Exercise associated menstrual disturbances (EAMD) are often attributed to hypothalamic inhibition of the reproductive axis secondary to energy deficiency. However, some exercising women with menstrual disturbances do not present with the traditional metabolic profile of suppressed resting energy expenditure (REE), decreased concentrations of total triiodothyronine (TT3) and T4, and elevated ghrelin concentration typical of energy deficiency. Hyperandrogenism may be an alternative or coexisting mechanism underlying menstrual dysfunction in a subset of exercising women. PURPOSE: To determine if there are differences between the metabolic profiles of exercising women with menstrual disturbances and without hyperandrogenism (EAMD-HA; n=30), EAMD-NA (n=67). METHODS: Fasting blood samples were collected to assess TT, leptin, ghrelin, sex hormone binding globulin (SHBG), and total testosterone (T) concentrations. Metabolic status was determined by TT, leptin, ghrelin, BMI. percent body fat (%BF, DXA-derived), and measured REE compared to Harris-Benedict predicted REE (mREE/pREE). Androgen status was determined by SHBG, total T, and calculated free T; hyperandrogenism was defined as a calculated free androgen index (FAI) value >2.92 [FAI=totalT/SHBG*100], which is determined by SHBG, total T, and calculated free T; hyperandrogenism was defined as a calculated free androgen index (FAI) value >2.92 [FAI=totalT/SHBG*100], which represented the upper bound of the 95% confidence interval for all subjects. Two-sided independent t-tests were used to compare differences between groups. RESULTS: The EAMD-HA and EAMD-NA groups were similar with respect to age (22yrs), height (165.1cm), weight (57.19kg), and concentrations of ghrelin (1275.17µg/mL) and TT, (86.07ng/dL) (p>0.05). BMI (p=0.005), %BF (p=0.015), FAI (p=0.001), and leptin (p=0.025), total T (p<0.001) and cfree T concentrations (p<0.001) were all greater in EAMD-HA compared to EAMD-NA. SHBG concentrations (p=0.001) were lower in EAMD-HA compared to EAMD-NA. mREE/pREE was similar between groups and

3336 Board #205 June 2 9:30 AM - 11:00 AM
The Metabolic and Androgen Profiles of Exercising Women With Menstrual Disturbances
Kristen J. Koltun, Nancy I. Williams, FACSM, Mary Jane De Souza, FACSM. Pennsylvania State University, University Park, PA. (Sponsor: Mary Jane De Souza, FACSM)

Adipose tissue was considered a passive reservoir for energy storage, but now is viewed as an active endocrine organ secreting adipokines such as resistin and adiponectin. Resistin tends to be inflammatory in nature, while adiponectin tends to resist inflammation. Few researchers have examined the impact of age and physical activity level on serum resistin and adiponectin within the same study. The purpose of this study was to assess the relationships among age, physical activity level, and resistin and adiponectin levels in healthy young and older adults. METHODS: A convenience sample was used consisting of 20 young (10M/10F; Age: 21.0±1.2y; BMI: 24.3±4.5 kg·m⁻²) and 20 older (6 M/14 F; Age: 68.4±3.0y; BMI: 25.5±3.1 kg·m⁻²) adults. Physical activity frequency and intensity were determined in young and older subjects using the International Physical Activity Questionnaire (IPAQ) and the Community Healthy Activities Model Plan for Seniors (CHAMPS), respectively. Enzyme-linked immunosorbent assay were used for the detection and quantification of serum resistin and adiponectin. RESULTS: Young and older subjects had average resistin levels of 3.49 ± 0.97 ng·mL⁻¹ and 2.97 ± 0.69 ng·mL⁻¹; and adiponectin levels of 101.40 ± 61.65 ng·mL⁻¹ and 106.03 ± 59.39 ng·mL⁻¹, respectively. Physical activity level below 0.90 (EAMD-HA: 0.87±0.01; EAMD-NA: 0.86±0.02, p<0.05). Conclusion: These findings support evidence that hyperandrogenism can coexist with an energy deficiency, exercising women and may contribute to menstrual disturbances. Proper screening must be conducted to ensure diagnosis and treatment of the appropriate etiology of menstrual disturbances.
was not correlated with either resistin or adiponectin. Resistin tended to be lower in older compared to young subjects (p = 0.056). There was no significant difference in adiponectin levels between young and old subjects (p = 0.57). Adiponectin was correlated with BMI within both groups (old: r = -0.45, p = 0.034; young: r = -0.46, p = 0.043) and when old and young subject data were combined (r = -0.45, p = 0.004).

CONCLUSIONS: Body composition appears to be more predictive of serum levels of the anti-inflammatory adipokine, adiponectin, than either age or physical activity level. Surprisingly, resistin, a pro-inflammatory adipokine, was lower in older compared to young adults. Future studies with larger sample sizes and objective measures of physical activity level are warranted to better understand the relationships among age, physical activity level, and the expression of these adipokines.

Osteoporosis is an important health care problem in female athletes. Previous studies have shown that vitamin D receptor (VDR) gene polymorphisms are related to osteoporosis in the general populations; however, associations in female athletes are not known. PURPOSE: To investigate the association between bone mineral density (BMD) and VDR gene polymorphisms in female athletes.

METHODS: One hundred and eighty seven female athletes (age: 20.3±1.2 years, height: 161.6±6.3 cm, body weight: 58.3±9.8 kg, percent body fat: 24.8±3.7%) participated in the present study. BMD of the whole-body, lumbar spine (L2–L4), and femoral neck was measured using dual-energy X-ray absorptiometry. Analyses of VDR genes FokI, ApaI, and TaqI polymorphisms were performed using TaqMan Genotyping Assay.

RESULTS: The genotype frequencies of VDR genes FokI, ApaI, and TaqI polymorphisms were in Hardy-Weinberg equilibrium. The VDR genotype for FokI, FF was found in 44.9%, Ff in 41.7%, and ff in 13.4% of the subjects (p=0.31). For ApaI, AA was found in 12.3%, Aa in 42.5%, and aa in 45.2% (p=0.051). For TaqI, TT was found in 72 %, TT in 26.4%, and tt in 1.6% (p=0.054). There was no significant difference in physical characteristics among the VDR FokI, ApaI, and TaqI genotypes. No significant difference was observed between whole body BMD, lumbar spine (L2–L4) BMD, and femoral neck BMD in association with the VDR gene FokI, ApaI, and TaqI polymorphisms. However, the genotype of the VDR Apal polymorphism was significantly associated with lower whole-body BMD than the AA genotype (p=0.05).

CONCLUSIONS: An association with the VDR gene Apal polymorphism was found in this study only for whole-body BMD. In conclusion, the VDR gene Apal polymorphism as genotype is associated with decreased whole-body BMD in female athletes.

High-intensity exercise is related to increase the oxidative stress by excessive production of reactive oxygen species (ROS). Salivary nitric oxide (sNO) has been known to be a factor influencing the production of ROS. Therefore, there is a possibility of noninvasively evaluating ROS during exercise by measuring sNO. However, the influence of the difference of exercise intensity on sNO secretion are not known. PURPOSE: To determine the effect of wearing lower-body compression garment (CG) during prolonged running on tissue vibration and exercise-induced muscle damage and inflammatory responses.

METHODS: Ten male subjects (170.5 ± 0.4cm, 62.6 ± 0.7kg, VO2 max: 50.6 ± 0.7mL/kg/min) performed 2 exercise trials in a random order. The exercise consisted of 120 min of uphill running (7% gradient) at 60% of VO2 max. The exercise trials included 1) wearing lower-body CG with exerting 15 mmHg to thigh and calf [CG]; and 2) wearing lower-body garment with exerting below 5 mmHg to thigh and calf [CON]. During exercise, heart rate (HR), rating of perceived exertion (RPE), stride parameters (length and frequency) and tissue vibrations (3-axis acceleration of vastus lateralis, biceps femoris, tribia and gastrocnemius muscles) were evaluated. Jump performances and maximal voluntary contraction for knee extension (MVC) were evaluated before and immediately after, 60 min and 180 min after exercise. Blood variables were collected to determine blood glucose and lactate, serum myoglobin, and plasma IL-6, IL-1ra, IL-10, TNF-α and MCP-1 concentrations.

RESULTS: Average HR during 120 min of exercise was significantly lower in the CG trial than in the CON trial (163 ± 14 bpm vs. 167 ± 11 bpm, P = 0.042). Although stride parameters during exercise did not significantly differ between two trials, CG trials showed significantly lower tissue vibrations compared with the CON trial (P<0.05). Jump performances and MVC were significantly decreased after exercise in both trials, whereas the CG trial showed significantly higher value of MVC at 180 min after exercise (92.4 ± 6.6 % vs. 85.0 ± 11.4 %, P = 0.044). There were significant increases in all of plasma cytokine concentrations after exercise in both trials (P < 0.05). Area under the curve (AUC) for IL-6 concentration during exercise and post-exercise period was significantly lower in the CG trial than in the CON trial (2,560 ± 1,686 pg/mL vs. 4,021 ± 3,234 pg/mL, P = 0.04). Furthermore, AUCA for plasma IL-1ra and IL-10 concentrations during post-exercise period tended to be lower in the CG trial.

CONCLUSION: Wearing lower-body CG during 120 min of uphill running caused significantly lower exercise-induced increase in HR, tissue vibration, inflammation and faster recovery of muscular strength.

High-intensity exercise significantly increased (P = 0.021) in 60 min (362 ± 58 µmol/L), whereas the change in sNO secretion rate in both conditions did not significantly change in time. In the comparison between the interventions, the change in sNO secretion rate in the high-intensity (0.22 ± 0.05 µmol/min) was significantly higher (P = 0.04) than the moderate (-0.01 ± 0.05 µmol/min) at 60 min, while the change in sNO concentration was not significantly different (P = 0.075) between the high-intensity (362 ± 58 µmol/L) and moderate (64 ± 69 µmol/L) at 60 min. CONCLUSIONS: In this study, sNO concentration significantly increased after the high-intensity exercise, although it did not change after the moderate exercise. It was suggested that the difference of exercise intensity may affect the response of sNO.

Purpose: To determine effect of wearing lower-body compression garment (CG) during prolonged running on tissue vibration and exercise-induced muscle damage and inflammatory responses.

Methods: Ten male subjects (170.5 ± 0.4cm, 62.6 ± 0.7kg, VO2 max: 50.6 ± 0.7mL/kg/min) performed 2 exercise trials in a random order. The exercise consisted of 120 min of uphill running (7% gradient) at 60% of VO2 max. The exercise trials included 1) wearing lower-body CG with exerting 15 mmHg to thigh and calf [CG]; and 2) wearing lower-body garment with exerting below 5 mmHg to thigh and calf [CON]. During exercise, heart rate (HR), rating of perceived exertion (RPE), stride parameters (length and frequency) and tissue vibrations (3-axis acceleration of vastus lateralis, biceps femoris, tribia and gastrocnemius muscles) were evaluated. Jump performances and maximal voluntary contraction for knee extension (MVC) were evaluated before and immediately after, 60 min and 180 min after exercise. Blood variables were collected to determine blood glucose and lactate, serum myoglobin, and plasma IL-6, IL-1ra, IL-10, TNF-α and MCP-1 concentrations.

Results: Average HR during 120 min of exercise was significantly lower in the CG trial than in the CON trial (163 ± 14 bpm vs. 167 ± 11 bpm, P = 0.042). Although stride parameters during exercise did not significantly differ between two trials, CG trials showed significantly lower tissue vibrations compared with the CON trial (P<0.05). Jump performances and MVC were significantly decreased after exercise in both trials, whereas the CG trial showed significantly higher value of MVC at 180 min after exercise (92.4 ± 6.6 % vs. 85.0 ± 11.4 %, P = 0.044). There were significant increases in all of plasma cytokine concentrations after exercise in both trials (P < 0.05). Area under the curve (AUC) for IL-6 concentration during exercise and post-exercise period was significantly lower in the CG trial than in the CON trial (2,560 ± 1,686 pg/mL vs. 4,021 ± 3,234 pg/mL, P = 0.04). Furthermore, AUCA for plasma IL-1ra and IL-10 concentrations during post-exercise period tended to be lower in the CG trial.

Conclusion: Wearing lower-body CG during 120 min of uphill running caused significantly lower exercise-induced increase in HR, tissue vibration, inflammation and faster recovery of muscular strength.

Hamstring strain injuries (HSIs) occur when there is excessive strain on the muscle during eccentric contraction, with the biceps femoris (BF) being the most common injury site. The characterisation of muscle activation during different hamstring strengthening exercises may enable evidence-based prescription of preventative/rehabilitation exercises consistent with the aetiology of injury.
**S962 Vol. 49 No. 5 Supplement**

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

**Purpose:** To identify the hamstring strengthening exercise which elicits the highest muscle activation of the BF during eccentric contraction at longer muscle lengths. **Methods:** Eleven exercise-trained males (22 ± 3.3 years) participated in this cross-sectional study. BF and semitendinosus (ST) electromyography (EMG) amplitude was measured during the eccentric phase (three consecutive 15° sectors preceding the end range-of-motion (ROM)) of six different hamstring strengthening exercises (3 repetitions, 3RM load). Common and lengthened-state variants of hamstring exercises were performed with a 2D sagittal plane video was used to analyse ROM of exercises. **Results:** EMG amplitude was progressively higher towards the end of the eccentric phase for each exercise (p < 0.001). During the last 15° sector preceding end ROM, BF activity was highest in the CN (75.2 ± 8.2%, followed by GM (69.9 ± 6.6%) and SLC (67.8 ± 7.4%). BF/ST ratio was different between exercises (p = 0.024; CN < IHE & SHE; SLC < IHE & SHE). Muscle elongation (KJA-HJA) during end ROM was highest in the SLC (86.6%) and lowest during CN (-31%). **Conclusion:** Differences in EMG amp with ROM sector suggest that besides contraction type, joint angle also influences muscle activation during these exercises. The high BF activity and muscle elongation of the SLC during end-ROM suggest that it may be an effective hamstring strengthening exercise.

**Rehabilitation following knee surgery (e.g., ACL reconstruction) is prolonged and many individuals do not completely regain their quadriceps size and strength. These persistent impairments give rise to limb asymmetry which increases risks for re-injury and osteoarthritis. Purpose:** To establish exercise with blood flow restriction (BFR) as a home-based program to overcome persistent quadriceps size and strength impairments and restore limb symmetry long after knee surgery. **Methods:** Five adults with an ACL reconstruction and/or meniscus repair (4.4 ± 2.5 years post-surgery) volunteered. Participants had at least 10% asymmetry in quadriceps size and/or strength. Participants exercised at home 4x/week for 4 weeks. Exercises included body weight squats, single-leg knee extension with resistance bands, and walking. Blood flow to the affected limb was restricted using a 1.5cm pressurized cuff inflated to 50% of limb occlusion pressure. Vastus lateralis and rectus femoris thickness along with knee extensor strength were measured before and after training. Percent difference between affected and contralateral limbs was used as an index of limb asymmetry. Post-training asymmetry indices were compared to healthy uninjured controls (n = 5). **Results:** Following training, asymmetry in muscle thickness decreased for the vastus lateralis (9.7 ± 2.0% to 4.0%, p = 0.04) and rectus femoris (11.9 ± 7.8 vs. 2.6 ± 3.5%, p = 0.03). Knee extension strength asymmetry decreased from 10.9 ± 2.6% to 5.4 ± 2.7% (p = 0.02). Post-training quadriceps size and strength asymmetry indices were not different from controls (5%, all p > 0.05). **Conclusion:** These results extend upon early post-operative application of exercise with BFR and demonstrate that this modality can also be used to overcome persistent quadriparesis impairments long after knee surgery. Exercise with BFR could serve as a cost-effective home option for improving function after supervised rehabilitation ends. Supported by Blue Cross Blue Shield of Michigan Foundation.

**Body Composition Measures Associate with Physical Performance but not Disability in Individuals with Knee Osteoarthritis**

Hope C. Davis¹, Malia N. Blue¹, Katie R. Hirsch², Brittany A. Luc-Harkey¹, Cara C. Anderson¹, Abbie E. Smith-Ryan, FACSM¹, Brian Pietrosimone, FACSM¹. University of Kentucky, Lexington, KY. (No relevant relationships reported)

Higher body mass index (BMI) is associated with more disability in individuals with knee osteoarthritis (KOAr); however, BMI does not always provide accurate information about body composition, which may be a better predictor of disability in these patients. **Purpose:** Determine the associations between body composition and self-reported disability (Western Ontario and McMaster Universities Osteoarthritis Index [WOMAC] function) and physical performance (20m fast-paced walk, chair-stand, stair-climb) after accounting for BMI in individuals with KOA. **Methods:**

Body mass and height were objectively measured, and percent fat (%FM) and lean mass (%LM) were determined using dual energy x-ray absorptiometry on 47 adults with radiographically defined KOA (Kellgren-Lawrence grade 2-4; 30% male; 60.2 ± 3.3 years; BMI = 29.5 ± 3.8 kg/m²). The WOMAC function subscale, 20m fast-paced walk (WALK), chair-stand (CHAIR), and stair-climb (STAIR) were completed on the same day. Separate linear regression analyses were conducted to determine the unique variance in WOMAC and each physical performance test explained individually by %FM and %LM after accounting for BMI (AR). Regression models accounted for sex and K-L grade, as both have been reported to associate with disability or body composition in individuals with KOA. **Results:** Higher %FM significantly associated with lower body mass (WALK: ΔR² = 0.10, p = 0.03; CHAIR: ΔR² = 0.16, p = 0.01; STAIR: ΔR² = 0.13, p = 0.02). Higher %LM significantly associated with better chair-stand performance but not 20m fast-paced walk or stair-climb tests (WALK: ΔR² = 0.04, p = 0.17; CHAIR: ΔR² = 0.09, p = 0.04; STAIR: ΔR² = 0.08, p = 0.07). Neither %FM (ΔR² = 0.004, p = 0.70) nor %LM (ΔR² = 0.001, p = 0.84) associated with WOMAC after accounting for BMI. BMI did not explain a significant amount of variance in WOMAC or physical performance outcomes (R² range = 0.004 - 0.07, p > 0.05) as part of any regression model.

**Conclusions:** Lower %FM and higher %LM associated with better physical performance but not WOMAC. BMI did not significantly associate with WOMAC or physical performance. Future interventions should seek to increase %LM and decrease %FM, rather than focusing on overall reduction in BMI to improve physical performance. Supported by NIH NIAIM U21AR067560-01.

**Effects of whole body vibration on neuromuscular performance in patients with osteoarthritis of the knee**

Javier H. Carreño, Daniel D. Cohen, Rodrigo Argorthy, Universidad del Rosario, Bogotá, Colombia. (No relevant relationships reported)

**Abstract**

**Background:** The effect of whole body vibration on strength, power and force differences (asymmetries) during the sit to stand (STS) test and isometric strength test assessed with uniaxial force platforms in patients with osteoarthritis of the knee. **Objective:** To evaluate the effects of whole body vibration on neuromuscular performance and asymmetries in lower limbs in patients with or at risk of knee osteoarthritis. **Methods:** Randomized-Controlled trial with 60 subjects (mean age of 48 years ± 14.2) with diagnosis or at risk of knee osteoarthritis (OA) but physically active, were randomly assigned to training program for 12 weeks: with vibration (WVB) and without vibration (CON). The force platforms was used for the strength measurements (Paso sample = 500Hz).

**Results:** The data was analyzed with the software ForeDekks. Statistically significant differences were found for the CON group between Peak Vertical Force (PVF) pre-training: 655N and POST training: 837N (p = 0.00); the rate of force development (RFD) PRE= 935Ns, POST= 1634Ns (p = 0.05), while in the WVB group there was a non-significant increase: PVF (pre-training: 628N and POST training: 685N) (p = 0.20), the RFD (PRE= 599Ns, POST= 645Ns) (p = 0.13). In the WVB group there was a significant decrease of pain according to the Visual Analogue Scale (VAS). Significant differences were found between the groups being much greater in the group CON, in the isometric leg press test in RFD-200Ns (p = 0.03) and relative peak force (P< 0.04).

**Conclusion:** In individuals with knee OA 12 weeks of strength training performed with whole body vibration led to lower neuromuscular performance gains than the same training performed without vibration, however pain intensity decreases at knee, hip and lower back level according to the (VAS).

**Key words:** Resistance training, acceleration training, Osteoarthritis knee, Reflex starle, Muscle strength.

**Does Blood Flow Restricted Training Improve Quadriceps Strength Following an ACL Injury?**

Kathryn Lucas, Darren L. Johnson, Mary L. Ireland, FACSM, Brian Noehren, FACSM. University of Kentucky, Lexington, KY. (Sponsor: Brian Noehren, FACSM)

**No relevant relationships reported**

**Purpose:** Anterior cruciate ligament (ACL) injuries result in significant quadriceps weakness, causing pain and compensations in gait. High resistance strengthening is often not well tolerated after an ACL injury. Blood flow restricted training (BFRT), which uses partial occlusion of blood flow through applied cuffs, may be an effective technique to maximize strength at low intensities. While BFRT has been well
studied in healthy populations, its effectiveness in an injured population has not been established. We hypothesized that a 4-week blood flow restricted quadriceps strengthening protocol will significantly improve quadriceps strength and the limb symmetry index of the quadriceps.

**METHODS:** Nine subjects status-post ACL injury participated in this study. After determining the subjects' preoperative isometric quadriceps strength on a Bioware and their 1 repetition maximum on each piece of exercise equipment, they then performed a 4-week BFRT protocol. Training was performed at 30% of the subject's 1 rep maximum with BFRT optimal pressure determined per manufacturer instructions.

Four quadriceps strengthening exercises were performed at each session. Three sets of 10-30 repetitions were performed for each exercise. At the end of 4 weeks, quadriceps strength was reassessed. A paired t-test was used to compare pre and post intervention quadriceps strength normalized to body weight, and limb symmetry indexes were calculated.

**RESULTS:** Quadriceps strength of the involved side significantly increased (p<0.0001) from 2.24 ± 0.67 Nm/kg to 2.82 ± 0.71 Nm/kg. The limb symmetry index improved from 0.70 pre-BFRT to 0.88 post-BFRT.

**CONCLUSIONS:** A four-week blood flow restricted training protocol significantly increases quadriceps strength in a preoperative ACL reconstruction population. By training at 30% of the individual’s 1RM, the risk of further injury or pain is minimized. Restoring quadriceps strength before surgery may result in a faster recovery and better long term outcomes. Further research should investigate if blood flow restrictive training is appropriate for other injured populations and for postoperative care of patients who have had an ACL reconstruction.

3347 Board #216 June 2 9:30 AM - 11:00 AM
**Effect of Fatigue on The Neuromuscular Transmission of Hamstrings During Eccentric Muscle Action**
Ziwen Pei, Jian Chen, Danyang Li. Wuhan Sports University, Wuhan, China.

(No relevant relationships reported)

Electromechanical delay (EMD) is a key to evaluate the ability of neuromuscular transmission, and fatigue is believed to be associated with altered neuromuscular transmission of hamstrings, which may increase the risk of non-contact anterior cruciate ligament (ACL) injury. However, experiment evidence supporting this relationship is insufficient.

**PURPOSE:** The purpose of this study is to investigate the effect of fatigue on electromechanical delay times of hamstrings during eccentric muscle action.

**METHODS:** Twenty female (20±2 ys) volunteers participated in the study and EMD of semitendinosus (ST), semimembranosus (SM) and biceps femoris (BF) were determined before and after fatigue during eccentric muscle action at 120° and 240°/s. All subjects followed an isokinetic fatigue protocol until flexion torque fell below 50% of initial torque for three consecutive repetitions. A 2×2 ANOVA was used to calculate the effect of fatigue, movement velocity, type of muscle and their interaction on EMD. **RESULTS:** There was no significant difference in the EMD of the 3 muscles examined (BF: 119.0±25.3ms vs. SM: 118.9±24.0ms vs. ST: 12.0±3.249ms, P<0.05), irrespective of fatigue status or movement velocity. Fatigue caused a significant increase on EMD of muscles examined (non-fatigue: 98.4±11.5ms vs. fatigue: 140±13.8ms, P<0.001). Irrespective of fatigue, EMD of the 3 muscles significantly increased with increasing movement velocity (low angular velocity: 107.8±20.9ms vs. high angular velocity: 131.0±22.5ms, P<0.001).

**CONCLUSIONS:** Our findings suggest that fatigue decrease the ability of neuromuscular transmission of hamstrings during eccentric muscle action, irrespective of movement velocity. This would suggest that improving resistance to fatigue of hamstrings may be an effective prevention tool of non-contact ACL injury.

3348 Board #217 June 2 9:30 AM - 11:00 AM
**Differences In The Mitochondrial Capacity Of The Right And Left Biceps Brachii Muscle**
Elizabeth Pryor, Katie Luquire, Kevin McCully, FACSM. University of Georgia, Athens, GA. (Sponsor: Dr. Kevin McCully, FACSM)

(No relevant relationships reported)

**PURPOSE:** Near infrared spectroscopy (NIRS) has been used to measure mitochondrial capacity of various muscles, but not specifically the biceps brachii.

**PURPOSE:** Measure mitochondrial capacity using NIRS in the dominant and non-dominant arms of young healthy adults. **METHODS:** Five untrained subjects (mean age 20.4±0.7 years) were tested in the supine position with a NIRS device (Artinis, Ltd) placed in the middle of the biceps brachii muscle. Electrical stimulation (6 Hz, 25-40 mAmps) was used to activate the muscle. A 5 cm blood pressure cuff was placed proximal to the NIRS device and used for arterial occlusion (225 mmHg). The protocol consisted of 30 seconds of resting metabolism, 30 seconds of post stimulation metabolism, three minutes of ischemia followed by perrefusion to measure the rate of reoxygenation, and two mitochondrial capacity tests. The mitochondrial capacity test consisted of electrical stimulation followed by a series of 22 ischemic cuffs lasting from 5-10 seconds, each allowing muscle reoxygenation. **RESULTS:** There was no difference in mitochondrial capacity between the dominant and non-dominant arms of the untrained subjects. **CONCLUSIONS:** The biceps brachii muscle had mitochondrial capacity values similar to the forearm values from previous studies, and slower than values for the gastrocnemius and quadriceps muscles. We found no evidence for differences between the dominant versus non-dominant biceps brachii muscles. Supported in part by CURU Assistantship.

3349 Board #218 June 2 9:30 AM - 11:00 AM
**Impact of Discipline and Gender on Hamstring and Quadriceps Strength in Elite Alpine Skiers**
Marie Alhammoud1, Baptiste Morel2, Regis Mecca3, Erick Naël4, Marie-Philippe Rousseaux-Blanchi5, Christophe Hautier6, 1French Ski Federation, Annecy, France. 2Le Mans University, Le Mans, France. 3Ski and Snowboard National training Centre (CNSS), Albertville, France. 4Physiotherapy Center of Seynod, Annecy, France. 5High Level Sport Medicine Center, Hospital of Albertville-Moûtiers, Albertville, France. 6University Claude Bernard Lyon 1, Villeurbanne, France. (Sponsor: Lee Taylor, FACSM)

(No relevant relationships reported)

PURPOSE: Examine the influence of discipline and gender on hamstring and quadriceps strength of elite alpine skiers. **METHODS:** Twenty-eight French national team skiers (14 male) underwent ischemic dynamometry evaluation. Skiers were split by discipline into technical (Slalom and Giant Slalom, GpT, n=14) or speed (Super Giant and Downhill, GpS, n=14). Maximal conventional ratios (i.e. concentric) at 60°.s⁻¹ and 180°.s⁻¹ and maximal functional ratios at 60°.s⁻¹ and 90°.s⁻¹ were calculated for Hamstring-to-Quadriceps (HQ) ratio, together with isoangular HQ ratios between 30° and 90° (0° representing full extension). **RESULTS:** No gender difference in HQ peak torque ratios was apparent, yet females demonstrated a delayed quadriceps Angle of Maximal Torque (AMT). Statistic parametric mapping demonstrated lower hamstring torque and a low HQ ratio near full knee extension in female skiers regardless of velocity. A greater hamstring AMT in GpT skiers compared to GpS was observed, along with greater dynamic quadriceps strength after 72° of knee flexion in GpT skiers.

**CONCLUSION:** Discipline and gender both influence the HQ strength profile of elite alpine skiers, which are further modified according to the joint angle and angular velocity employed. The data provide normative values based on gender and discipline which may be of use during pre-season isokinetic screening, which is common in practice and often used to inform subsequent knee injury prevention interventions.

3350 Board #219 June 2 9:30 AM - 11:00 AM
**EMG Analysis of Lower Limb Muscle Activation During 6-Minute Treadmill Walking Following Novel Over-Ground Locomotor Training in Incomplete Spinal Cord Injury**
Donal Murray, Andrew A. Guccione, Kerry J. Bollen, Brian T. Neville, Caitlin A. Bryson, Randall E. Keyser, FACSM. George Mason University, Fairfax, VA. (Sponsor: Randall E. Keyser, FACSM)

(No relevant relationships reported)

Physiological impairments in incomplete spinal cord injury (SCI) can include muscle weakness and altered skeletal muscle activation. Reduced voluntary muscle activation in SCI can cause inadequate fibre recruitment and in turn the muscle may undergo adverse morphological adaptations.

**PURPOSE:** The study aimed to characterize the level of lower limb muscle activation using surface electromyography (EMG) during 6 minutes of treadmill walking in SCI following 12 weeks of a novel overground locomotor training (OLT) program.

**METHODS:** A convenience sample of 3 individuals with SCI (Age: 39±15.5 years, AIS C or D, 6+months post-SCI) completed 12 weeks of OLT, which consisted of two 90-minute sessions per week. The principles of OLT included the motor learning concepts of task specificity, practice variability and progressive overload. Sessions were broken down into 5 segments: joint mobilization, motor activation, task isolation, task integration and task rehearsal. Each session catered to a specific component of the gait cycle. Pre- and post-assessment included 6 minutes of treadmill walking, performed at participant’s self-selected speed (0.5-1.4mph). Two sets of bipolar electrodes were placed on the muscle belly of the left lateral gastrocnemius (GA), left tibialis anterior (TA) and left bicep femoris (BF). EMG data was continuously collected over the 6 minutes. The root mean square (RMS) and peak activation of EMG during the last 10 seconds of minute 1, 3 and 6 were calculated using Matlab programming code. The values for each minute were normalized to the RMS
and peak value of the first 10 seconds of the walking bout. Cohen’s d was calculated to determine effect size (ES) of EMG signal pre- and post-OLT, as well as comparing minute 1 to minute 6 of walking.

RESULTS: Following OLT the RMS during minute 6 of the GA and BF increased, difference of 37.52mV with strong ES >0.8. Comparing pre-OLT minute 1 to minute 6 shows a trend of reduced activity in the GA, TA and BF (A: -9.11mV, A: -8.11mV, A: -28.17mV; ES: <0.63, ES: <0.68 ES: <0.75), yet post-OLT the trend is positive (A: <48.72mV; A: 71.2±16.3 years; ES: 0.74-0.83; ES: 0.51-0.64). CONCLUSIONS: Higher RMS of the EMG during minute 6 of the walking trail could indicate greater activation of measured muscles in SCI following OLT.

The purposes often suffer from impairments of their lower limbs and disability of locomotion. Quadriceps femoris (QF) is one of the key muscles contributing to locomotor functions and it has been established that QF quantity is associated with locomotor functions in disabled patients. Muscle quality is defined as ratio of adipose tissue to muscle tissue. QF quality of patients could become worse by increased ratio of adipose tissue to muscle tissue. As far as we know, there were no studies showing that QF quality has a relationship with locomotor functions in disabled patients.

PURPOSE: The purpose of this study was to assess the relationships between QF quality and locomotor functions in disabled patients. METHODS: Fourteen hospitalized patients (11 patients with stroke and 3 patients with lower extremity fractures; age, 71.2±16.3 years; height, 157.1±9.6 cm; weight, 55.2±14.7 kg; body mass index, 22.1±3.7 kg/m^2) participated in this study. The QF muscle quality based on echo intensity and muscle thickness as an index of muscle quantity at the mid-thigh were assessed using ultrasonography. Timed up and go (TUG) test, berg balance test, there was a significant decrease in the glucose AUC during the electrically induced exercise session for people with a SCI (7,763.3±670.0 (STIM) and 8,904±4,039 (CTL) p<0.003), but no difference for people without SCI (5,205±2,487 (STIM) and 5,500±2,355 (CTL), p<0.58). Significantly less insulin was needed during the exercise as compared to the control session (124.1±34.4 and 190.2±40.8, p<0.013). Conclusions: A dose of low frequency electrically induced muscle exercise attenuated the severely glycemic response in people with SCI after a meal. These findings offer a unique strategy for people who are paralyzed to improve their glucose tolerance after a meal. Supported by NIH Grants R01HD084645 and R01HD082109

Exercise as a form of medicine attenuates the development of chronic non-communicable diseases (CNCDs) in people with intact nervous systems as they age. However, there is a knowledge gap regarding the influence of electrically induced skeletal muscle exercise on CNCDs in people with spinal cord injury (SCI). Gene signaling pathway analysis offers an opportunity to understand the long term effects of electrically induced exercise on people with chronic and complete paralysis from SCI, providing a basis for interventions to be studied in future clinical trials. PURPOSE: To determine if long term electrically induced skeletal muscle exercise regulates complex network signaling pathways associated with improved health in people with SCI. METHODS: 17 males with a complete SCI participated in this study. Participants completed 3, 6, or 12 months of a unilateral exercise training program using electrical muscle stimulation. After exercise training, participants underwent muscle biopsies of the trained and untrained limbs. RNA was extracted and hybridized to an exon microarray. Resulting gene expression signals were analyzed using a gene set enrichment analysis and applied to a network connectivity map. RESULTS: We analyzed over 17,000 genes and 1,900 genes curated from the Reactome database. We found that the genesets significantly increased (<25% FDR; p<0.05) depended on the duration of training. Of the 242 genesets upregulated in the trained limb at 3, 6, and 12 months of training. Of the 242 genesets upregulated in the trained limbs at 12 months, 21% were directly associated with hyper trophy and metabolism/oxidative phosphorylation. Among the genes with the highest expression levels in trained muscles were MYH7b(4.87±3.6) and MYH6b(2.56±3.11), while MSTMN(0.66±0.31) and ACTN3(0.68±0.53) were among those genes with the greatest suppression in the trained limbs. Conclusions: Overall health is dependent, in part, on skeletal muscle size and metabolic capacity, 6 months of chronic electrically induced exercise was sufficient to reverse hypertrophy gene pathways and improve metabolic signaling to a more oxidative state. Future studies are underway to ascertain if electrically induced exercise attenuates the development of CNCDs in people with SCI. Supported by NIH Grants R01HD084645 and R01HD082109

Regular exercise is an important strategy to prevent the development of several chronic non-communicable diseases (CNCDs), including metabolic inflexibility and diabetes. Skeletal muscle increases glucose uptake through two distinct pathways: Insulin receptor sensitivity pathway and the exercise induced AMPK pathway. Because people with paralysis are unable to move, they never reap the benefits of muscle exercise/activity following a meal. PURPOSE: To determine if electrically induced exercise regulates the glycemic response after an oral glucose load in people with and without a SCI. METHODS: 8 and 14 people with and without a SCI participated in this study. Participants completed 2 sessions of a 2 hour oral glucose tolerance test at least 7 days apart. 15 minutes after ingesting 75g glucose beverage, participants sat passively (control) or were given a dose of electrically induced muscle stimulation delivered at a 3Hz frequency for 1-hour, then rested for the next hour. Glucose and insulin were measured from venous blood draws at baseline and 120 minutes. Capillary glucose measurements were performed at baseline, 30, 60, 90, and 120 minutes. A mixed design analysis of variance was used for all comparisons with pairwise comparisons where appropriate. Results: At baseline, neither glucose (85.5±9.4 and 93.1±6.8 mg/dL, p=0.62) or insulin (13.2±8.8 and 7.8±4.1 μIU/mL, p=0.84) was significantly higher for people with a SCI compared to those without. During the oral glucose tolerance test, there was a significant decrease in glucose AUC during the electrically induced exercise session for people with a SCI (7,763.3±670.0 (STIM) and 8,904±4,039 (CTL) p<0.003), but no difference for people without SCI (5,205±2,487 (STIM) and 5,500±2,355 (CTL), p<0.58). Significantly less insulin was needed during the exercise as compared to the control session (124.1±34.4 and 190.2±40.8, p<0.013). Conclusions: A dose of low frequency electrically induced muscle exercise attenuated the severely glycemic response in people with SCI after a meal. These findings offer a unique strategy for people who are paralyzed to improve their glucose tolerance after a meal.
increase in vertical accelerations. The divergence between actual EE and accelerometer based estimates of EE may contribute to erroneous inferences concerning free-living physical activity.

3355 Board #224 June 2 9:30 AM - 11:00 AM The Test-retest Reliability And Exercise-driven Changes Of UCH-L1 In Healthy, Recreationally Active College Students

Grant H. Cabell1, Elizabeth F. Teel2, Erik D. Hanson3, Jason P. Mihalik1, Kevin M. Gusiewicz, FACSM1. 1University of North Carolina at Chapel Hill, Chapel Hill, NC; 2McGill University, Montreal, QC, Canada.

Concussions are common in sports, yet remain difficult to diagnose since truly objective assessments are lacking. Test-retest reliability studies are crucial to solving this problem. A biomarker must be sensitive and specific to head injury before it can be further studied as a clinically useful diagnostic for sport-related concussion (SRC).

PURPOSE: To investigate the test-retest reliability and acute exercise effect on a novel head injury biomarker, Ubiquitin C-Terminal Hydrolase-L1 (UCH-L1) in healthy subjects such that findings could assist with interpretation of findings in acutely injured athletes. METHODS: Recreationally active (>30 min activity 3 days/week) college students (n=27, males=14, age=21±2.3 yrs) completed a maximal cycle ergometer exercise test (10-14 min) while wearing the electrode assembly. Blood samples were collected within 10 minutes before and after each test. UCH-L1 values were determined through sandwich enzyme linked immunosorbent assays (ELISA) run in triplicate. Intraclass correlation coefficients (ICC) and 80% reliable change indices (RCI) examined the test-retest reliability of UCH-L1. A 2 (sex) x 2 (pre/post) ANOVA characterized the acute exercise effect on UCH-L1 at rest. RESULTS: UCH-L1 was moderately reliable in the entire cohort (ICC=.505, 80% RCI=107.0 pg/ml). Males had excellent reliability (ICC=.698, 80% RCI=44.4 pg/ml), while females had poor reliability (ICC=.094, 80% RCI=138.8 pg/ml). No significant effects of acute exercise (F1,26=0.002, p=0.966), sex (F1,26=0.981, p=0.357), or sex by exercise interaction (F1,26=1.108, p=0.303) on UCH-L1 values were found. CONCLUSIONS: UCH-L1 may have potential to be clinically useful in males. The high reliability and negligible effect of exercise suggest the biomarker remains stable in healthy males and is unaffected by acute exercise. Thus, changes may be attributed to external factors known to affect the biomarker such as head trauma. Conversely, the low reliability and wide RCI suggests UCH-L1 use in females should be limited.

Further investigation of sex differences in reliability of UCH-L1 and feasible methods of sideline biomarker analysis are needed in hopes of improving SRC detection and identification.

3356 Board #225 June 2 9:30 AM - 11:00 AM Effects of Body Position and Electrode Type on the Reliability of Bioimpedance Spectroscopy

Michael Lane1, Lee A. Doernte2, April M. Spears3, Ryan M. Bean1, Jordan R. Moon1, Eastern Kentucky University, Richmond, KY. 1Impedimed, Inc., Carlsbad, CA.

PURPOSE: To compare multiple BIS measurements taken using the traditional approach (gel-backed wet electrodes and subject supine) to BIS measurements taken when subjects are standing or seated using fixed metal electrodes and determine the reliability of each method. METHODS: Twenty-five subjects (n=10/f=15) participated in the study (22 +/- 3 years, 171.5 +/- 12.0 cm, 70.9 +/- 13.6 kg). Four (whole body right side) measurements each were taken for sitting with metal electrodes (SiM), standing with metal electrodes (SiM), and supine with gel-backed electrodes (SuG). Data was analyzed comparing the two back-to-back measurements both before and after repositioning as well as measurements taken before repositioning to measurements taken after repositioning (pre-to-post). RESULTS: Both back-to-back and pre-to-post analysis revealed all methods to be highly reliable (ICC > 0.98, %CV < 2.32). Back-to-back measurements resulted in more reliable RO and Rinf data compared to pre-to-post repositioning data for SiM, SiM, and SuG (ICC > 0.995, %CV < 0.87, SEM = 0.672 Ohms), compared to pre-to-post data for SiM, SiM, and SuG (ICC > 0.987, %CV < 2.32, SEM = 13.33 Ohms). SuG produced the most reliable back-to-back measurements (SuG: ICC = 1.00, %CV < 0.34, SEM = 1.48 Ohms, SiM/SiM: ICC > 0.995, %CV < 0.97, SEM = 0.672 Ohms) but had the largest reliability errors from pre-to-post compared to SiM and SiM (ICC < 0.986, %CV < 2.32, SEM = 13.33 Ohms, SiM/SiM: ICC > 0.991, %CV < 1.51, SEM = 10.29 Ohms). Similar results were observed when comparing SiM to SiM for both back-to-back and pre-to-post measurements. CONCLUSIONS: Siting with metal electrodes, standing with metal electrodes, and lying supine with gel-backed electrodes all appear to produce reliable and repeatable BIS measurements (RO and Rinf). Gel-backed electrodes appear to produce greater variability when measurements are taken after re-applying the electrodes compared to repositioning. Yet, back-to-back measurements have slightly greater variability with metal electrodes compared to gel-backed electrodes. BIS measurements that require tracking of changes over time appear to be more reliable when using metal electrodes over gel-backed electrodes.

3357 Board #226 June 2 9:30 AM - 11:00 AM Pulmonary Testing and Exercise-Induced Bronchoconstriction in Collegiate Baseball Players

Matthew J. Garver1, Molly A. Jennings1, Dustin W. Davis, Brian J. Hughes,2 Steve Burns,3 Taylor K. Dinyer2, Alex Rickard2, Justin L. Colf1, Jenna L. Carducci1, Anna L. Blazer1, Laura A. Wilson1, Dave M. Burnett2. 1University of Central Missouri, Warrensburg, MO; 2University of Kentucky, Lexington, KY; 3University of Kansas Medical Center, Kansas City, KS.

Testing for pulmonary conditions such as asthma and exercise-induced bronchoconstriction (EIB) is often overlooked in collegiate athletes, despite the fact that they may have profound effects on performance and health. Asthma is a chronic condition, while EIB is a transient narrowing of the airways activated by strenuous exercise. PURPOSE: The purpose of this analysis was to investigate the prevalence of asthma, undiagnosed asthma, and EIB in collegiate baseball players. METHODS: Participants with asthma were noted and removed from the EIB provocation protocol. The protocol commenced with maximal forced spirometry. Participants were encouraged to achieve a six-second plateau, and spirometry values were collected in duplicate. Participants failing to achieve a baseline forced expiratory volume (FEV1) of at least 70% of the predicted value were removed from ongoing testing. Those passing the baseline spirometry screening proceeded to a single bout of exercise on a treadmill. In stepped fashion, participants progressed to an intensity matching 80-90% of age-predicted maximal heart rate. Exercise intensity was confirmed with ventilation (35*FEV1*0.5 and 35*FEV1*0.6). Participants maintained target intensity for four minutes. Immediately post-exercise, participants resumed a seated position. Maximal forced spirometry efforts were repeated at 2, 5, 10, 15, and 20-min time points. A fall in FEV1 >10% from baseline was considered positive for EIB. RESULTS: Thirty athletes (age: 20.3±1.9 yr, height: 184.2±6.4 cm, and weight 86.5±8.8 kg) volunteered for testing. One (3.3%) had been previously diagnosed with asthma. At baseline, two participants (6.67%) failed to obtain 70% of predicted FEV1 values (labeled as potentially undiagnosed asthma and removed from ongoing testing). A total of 27 participants completed the EIB provocation protocol. Five (16.7% of cohort) failed to obtain 90% of their pre-exercise FEV1 value (an indication of EIB) at one of the post-test time points. The mean drop among those failing was 30.5% with all values being reviewed by a registered respiratory therapist. CONCLUSIONS: The prevalence of pulmonary conditions in athletes may be masked by a lack of testing. It would seem prudent to test athletes for these conditions and create treatment plans.

3358 Board #227 June 2 9:30 AM - 11:00 AM Decreased Aerobic Efficiency in Pediatric and Young Patients with Sickle Cell Disease : Race Comparison

Sandra K. Glete, Wayne A. Aysz, Mallaree C. Rice, Andrea L. Grzeszczak, Adam W. Powell, Clifford Chin, Punam Malik, Tarek Alsaied. Cincinnati Children’s Hospital, Cincinnati, OH. (No relevant relationships reported)

PURPOSE: To compare the differences in aerobic efficiency between pediatric and young Sickle Cell patients (SS) and African American (NAA) and Caucasian (NC) controls. METHODS: We evaluated 14 SS patients, NAA and NC age, gender, and size matched using a Ramp-Cycle Ergometry protocol. Oxygen consumption (absolute and indexed), carbon dioxide production, expiratory minute volume (VE), respiratory exchange ratio (RER), systolic blood pressure (SBP) and heart rate (HR) were obtained at all stages. The VE/VO2 (VO2Eq) and VE/VCO2 (VCO2Eq) equivalents, oxygen consumption uptake efficiency slope (OUES), VE/VCO2 slope (Slope) and oxygen pulse (O2Pulse) were calculated at anaerobic threshold (AT) and maximal exercise (Max). RESULTS: There was no difference in SBP between SS, NAA and NC groups. Max RER was significantly elevated in SS. Indexed Max oxygen consumption (IMVO2) was significantly deceased in SS. O2Pulse and OUES were significantly decreased in SS at AT and Max. Slope, VO2Eq and VCO2Eq at Max were significantly elevated in SS. The HR at AT was significantly elevated in NAA compared to SS at AT.
G-48  
Free Communication/Poster - Exercise-Children  
Saturday, June 2, 2018, 7:30 AM - 11:00 AM  
Room: CC-Hall B

We measure peak oxygen consumption (VO2peak) in children with severe burns via indirect calorimetry. When we can’t measure VO2peak, we estimate it using the Cooper equation (CEq). In addition, a pharmacological agent sometimes used in burns via indirect calorimetry. When we can’t measure VO2peak, we estimate it using the Cooper equation (CEq). In addition, a pharmacological agent sometimes used in burns

**PURPOSE:** It is unknown, how propranolol affects the prediction of VO2peak using CEq. Therefore, we compare predictive and measured VO2peak and metabolic equivalents (METS) in children with severe burns.

**METHODS:** Children with severe burns were randomly assigned to receive propranolol or no drug during their hospital stay. At discharge, patients underwent a treadmill exercise test using the Bruce protocol. VO2peak and METS were measured and compared to predicted values using CEq (male: VO2peak = (43.6 x height (cm) - 4547.1)/weight (kg)); female: VO2peak = (22.5 x height (cm) - 1837.8)/weight (kg)). Values are means ± SD.

**RESULTS:** We studied 99 children with burns with admit dates between March 1990 and November 2015; with 46 children receiving propranolol and 53 receiving no drug. Mean age at burn was 12±3 years in the propranolol group and 12±3 years in the control group (p = 0.512). Height was 150±18 cm and 148±17 cm (p = 0.571); total body surface area burned was 44±12 % and 49±12 %, respectively (p = 0.072). Measured VO2peak (25.1 ± 5.6 mL/min/kg vs. 22.1 ± 4.9 mL/min/kg, p = 0.005) and METS (7.2 ± 6.3 vs. 6.3 ± 1.4, p = 0.004) were significantly higher in the propranolol group. However, the actual values were lower than the predicted values, with the propranolol group being closer to predicted values (R2=0.24; R2 control: 0.13).

**CONCLUSIONS:** This study indicates that patients receiving propranolol can achieve higher VO2peak and METS at discharge. However, estimated VO2peak and METS using CEq may need to be re-evaluated considering additional factors such as age, gender and body mass index.

This study was supported in part by: The National Institute on Disability, Independent Living, and Rehabilitation Research 90DPBU0003; 90DP0004; the National Institutes of Health R01-HD49071, P50-GM060338, T32-GM8258; the Department of Defense W81XWH-09-2-0194, W81XWH-14-2-0160; and Shriners Hospitals 84080. The content is solely the responsibility of the authors and does not necessarily represent the official views of these agencies.

3360  Board #229  
June 2 9:30 AM - 11:00 AM  
Correlation Between Self-reported Physical Activity And Objective Measurement In Children With Cardiac Disease  
(No relevant relationships reported)

Children with significant cardiac disease (SCD) have lower levels of physical activity compared to population norms. Few studies have compared objective measures of physical activity (O-PA) to subjective measures of physical activity (S-PA) in children and adolescents with and without SCD.

**PURPOSE:** To examine the relationship between S-PA and O-PA in children and adolescents with and without SCD.

**METHODS:** Children and adolescents with SCD (n=22; 70% single ventricle physiology, 12% pulmonary hypertension, 27% heart failure) and age and gender matched healthy controls were recruited (Total n=56; mean age 12± 2.6 years old; 39.3% female). All subjects wore a tri-axial accelerometer over their non-dominant hip for 7 days. The Everson cutpoints for moderate-to-vigorous PA (MVPA) were applied. A minimum of 3 days with 10 hours of wear time was necessary to be included in the analysis (1 subject excluded due to inadequate wear time). Past year S-PA, in hours/week and MET hours/week, was assessed using the interviewer administered Modifiable Activity Questionnaire for Children or Adolescents (MAQ-C or MAQ-A, respectively). Past 7-day physical activity was assessed with the Physical Activity Questionnaire for Children or Adolescents (PAQ-C or PAQ-A, respectively). Relationships between the MAQ-C/A, PAQ-C/A, and the accelerometer results were assessed using Partial correlations controlled for accelerometer wear time. **RESULTS:** Significant positive relationships were found between the self-reported PAQ-C/A and O-PA in SCD with all intensities of PA (Sedentary r=−0.516, p<0.004; Light r=0.552, p=0.002; Moderate r=0.615, p=0.001; Vigorous r=0.368, p=0.046; MVPA r=0.598, p=0.001). Significant positive relationships were also found between the PAQ-C/A and O-PA in the control group with moderate PA (r=0.503; p=0.024) and MVPA (r=0.493; p=0.027). In the SCD group, there were no significant relationships of O-PA with MAQ hours/week or MAQ MET hours/week. In the control group, youth had significant positive relationships in sedentary PA and MAQ hours/week (r=−0.435, p=0.049) and MAQ MET hours/week (r=−0.450, p=0.041). **CONCLUSIONS:** The self-reported PAQ-C/A had the strongest relationship with O-PA in the SCD group. The PAQ-C/A may be a reliable tool to assess PA in children and adolescents with SCD.
Obesity is a widespread issue that affects people regardless of age, socioeconomic status, culture, or ethnicity. This issue is commonly associated with metabolic risk factors, inherited genes and family history, as well as unhealthy behavior such as tobacco or alcohol use. Furthermore, obesity is one of the main causes of early manifestation of chronic diseases, which account for about 70% of yearly mortality indexes worldwide. Insulin resistance (IR) is a key element in the chain of events that lead from obesity to chronicity. Therefore, insulin resistance markers in high-risk individuals must be under constant screening. The Homeostatic Model Assessment (HOMA) constitutes a reliable indirect method for detecting initial signs of IR presence; however, it requires the use of instruments not always available in areas of low income, where accessibility to medical equipment is limited. For this reason, finding reliable, external predictors of IR may be useful to trigger prompt interventions, or to prevent IR rise, while avoiding the need of special tools.

**PURPOSE:** To evaluate a predictive model of IR in adolescents with obesity.

**METHODS:** Blood samples, anthropometric information, and family history were collected from a sample of 216 obese adolescents, patients at the Children Hospital of the State of Sonora, Mexico. Hierarchical Regressions were performed to establish the predictive power of the parameters of the Metabolic Syndrome, hereditary and family history, as well as of Acanthosis Nigricans. HOMA indexes were calculated by fasting glucose and insulin. RESULTS. After controlling age and gender, HOMA was significantly predicted through a model (F = 12.035, R² = .371, p < .001) that included only Acanthosis Nigricans (β = .142, p = .019). CONCLUSIONS: Acanthosis Nigricans, which can be easily detected through skin exams, may represent an early indicator of risk of high HOMA, and consequently it can be used as a powerful and relatively easy assessment tool for conditions of insulin resistance in patients with obesity.

**3362 Board #231**

June 2 9:30 AM - 11:00 AM

**Predictors Of Insulin Resistance In Obese Adolescents**

Armando Coca, Michaela Coca, Grethel Ramirez Siqueiros, Oswaldo Ceballos Gurrola, 1 Texas AM&University San Antonio, San Antonio, TX. 2 State University of Sonora, Hermosillo, Mexico. 3 Autonomous University of Nuevo Leon, Monterrey, Mexico.

(No relevant relationships reported)

Post 35.2 ± 2.2) and object control (pre 27.0 ± 2.0, post 35.5 ± 2.2), while the control group showed minimal changes. The associated effect sizes (Cohen’s d = 1.2 and 1.3, respectively) indicated a large effect on FMS. The programs improved cardiovascular fitness (5.9% decline in Delhi HR) with an effect size commensurate with that reported for asthmatic children completing exercise training (d = 0.5). There were no significant changes in perceived competence and HR-QoL. **CONCLUSION:** A 7-week movement program increases FMS proficiency in children with non-CP bronchiectasis and has a moderate positive effect on cardiovascular fitness.

**3364 Board #233**

June 2 9:30 AM - 11:00 AM

**BMI versus Body Composition as Measures of Success in a Clinical Pediatric Weight Management Program**

Amanda Gier, Philip Khoury, Shelley Kirk, Christopher Kist, Robert Siegel. Cincinnati Children’s Hospital Medical Center, Cincinnati, OH.

(No relevant relationships reported)

PURPOSE: To determine the proportion of patients that achieve favorable changes in body composition in the absence of improvements in body mass index. METHODS: Data from 52 months of clinical visits to a pediatric weight management program were extracted from electronic medical records. Body mass index (BMI) and body composition measurements were collected during clinical care. Height and weight were used to calculate BMI. BMI percentile (BMI%ile) for age and gender was determined. Bioelectrical impedance analyzers were used to measure body fat percentage (BF%). Data were analyzed to determine what proportion of patients had a favorable decrease in BF% despite an unchanged or increased BMI. RESULTS: Data were obtained for 1741 patients (943 females, 798 males), ages 4-21 years old, with at least two clinical visits. Initial age (±SD) was 12.2 ± 3.1 years. Initial BMI was 32.8 ± 7.0 kg/m². Initial BMI%ile was 98.6 ± 1.7. Initial BF% was 44.0 ± 6.4%. At follow-up, BMI increased or remained unchanged in 1148 patients (66%). BF% decreased in 298 patients (53%). There was an overall increase in BMI (1.20 ± 3.03 kg/m², p < 0.0001). However, BMI%ile and BF% decreased (0.31 ± 1.73, p < 0.0001 and 0.66 ± 3.94%, p < 0.0001). In patients whose BMI increased or remained unchanged, overall BMI%ile and BF% increased (0.15 ± 0.89, p < 0.0001 and 0.53 ± 3.15%, p < 0.0001). In males, the increase in BF% was small (1.99 ± 0.06%, p < 0.0001). Of the 779 patients whose BMI increased by 1.0 kg/m² or more, 239 (30.1%) had a decrease in BF%. CONCLUSION: Results suggest that including body fat percentage as a measure of success may be beneficial in a pediatric clinical weight management program. While patients with stable or increasing BMIs did not improve body composition overall, males demonstrated stabilized body fat percentages. In addition, of those patients whose BMI increased by 1.0 kg/m² or more, 30% still demonstrated an improvement in body composition. While this may not be clinically significant for the patient population as a whole, it is a measure of success for a specific subset of patients who otherwise may believe they had done poorly. This may act as a motivator for patients to continue with healthier lifestyle changes. Future research in this area may include examining age cut-offs and gender differences for the usefulness of body composition assessment.

**3365 Board #234**

June 2 9:30 AM - 11:00 AM

**Enhanced Erythrocyte Antioxidant Status Following an 8-Week Aerobic Exercise Training Program in Heavy Drinkers**

Athanasios Z. Jamaltsis, Kalliopi Georgakoulí, Eirini Manthou, Panagiotis Georgoulis, Chariklia Deli, Yiannis Koutedakis, Ioannis Fatouros. 1 University Of Thessaly, Department Of Physical Education & Sport Science, Trikala, Greece. 2 University Of Thessaly, Department Of Nuclear Medicine, Trikala, Greece.

(No relevant relationships reported)

Alcohol-induced oxidative stress is involved in the development and progression of various pathological conditions and diseases whereas exercise training has been shown to improve redox status, thus attenuating oxidative stress-associated disease processes. **PURPOSE:** To evaluate the effect of an exercise training program on blood redox status in heavy drinkers. METHODS: Eleven sedentary, heavy drinking men participated in an intervention where they completed an 8-week supervised aerobic training program of moderate intensity. Blood samples were collected before, during (week 4) and after intervention and analyzed for total antioxidant capacity (TAC), thiobarbituric acid reactive substances (TBARS), and uric acid (UA). TAC, TBARS, and uric acid (UA) were determined using standard methods. **RESULTS:** Total antioxidant capacity increased by 12.2 ± 16.0 µmol/g Hb after 8 weeks of intervention compared to week 4 (299.5 ± 187.7 µmol/g Hb). Uric acid increased by 8 weeks of intervention (1.22 ± 0.16 µmol/g Hb) compared to the control condition (1.11 ± 0.15 µmol/g Hb) and to week 4 (1.11 ± 0.15 µmol/g Hb). TAC, UA, bilirubin, TBARS and catalase activity. **CONCLUSION:** Catalase activity increased by (p < 0.05) after 8 weeks (340.7 ± 13.3 µmol/g Hb) of intervention compared to week 4 (299.5 ± 187.7 µmol/g Hb). GSH increased (p < 0.05) after 8 weeks of intervention (1.22 ± 0.16 µmol/g Hb) compared to the control condition (1.11 ± 0.15 µmol/g Hb) and to week 4 (1.11 ± 0.15 µmol/g Hb). TAC, UA, bilirubin, TBARS and PC did not significantly change at any time point. **CONCLUSION:** An 8-week aerobic exercise training program improves redox status in heavy drinkers.

Abstracts were prepared by the authors and printed as submitted.
training program enhanced erythrocyte antioxidant status in heavy drinkers, indicating that aerobic training may attenuate pathological processes caused by alcohol-induced oxidative stress.

G-48b Free Communication/Poster - Late-Breaking Abstracts
Saturday, June 2, 2018, 7:30 AM - 11:00 AM
Room: CC-Hall B

Background: An age related loss of muscle mass is frequent among older adults, a phenomenon termed sarcopenia. In order to circumvent this age related phenomenon, nutritional strategies of increased protein intake has been proposed, however studies investigating the effect of long-term habituation to divergent protein intakes are scarce. In this study we wish to examine if divergent levels of protein intake, is reflected in postprandial whole body protein kinetics in older male subjects.

Method: 12 male subjects ages 65-70 were included in a double blinded cross-over design. Subjects were metabolic challenged and possibly amino acid deprived.

Results: The absorption rate of PHE from casein protein was elevated in the late postprandial period after being habituated to low protein intake (interaction: P=0.01, F=3.3, P<0.05). SLC3A9 responded to whey-protein feeding with a greater mRNA-expression at 0.5h post-feeding compared to post-absorptive state and 2h post-feeding (P<0.05).

Conclusions: In contrary to our hypothesis, no difference was seen between WT and APOE-/- mice in the post-prandial period. MPS rates are known to be influenced by different types of protein on MPS is unclear and has not been evaluated following concurrent exercise.

PURPOSE: The objective of this study was to determine the capacity of total milk protein (MILK), whey (WHEY), micellar casein (CASEIN), and soy protein, without (SOY) and with additional leucine (SOY+LEU) to support postprandial myofibrillar protein synthesis (MyoPS) following concurrent exercise.

METHODS: 72 young recreationally active males participated in this parallel group, double-blind, randomized controlled trial consisting of two arms. In arm #1, 48 subjects (23±0.3 y) ingested 45 g of carbohydrate with either 0 g protein (CHO), or 20 g MILK, WHEY, or CASEIN protein. In arm #2, 36 subjects (23±0.5 y) ingested 45 g of carbohydrate with 20 g WHEY, SOY, or SOY+LEU. A primed continuous infusion of L-[ring-13C6]-phenylalanine with blood and muscle biopsies was applied to evaluate postprandial MyoPS over 360 minutes after exercise. RESULTS: In arm #1, MyoPS did not differ between treatments (P=0.12) during the post-prandial period after exercise (FSR: CHO=-0.051±0.003; MILK=0.061±0.003; WHEY=0.056±0.002; CASEIN=0.062±0.005 %/h). When MILK, WHEY, and CASEIN were collapsed into a single group (PROTEIN), protein-carbohydrate co-ingestion resulted in greater MyoPS rates than carbohydrate alone (FSR: PROTEIN=0.060±0.002; CHO=0.051±0.003 %/h; P=0.042). In arm #2 MyoPS did not differ between treatments (P=0.85) after exercise (FSR: WHEY=0.056±0.002; SOY=0.056±0.004; SOY+LEU=0.058±0.004 %/h). CONCLUSION: Total milk protein, whey, and micellar casein (arm #1) do not differ in their capacity to support postprandial MyoPS rates when co-ingested with carbohydrate following concurrent exercise in young males. Similarly, whey and soy protein, irrespective of leucine enrichment of soy (arm #2), do not differ in their capacity to support postprandial MyoPS after concurrent exercise. Co-ingestion of protein with carbohydrate results in greater postprandial MyoPS rates than carbohydrate alone, and may therefore represent a nutritional strategy to support skeletal muscle remodeling following concurrent exercise.
intervention study. Subjects were randomly assigned to consume each morning in a double-blind manner either a WP supplement (WP: 0.33 g/kg; n = 8) or an isocaloric, isonitrogenous, non-essential amino acid control (CON: 0.33 g/kg n = 8) with a timed and standardised diet (35 kcal/kg/day; 2 g/kg/day protein). Peak isotopic square force (ISQ) and countermovement jump displacement (CMJ) were used to assess baseline contractile function. Subjects then completed three RT bouts (0.7 IMR back squat; 10 repetitions per set; 0.25 duty cycle; point of exhaustion = 8 [2 sets], every other day. Other activities during training did not influence these measurements. The measurement of ISQ, CMJ, muscle pain and serum creatine kinase (CK) activity (an index of muscle damage) was taken pre-RT, +24h and +48h post-RT, each bout. Muscle protein FSR was measured between muscle biopsies taken from the vastus lateralis pre- and 5 h post- the first RT intervention using the De(2)O stable isotope tracer technique. The observed changes are reported as the mean [low, high] 90% CI, p-value (P).

RESULTS: A 1 [0.7, 1.3] fold increase (P < 0.008) in CK and muscle pain (20 [10, 30] %; P = 0.01) was observed +24h the first RT bout only, confirming an absence of overt muscle damage. An acute loss of ISQ was observed following all RT bouts +24h (-19 [21, -17] %; P < 0.001) and +48h ISQ (-19 [-21, -17] %; P < 0.005), and +25h for the CMJ (+7 [-9, -5] %; P < 0.05). Whilst acute FSR was increased for WP over and above the CON (+0.275 [0.148, 0.403] %/day; P = 0.07), no discernible difference between WP and CON was observed for any measure of contractile function, pain, or CK (P > 0.49).

CONCLUSIONS: We conclude that, whilst peri-RT supplementation with WP augments muscle protein FSR, further inference of this pro-anabolic effect should not extend to acute (0 to 48 h) recovery of peri-RT muscle contractile function.

### 3370 Board #: 240
June 2 9:30 AM - 11:00 AM
Effects of Olive Oil Phytochemicals and Exercise on Circulatory Leukocytes and Inflammation in Atherosclerosis-Rats
Tianzu Zhang, Tao Liu, Yuzi Zhang, Jose Amerigo, Jing Shao, Dongwook Yeo, Li Li Ji, FACSM.

"University of Minnesota-Twin Cities, Minneapolis, MN. 2International Society for Oleocanthal, Malaga, Spain."

(No relevant relationships reported)

### 3371 Board #: 240
June 2 9:30 AM - 11:00 AM
Effects of Olive Oil Phytochemicals and Exercise on Circulatory Leukocytes and Inflammation in Atherosclerosis-Rats
Tianzu Zhang, Tao Liu, Yuzi Zhang, Jose Amerigo, Jing Shao, Dongwook Yeo, Li Li Ji, FACSM.

"University of Minnesota-Twin Cities, Minneapolis, MN. 2International Society for Oleocanthal, Malaga, Spain."

(No relevant relationships reported)

### 3372 Board #: 241
June 2 9:30 AM - 11:00 AM
Effects Of A Novel Probiotic On Exercise-Induced Gut Permeability and Microbiota in Endurance Athletes
Conerry J. Brennan, Christopher L. Axcell, Deborah Paul, Michaela Hull, John P. Kirwan, FACSM. Cleveland Clinic Lerner Research Institute, Cleveland, OH.

(No relevant relationships reported)

Exercise-induced hyperpermeability of the gastrointestinal (GI) tract contributes to abdominal pain, bloating, and fatigue; symptoms commonly expressed in Inflammatory Bowel Disease, Celics’s Disease, and Type 1 Diabetes. Therapies that can ameliorate the symptoms and conditions are lacking. Purpose: To assess the efficacy and feasibility of Lactobacillus Salivarius (UCC118) supplementation on GI permeability in healthy humans. Methods: In a randomized, double blind crossover study, 7 highly-trained endurance athletes (31 ± 6.1 y, VO2max: 57.3 ± 9.3 ml/kg/min) received 4 weeks of daily probiotic or placebo supplementation. The initial 4 week period was followed by a 4 week washout, followed by an additional 4 weeks of placebo or probiotic supplementation. GI permeability, blood chemistry, and fecal microbiota were assessed before and after each 4 week intervention period. GI permeability was challenged using 2 hours of continuous treadmill running at 60% VO2max. After 20 minutes of running, subjects ingested 5 grams of L-rhamnose, sucrose, and lactulose. Urine was collected before, immediately after, and every hour for 5 hours after exercise. GI permeability was measured as sugar recovered in urine as determined by LC/MS/MS. Metagenomic sequencing was performed on fecal samples with Illumina HiSeq 4000 utilizing a 2 x 150 configuration for an average of 120-130M paired end reads per sample. Beta diversity was estimated using Bray-Curtis method to reveal the microbial diversity between pre and post intervention samples. Results: Compared to placebo, UCC118 treatment reduced area under the curve for urine (P<0.081) and rhamnose recovery (P<0.100). Gut taxonomy sequencing revealed significant changes in 60 bacterial species (P<0.05) after UCC118 supplementation. Additionally, there was an increase in microbial diversity after probiotic use. Conclusion: The results described herein provide proof of principle that 4 weeks of UCC118 supplementation attenuates exercise-induced intestinal hyperpermeability. Molecular processes are ill-defined, so further investigation is needed to determine associated pathways, protein interactions, and impact of specific bacterial taxa. Study supported by external sponsor.
the closest example of this ancient lifestyle that thrived for thousands of years. PURPOSE: To determine the energy demands, and changes in body composition and metabolic factors in humans during a 12-day wilderness hunting immersion. METHODS: Four healthy men (age: 42 ± 1 yr, BMI: 27 ± 2 kg/m²) without any known cardiovascular, neurological, pulmonary or metabolic pathology were recruited for participation in the study. Total energy expenditure (TEE) was measured using the doubly labeled water method and a written food diary was utilized to estimate total energy intake (TEI). Body composition was measured using dual energy x-ray absorptiometry; cross sectional area of the upper thigh (XT) and intraephracic lipid (IHL) was measured using magnetic resonance imaging/spectroscopy. Fasted blood samples were collected for the measurement of total cholesterol (TC), high (HDL) and low-density lipoproteins (LDL). Results were analyzed using paired t-tests, presented as means±SEM and considered significant at P<0.05. RESULTS: TEE and TEI were 4226±219 kcal/day and 2499±422 kcal/day, respectively, and resulted in a caloric deficit of 1726 kcal/day. There was a decrease in body weight (-3.2±0.2 kg), total fat mass (-3.1±0.1 kg) and visceral fat volume (-261±47 cm³). In contrast, total, leg, and arm lean tissue mass and XT were preserved. There was a decrease in IHL (-4.0±1.0 %) without a peak. Blood samples were not in blood lipids, but two of the four participants did not have their blood samples collected due to conflicts with weather and bush flight schedules. CONCLUSION: In the context of a chronic caloric deficit, adipose tissue and IHL decreased without any reduction in lean tissue mass or muscle mass. These alterations may reflect the interactive influence of movement constancy and caloric deficit on the health benefits of the hunter-gatherer lifestyle. Supported by NIH grant U54GM118991; TL4GM118992, or R55GM118980 and by a grant from the University of Montana.

3374 Board #: 243
June 2 9:30 AM - 11:00 AM
The Effects Of Acute Exercise On Npy/AgRP And POMC Neuron Activity In The Mouse Hypothalamus
Wyatt P. Bunner, Brenton T. Laing, Hu Huang. East Carolina University, Greenville, NC.
(No relevant relationships reported)
NeuroPeptide Y/Agherlin-related peptide (NPY/AgRP) and pro-opiomelanocortin (POMC) neurons are key components of the neuronal circuits that respond to various physiological condition to regulate food intake and energy homeostasis. However, far less is known about how these neurons respond to acute exercise. PURPOSE: To determine effects of acute exercise on the activity of AgRP/ NPY and POMC neurons in the mouse hypothalamus. METHODS: NPY-GFP reporter mice were used in 3 separate experiments. We randomly assigned cohort 1 (N=6) mice to a treadmill exercise with a speed of 13 M/min and an 8.75% grade for a duration of an hour group or a sedentary group, blood glucose was measured immediately post-exercise. Mice were then intracardially perfused, and their brains were isolated to examine the colocalization of the neuronal activation marker e-FOS and the signaling marker for phosphorylation of extracellular signal-regulated kinases (p-ERK) in NPY-GFP and POMC neurons. In cohort 2 (N=7) food intake was assessed following the same treadmill conditions over a 24-hour period. In the final cohort, (N=5) patch-clamp electrophysiological recordings were used to quantify changes in NPY-GFP neuron firing rate induced by exercise. Results: Despite normal glucose levels and food intake after the acute treadmill exercise, e-FOS and p-ERK in NPY/AgRP neurons are significantly increased (p<0.05) in the exercised mice compared to the control mice. This result was further confirmed by electrophysiological recording showing that the firing rate was increased in the NPY/AgRP neurons of exercised mice. In contrast, exercise induced e-FOS expression was decreased in the POMC neurons of exercised mice. Conclusion: Acute treadmill exercise increases NPY/AgRP neuron activation, whereas POMC neuron activation is decreased. The responsiveness of these neurons to acute exercise is independent from food intake and glucose regulation but might associate with exercise-induced phosphorylation of ERK in the mouse hypothalamus. Supported by East Carolina University start-up fund.

3375 Board #: 244
June 2 9:30 AM - 11:00 AM
Markers of Non-Functional Overreaching Syndrome During the Race Across America (RAAM): A Case Study
Edward K. Merritt1, David C. Nieman, FACSM2, Brian E. Barnett3, Lauren E. Parrish1, Kathryn Cardwell1, Brian R. Toone1, Arnouf Groen4, Artyom Pugachev7, 1Southernwestern University, Georgetown, TX. 2Appalachian State University, 3North Carolina Research Program, Kannapolis, NC. 4Delta State University, Cleveland, MS. 5University of Kansas, Lawrence, KS. 6University, Shell Lake, WI. 7Samford University, Homewood, AL. 8ProteoQ Biosciences GmbH, Berlin, Germany.
(No relevant relationships reported)
In a previous study, global proteomics procedures identified blood proteins as potential overreaching and overtraining biomarkers, and a targeted proteomics panel of 21 proteins was developed. PURPOSE: To measure targeted blood protein changes in an athlete competing in RAAM. METHODS: The 40-y old male athlete underwent fitness testing 4-wks pre-RAAM and 4-d post-RAAM to determine body composition and aerobic cycling capacity. Training during RAAM training distress score (TDS) and body mass were measured one and 2 times per day. Power output and heart rate (HR) were continuously measured during cycling. Fingerprick samples for dried blood spot samples (DBS) were obtained 4 wks, 24-h, and 2-h before the start of the race, twice per day of the race (morning/evening), and after 1 and 4 d recovery. Proteins were resolved/rehydrated from the DBS by trypsin based liquid chromatography/mass spectrometry (Multiple Reaction Monitoring) on an Agilent 6400 QqQ LC MS/MS. Data was processed and analysed using Skyline. RESULTS: The athlete completed the 4941-km race in 10.1 d at an average moving speed of 24.5 km/h. He cycled for 20.0 h/d, with 20 h sleep for the duration of the race. Power output was 102.6 ± 8.9 watts with the highest 24-h power in the first and last 24 h (108 vs. 120 watts). TDS was 1 before the start and increased to 30 by the finish. Body mass was 61.3% lower (61.6 vs. 57.5 mL kg⁻¹ min⁻¹), and maximal HR declined 5.7% (192 vs. 181 beats/min). No changes in body mass or composition occurred. The % change in blood proteins was calculated using the average of the 2 pre-race samples and 5 samples collected on days 8, 9, and the first day of recovery. The 5 blood proteins from the DBS samples that increased the most during RAAM included complement component C7 (359%), complement C4-B (231%), serum amyloid A-4 protein (210%), inter-alpha-trypsin inhibitor heavy chain H4 (191%), and alpha-1-antitrypsin (188%). CONCLUSION: This case study of an ultra-endurance athlete competing in the 2017 RAAM event (4th overall) showed the typical decrease in metabolic exercise performance associated with non-functional overreaching. Targeted proteomics procedures from DBS samples showed that the largest increases were measured for immune-related proteins that are involved with complement activation and the acute phase response. Previous research suggests that strict rest for 5 days following a concussion may prolong symptom presentation. Sub-maximal aerobic exercise is an efficacious treatment for post-concussion syndrome but therapeutic aerobic exercise is not well described in sub-acutely concussed patients. PURPOSE: To determine if sub-maximal aerobic exercise could be safely performed in the days following a sport-related concussion. METHODS: Fifteen participants (16 ± 1.5 years; 9 males; 6 females) were assigned using a randomized block design to a 40% Age-Predicted heart rate (HR) max (40HR), 60% Age-Predicted HR max (60HR), or seated rest control (CON) group. Participants exercised after their initial evaluation between Day 3 and Day 7 (4 ± 5 days) following their concussion. Participants’ HR and symptoms were monitored during the treatment. Descriptive statistics and a two-way mixed ANOVA were performed using SPSS 22. RESULTS: Fourteen (93%) participants were able to complete the treatment session. There was a significant interaction between group and time on heart rate (F(3,690, 20.297) = 5.163, P = 0.006, partial η² = 0.484. HR was significantly higher in the 60HR group compared to the 40HR and CON group. The majority of our participants were able to tolerate aerobic exercise within the first 3-7 days following a concussion and also reported a reduction in symptom severity.

3377 Board #: 246
June 2 9:30 AM - 11:00 AM
Erik A. Willis1, Pedro F. Saint-Maurice1, Herman Ponzett4, Charles E. Matthews, FACSM2, 1National Cancer Institute, Bethesda, MD. 2Hunter College, New York, NY.
(No relevant relationships reported)
PURPOSE: Strategies for the prevention and treatment of obesity require a better understanding of the association between physical activity (PA) and total energy expenditure (TEE). Current strategies are based on an additive model, where TEE and PA increases in a dose-dependent manner. However, recent evidence suggests a constrained TEE model, where increases in TEE plateaus at higher levels of PA, as the body adjusts to maintain an equilibrium of TEE through metabolic adaptations. Our aims were to examine the shape of the relationship between PA and TEE and to...
assess the role of energy balance status (negative, stable, positive) in this association.

**METHODS:** Participants were 642 older adults (50-74 yrs.) participating in the Interactive Diet and Activity Trial (iDART) study. TEE was assessed by doubly labeled water, PA, assessed by accelerometer, was estimated using three methods to calculate total PA: Vertical Axis counts per minute (CPM), Vector Magnitude CPM, and MET-hrs./d (using a machine learning algorithm [Sojourn-3x]). TEE for each subject was adjusted for anthropometric and demographic factors using linear regression. The relationship between PA and TEE was assessed using linear (i.e., correlations) and non-linear parameters (e.g., nonparametric LOESS regression curves). Percent weight change over a six month period of assessment was calculated as a proxy measurement of energy balance status. **RESULTS:** The difference in TEE between the top and bottom deciles of PA was +376(SD=341) kcal/d in the total sample, +499(SD=347) kcal/d in men, and +229(SD=318.4) kcal/d in women. TEE was positively associated with PA levels estimated by Vertical Axis (r = 0.36; <0.0001), Vector Magnitude (r = 0.39; <0.0001), and MET-hrs./d (r = 0.40; <0.0001). There was no evidence of a plateau in TEE as demonstrated by the LOESS curves or the change in median TEE over PA deciles. Individuals who lost ≥5% of their body weight showed evidence of a plateau in TEE at higher levels of PA. **CONCLUSIONS:** Overall, PA was associated with TEE in a linear dose-dependent manner. For individuals who lost weight, TEE was positively correlated with physical activity, but the relationship was stronger over the lower ranges of TEE. This study provides evidence to adopt a dynamic model for estimating energy expenditure as it pertains to obesity.

**3378 Board #: 247 June 2 9:30 AM - 11:00 AM Associations Of Skeletal Muscle And Appendicular Lean Body Mass With Blood Pressure And Hypertension**

Sunyu Ye, Chaonan Zhu, Chen Wei, Da Gan, Shankuan Zhu. Zhejiang University, Hangzhou, China.

(No relevant relationships reported)

**PURPOSE:** Previous studies have shown the negative effects of body fat on blood pressure (BP). However, the associations between skeletal muscle and BP remain unclear. The present study was aimed to investigate the associations of total skeletal muscle (TSM) and appendicular lean body mass (LBM) including leg and arm, with BP and hypertension.

**METHODS:** Data from 3,130 participants aged 18 to 80 years old were analyzed. Appendicular LBM including leg and arm were obtained from dual-energy X-ray absorptiometry. TSM was calculated based on arm LBM. The standardized beta coefficients of arm LBM indices included TSM, and appendicular, leg and arm LBM divided either by weight, or by squared height. Adjusted multivariate linear or logistic regression models were used to analyze the associations of TSM and appendicular, leg, and arm LBM with BP or hypertension, respectively. To further investigate the associations of regional LBM with BP, arm and leg LBM were put in the linear regression models together, and the Wald test was used to compare the standardized parameter coefficients of arm and leg LBM.

**RESULTS:** TSM, and appendicular, leg and arm LBM indices were all positively associated with elevated systolic or diastolic BP after controlling for potential confounders including body fat percent and android to gynoid fat ratio, except for appendicular and leg LBM with systolic BP. In addition, higher odds of hypertension were observed in all TSM and appendicular LBM indices, except for leg LBM/weight. The standardized beta coefficients of arm LBM indices on systolic and diastolic BP were significantly higher than relevant indices of leg LBM, except for arm LBM/height on systolic BP.

**CONCLUSIONS:** Total skeletal muscle and appendicular LBM especially in arms are positively associated with elevated systolic or diastolic BP after controlling for potential confounders including body fat percent and android to gynoid fat ratio, except for appendicular and leg LBM with systolic BP. In addition, higher odds of hypertension were observed in all TSM and appendicular LBM indices, except for leg LBM/weight. The standardized beta coefficients of arm LBM indices on systolic and diastolic BP were significantly higher than relevant indices of leg LBM, except for arm LBM/height on systolic BP.

3378 Board #: 248 June 2 9:30 AM - 11:00 AM **Optimal Level of Objectively Measured Physical Activity for Long-Term Weight Loss**

Danielle M. Ostendörfer, Janet K. Snell-Beurgeon, Jan P. Lande, Anna E. Baron, Angela D. Bryan, Sarah J. Schmiege, Dawn Comstock, Edward L. Melanson, FACSM, Victoria A. Catanacci. University of Colorado Anschutz Medical Campus, Aurora, CO. University of Colorado Boulder, Boulder, CO.

(No relevant relationships reported)

**Purpose:** Existing physical activity (PA) guidelines for weight management have relied heavily on self-reported PA measures, which are typically overestimated. Our purpose was to determine the optimal level of objectively measured PA for sustaining long-term weight loss.

**Methods:** We conducted a secondary analysis of an 18 month behavioral weight loss trial, which included an exercise prescription of 300 min/wk of moderate-intensity PA. Participants received 6 months of supervised exercise during either months 0-6 or 7-12, followed by 6 months of unsupervised exercise during either months 7-12 or 12-18. PA was objectively measured with the SenseWear armband. Participants with valid wear time (>12 h/week and ≥10 weekdays and ≥1 weekend day) upon completing unsupervised exercise were included in analyses. Sustained bouts (≥10 min) of activity ≥3 METS were converted to moderate-to-vigorous intensity PA (MVPA). Receiver-operating characteristic curve analyses determined the optimal duration of bout MVPA to achieve ≥5% or ≥10% weight loss at 18 months. To identify the optimal cutoff, the Youden index and 95% bootstrap percentile confidence intervals were calculated using RStudio (pROC package). A linear mixed effects model examined the association between bout MVPA and weight loss.

**Results:** Participants included 143 adults (age 39.6±9.4 yrs, BMI 34.2±4.0 kg/m², 87% female). 102 provided an 18-month weight and of these, 82 had valid SenseWear data after completion of unsupervised exercise. The optimal level of bout MVPA upon completion of unsupervised exercise was median (95% bootstrap CI) 209 (144-301) min/wk to achieve ≥5% weight loss at 18 months or 267 (108-449) min/wk to achieve ≥10% weight loss at 18 months. There was a dose response relationship between bout MVPA and weight loss. Participants who met 5.9-9.9% or ≥10% weight loss at 18 months were at mean (±SD) 270±143 or 316±256 min/wk of bout MVPA upon completion of unsupervised exercise.

**Conclusions:** Results confirm the importance of high PA levels for sustaining clinically meaningful weight loss. These data validate existing guidelines with objective PA measures and suggest that ≥200-300 min/wk of bout MVPA is the optimal duration of PA required to achieve successful long-term weight loss (≥5-10% weight loss at 18 months).

3380 Board #: 249 June 2 9:30 AM - 11:00 AM **Prevalence Of Rash Suspicious For Tinea Among Minnesota High School Wrestlers -2017-18 Season**

Mark A. Berg, William O. Roberts, FACSM. University of Minnesota, St. Paul, MN.

(No relevant relationships reported)

**PURPOSE:** Transmittable skin infections in sport are a concern, especially for wrestlers. We followed a geographically defined group of Minnesota high school wrestlers over the 12-week 2017-18 season to determine the prevalence of rash suspicious for tinea (RST).

**METHODS:** Nineteen high school wrestling programs in the St Paul area were contacted, 17 agreed to participate. Wrestlers undergo skin inspections prior to each competition throughout the season. Wrestlers identified during skin checks with an RST (raised, red, <5mm diameter, and with dry flaky scale) were recruited.

**RESULTS:** 39 of 510 wrestlers (7%) developed RST. 34 wrestlers consented to enter the study and had a total of 38 RST’s meeting inclusion criteria (2 wrestlers developed 2 separate RST and 1 wrestler developed 3 RST). RST occurred throughout the season, with slightly more at the beginning and near the end. Slightly more RST occurred in middle competition weight categories. The most common site for RST was on the extremities(23 RST), followed by trunk(10), neck(2), face(1), and scalp(1). Empiric topical antifungal treatment had been started by 47% of the wrestlers.

**CONCLUSIONS:** RST prevalence of 7% was less frequent than found in previously reported wrestlers. This may be the result of routine skin inspections prior to competition. Empiric topical antifungal treatment is commonly employed. Empiric antifungal treatment may be a prevention strategy that deserves further study.

3381 Board #: 250 June 2 9:30 AM - 11:00 AM **Current Practices of Concussion Management in Primary Care: A Survey**

William L. Patterson Jr, Kristine Karlson, William Baxter, FACSM, Deborah Johnson, Christina Holt, Ardis Olson, Amy Haskins, Maine Medical Center, Portland, ME. Dartmouth Hitchcock, Lebanon, NH.

(No relevant relationships reported)

**PURPOSE:** Best practices for sports-related concussions (SRC) are evolving rapidly. We aim to describe the knowledge of standardized diagnostic tools and the current practices in SRC management by primary care providers (PCPs) in Northern New England.

**METHODS:** We designed an ‘action’ survey, using REDCap, to query current SRC management by pediatric and family physicians in ME, NH, and VT branches of the Academy of Pediatrics (AP) and Academy of Family Physicians (APF). An email was sent to providers with a link to a deidentified survey which included questions about demographics and clinical practices. The questions covered the frequency of SRCs, comfort level managing SRC, awareness of current guidelines and resources, use of imaging, return to school/play, and referral patterns. At the conclusion of the survey, the respondents could view their responses compared with others, and were sent links to other models.

**RESULTS:** Initial response rate is 16% (preliminary) (111 responses of 688 MEAFP and MEAP members surveyed). Demographics: 43 male, 68 female; mean age: 49.2 years; mean years in practice:18.7. 90% (100/111) have seen a patient with SRC in the past 2 years; however, 79% (88/111) see ≤1 per month. 56% work with ATCs to
manage SRC. 61% report moderate or extreme comfort managing SRC. 91% (101/111) are aware at least 1 guideline for SRC, but only 18% (20/111) are aware of the 2016 Berlin consensus statement. Results: Impairment of brain function and memory impairments were initially identified in 41% (43/106) of imaging work-up; however, findings are found initially; but 46% (51/111) are likely to order imaging at 3 weeks even without valid indication. 76% (76/100) generally do not prescribe medications for concussion symptoms. 41% (43/106) appropriately recommend staying out of school for 2 or less days after SRC. 86% (94/109) are aware of return to play (RTP) guidelines and 90% (85/94) are able to demonstrate appropriate management when an athlete fails a step. 

CONCLUSIONS: Clinicians responded well to a survey of current SRC practices, which provided updated clinical guideline tools. Most PCPs manage SRC; however, a majority report seeing ≤1 a month. A large proportion of PCPs do not follow current recommendations for imaging or return to school. Results could help guide future CME for SRC management.

3382 Board #: 251
June 2 9:30 AM - 11:00 AM
Effects of 6 Months Endurance Training on Quality of Life and Work Ability
Hedwig Stenner, Lena Grams, Momme Kück, Julian Eigendorf, Sven Haufe, Uwe Tegtbjer, Annette Melk, Andreas Hilfiker, Axel Haverich, Meike Stiesch-Scholz. Institute of Sports Medicine, Hanover, Germany. (No relevant relationships reported)

Purpose: In this prospective, randomized controlled study we assessed effects of moderate-intense supervised endurance training on quality of life and work ability in middle-aged sedentary women.

Methods: We randomized 291 healthy, non-smoking sedentary women (45-65 years) to a 6 months endurance training (EG, 210 min/week) or a wait-list-control (CG, no change of inactive lifestyle). At baseline and 6-month follow-up we assessed cardiorespiratory fitness (VO2peak) by oxygen uptake (VO2max) at maximal exercise testing, Work Ability Index (WAI) and quality of life (SF36), both by questionnaires. The metabolic syndrome score (MSS) was calculated using the sMS score. 

Results: At baseline, groups were well matched for anthropometric and cardiovascular parameters. Adherence to endurance training was 207±17 min/week (98±5%). After intervention, the exercise group improved significantly compared to controls in VO2peak (mean difference: 2.11 ml/min/kg, CI [1.42;7.9], p<0.001) and MSS (mean difference: 0.11 points, CI [0.053;0.175], p<0.001). VO2peak and WAI changes correlated significantly (R=0.201; p=0.002). SF36 improved significantly in the EG compared to the CG for the subscales “Physical Role Functioning” (EG: baseline 81.7±12.5, follow-up 88.1±12.5; CG: 82.4±19.4, 89.7±22.1, respectively; p=0.016). “General Health Perceptions” (EG: baseline 69.3±14.8, 73.6±14.3, CG: 72.5±13.6, 71.8±14.3; p=0.002) and the “Sum Scale Physical” (EG: baseline 50.8±6.5, 52.2±6.3, CG: 52.7±5.7, 52.3±6.4; p=0.040) after exercise training. WAI changed significantly in the EG compared to the CG for “Work Ability In Relation To Demands” (EG: baseline 78.1±3.5, follow-up 81.2±3.5, CG: 92.4±19.4, 89.7±22.1, respectively; p=0.016). “Number of Current Diseases” (EG: baseline 2.2±1.7, 1.9±1.6; CG: 2.1±1.7, 2.2±1.9; p=0.014) and total score of WAI (EG: baseline 38.3±5.0, 39.8±4.9; CG: 39.4±4.7, 39.3±4.9, p<0.001). 

Conclusion: Our results show that a moderate personalized 6-month endurance training in middle-aged previously sedentary women improved established parameters of cardiovascular function, prevented metabolic syndrome progression, work ability and quality of life.

3383 Board #: 252
June 2 9:30 AM - 11:00 AM
From the Perspective of Mitophagy: Study the Mechanism of Sustained Aerobic Exercises Alleviate Brain Aging
Wang Lu, DENG Wenqian, Li Xue. Chengdu Sports Institute, Chengdu, China. (No relevant relationships reported)

Our previous work has demonstrated that sustained aerobic exercise could affect the morphology and function of mitochondria, and mitigate the mental functions decline of rats caused by D-gal.

PURPOSE: To investigate whether sustained aerobic exercise could alleviate aged rats' brain aging by influencing mitophagy. This project will also study the role of mitophagy in brain aging of aged rats.

METHODS: Twenty-four male Sprague-Dawley rats were randomly assigned into a control group (C, n=12), and a sustained aerobic exercise group (E, n=12). Groups C received conventional feeding for four weeks, and group E received feeding and swimming training for four weeks, 60 min/day, 6 days/week. Firstly, we would analysis the effect of sustained aerobic exercise on spatial learning and memory ability of aged rats. Then, transmission electron microscope were used to observe the mitophagy in loubus fromats/Some indicators of mitophagy were detected by immunofluorescence, such as HSPO6 and LC3-II;HSPO6 and LAMP1;at last, related index to the mitophagy (Beclin1, P62 and LC3) were detected by western blotting. The experimental data were reported as means±SE, and P values<0.05 were considered significant.

RESULTS: Firstly, sustained aerobic exercise could alleviate rats' brain aging in spatial learning and memory ability. Mitophagy was significantly increasing in loubus fromatis detected by transmission electron microscope and immunofluorescence. According to the western blotting test, Beclin1 (C:0.08±0.02; E:0.63±0.09; respectively, P<0.05) and P62 (C:0.05±0.01; E:0.74±0.11; respectively, P<0.05) were significantly elevated after sustained aerobic exercise; LC3-II: LC3-I (C:0.12±0.03; E:1.25±0.17; respectively, P<0.05) was also signifi cantly increased. These indicators indicated that mitophagy was increasing after sustained aerobic exercise.

CONCLUSIONS: Results from this study suggest that four weeks of sustained aerobic exercise can improve spatial learning and memory ability of aged rats, by increasing mitophagy in rats’ loubus fromatis. Mitophagy is playing a very important role in brain aging of aged rats.

3384 Board #: 253
June 2 9:30 AM - 11:00 AM
Nurse Amie (Addressing Metastatic Individuals Every-day)
Erica Schleicher1, Leah Cream2, Rena Kass3, Michelle Farman4, Xiaochun Zhang1, Katlynn Mathis5, Jessica Moyer1, Kathryn Schmitz, FACS1. 1.Pennsylvania State University, Hershey, PA. 2. Ohio State University, Columbus, OH. (No relevant relationships reported)

About 1 in 8 US women will develop invasive breast cancer in her lifetime. Complications with symptoms include inability to deliver chemotherapy, hospitalizations and survival outcomes. For patients to benefit from pharmacologic interventions, clinicians must be made aware. At present, there is no standard of care system to ensure clinicians are made aware of symptoms.

Purpose: To investigate the feasibility and acceptability of a symptom assessment and management platform for metastatic breast cancer (MBrCa) patients, including exercise.

Methods: Our team developed an interactive symptom assessment and management platform, Nurse AMIE. Patients were provided with a tablet, pedometer, and resistance bands. Nurse AMIE asks a daily survey on sleep, fatigue, quality of life, pain, or other issues. Data from the pedometer and daily symptom questions were applied to an algorithm that resulted in a self-management intervention. Interventions included guided relaxation, social support forum, exercise, and music. Systematic symptom assessment and self-management interventions, along with weekly supportive phone calls determined whether self-management could continue or if there was a need to schedule an appointment with the clinician.

Results: 31 MBrCa patients had been consented to use Nurse AMIE. The initial patient adherence rate was 76%. Qualitatively, patient interviews suggest that Nurse AMIE is ‘surprisingly easy to use’ and the most valued interventions have been the social support forum, exercises, and music. Additionally, patients noted an improvement in fatigue while using the walking intervention. One patient who was only able to ambulate painfully with a walker at baseline now walks over 10,000 steps a day.

Thus far, all initial patients have been able to self-manage with no interval visits with clinicians while using Nurse AMIE.

Conclusion: Nurse AMIE is an interactive platform that allows MBrCa patients to successfully self-manage symptoms while providing critical feedback. Overall, the physical activity component of this intervention is particularly well received. Qualitative feedback suggests that clinicians and patients are pleased by this comprehensive and standardized approach to assessing and managing symptoms. Further evaluation will allow us to better understand symptom assessment and management.

3385 Board #: 254
June 2 9:30 AM - 11:00 AM
Interindividual Variability and Adverse Responses to Body Composition with Exercise Training in Adolescents with Obesity
Jeremy J. Walsh1, Gary Goldfield2, Glen Kenny3, Ronald Sigal4, Steven Doucette5, Brendon J. Gard1. 1.Children’s Hospital of Eastern Ontario, Ottawa, ON, Canada. 2.University of Ottawa, Ottawa, ON, Canada. 3.University of Calgary, Calgary, AB, Canada. 4.Nova Scotia Health Authority, Halifax, NS, Canada. 5.Queen’s University, Kingston, ON, Canada. (No relevant relationships reported)

Improved body composition (BC) is an expected outcome in adults undergoing exercise training. However, significant interindividual variability (IVV) has been observed in this response. Further, while some individuals fail to accrue training benefits, others demonstrate adverse responses, which can have implications for clinical exercise prescription. It is unknown if exercise training increases IIV and if it affects adverse response rates beyond what would be expected following a diet-only intervention in adolescents with obesity.

PURPOSE: To examine if exercise training increases IVV in the observed response of BC, and to quantify adverse response rates to training compared to diet-only control in adolescents with obesity.

METHODS: Post-pubertal boys and girls (n = 143; age 15.5 ±1.4 yrs; BMI = 34.8 ±4.6 kg/m²) were randomly assigned to either a diet-only control group (n = 56), aerobic (n = 35), resistance (n = 23), or combined aerobic/resistance training (n = 29). Supervised exercise training was performed 4 x/week for 6 months. All groups received diet counseling to reduce caloric intake by 250 kcal/day. BC

ACSM May 29 – June 2, 2018
Minneapolis, Minnesota
Doxorubicin (DOX) is a potent chemotherapy drug used to treat numerous cancers, but its use is limited due to its toxicities. DOX treatment may lead to skeletal muscle dysfunction which compromises the quality of life for cancer patients. It is suggested that DOX inhibits creatine transporter (CreaT) and creatine kinase (CK) expression in cardiac muscle, but little is known as to how it affects CreaT and CK expression in skeletal muscle. Additionally, resistance training has been shown to alleviate DOX-induced skeletal muscle dysfunction (weakness and fatigue), but the effects of resistance training on CreaT and CK expression in DOX-treated skeletal muscle is currently unknown. PURPOSE: To investigate the effects of resistance training prior to and during DOX treatment on CreaT and CK expression in the primarily type II, or fast, extensor digitorum longus (EDL) muscle. METHODS: Thirty-six male, Sprague-Dawley rats were randomly assigned to one of four groups: sedentary+saline (SSS), sedentary+DOX (SSD), resistance training+saline (RRS), and resistance training+DOX (RRD). The resistance training protocol incorporated a raised cage model where food and water were elevated progressively which provided hindlimb loading 10 weeks prior to DOX injection and during the course of DOX treatment. Animals receiving DOX received 5 mg/kg DOX administered i.p. weekly for 4 weeks (12 mg/kg cumulative) and animals receiving saline received equivalent volumes of 0.9% NaCl as a placebo. Five days following the final DOX or saline injection, EDL muscles were excised, and Western blotting was performed to quantify CreaT and CK expression. RESULTS: No significant drug effect or activity x drug interaction was observed for CreaT expression, but a significant activity effect was observed for CreaT expression (p=0.0479). No significant main effects or interaction was observed for CK expression. CONCLUSIONS: Resistance training prior to and during weekly DOX administration promoted an increase in CreaT expression suggesting that resistance training may play a role in alleviating DOX-induced skeletal muscle dysfunction by enhancing substrate availability for phosphocreatine synthesis.

Physical exercise and training results in adaptations in adipose tissue. Such adaptations in adipose tissue are of particular importance because they may impact obesity. Rather, exercise creates a positive, uniform shift in BC outcomes, thereby facilitating mitochondrial metabolism or an adaptive phenomenon of endomorphosis.

Effect Of 10 Weeks Of Low-load High-repetition Resistance Exercise Training On Human Skeletal Muscle

Chang Hyun Lim, Tae Seok Jeong, Chang Keun Kim. Korea National Sport University, Seoul, Korea, Republic of. 

Purpose: To study the influence of life-long training on mitochondrial biosynthesis indicators of CoxIV and cytochrome c, fusion proteins (Mfn2, Opa1), fission proteins (Drp1, Fis1), and mitophagy factors (PINK1, Parkin) in endurance athletes.

Methods: We aimed to investigate skeletal muscle functions, hypertrophy, and mitochondrial metabolism according to load and total work volume of exercise training based on molecular biology and physiological factors.

Results: After 10 weeks of exercise training, 30FAIL and 80FAIL showed an increase in peak torque, CSA, and satellite cell activation (p<0.05). In terms of endurance strength, 30FAIL was the only group that presented a significant increase after the training (p<0.001). Furthermore, 30FAIL recorded a significant rise in expression of mitochondrial biosynthesis indicators of COXIV and cytochrome c, fusion proteins (Mfn2, Opa1), fusion proteins (Drp1, Fis1), and mitophagy factors (PINK1, Parkin) after the exercise training (p<0.05).

Conclusion: Low-load high-repetition exercise training can be suggested as an effective method of exercise training to enhance skeletal muscle function and aerobic metabolism at the same time by facilitating mitochondrial metabolism of the skeletal muscle.
S704 Vol. 49 No. 5 Supplement

MEDICINE & SCIENCE IN SPORTS & EXERCISE®

Saturday, June 2, 2018

ACSM May 29 – June 2, 2018 Minneapolis, Minnesota

was statistically analyzed by Student’s-test. Results: UCP-1 gene expression was significantly greater in trained women compared with the control group (p=0.046). No significant difference was found between men compared to controls (p=0.257). Expression of CIDEA was, again, significantly higher compared with controls (p=0.049), but also in men (p=0.024). Finally, expression of PPAR-γ was significantly higher in trained women (p=0.005). Again no differences were found in men (p=0.924). Conclusion: Life-long endurance training results in a higher expression of brown adipose tissue markers in periumbilical WAT in women, in men only in expression of CIDEA, a factory closely associated with metabolic health. Previous results in rodents show a higher susceptibility of females to upregulate BAT markers following β-adrenergic signaling. A similar mechanism might be possible in humans. This effect might also be caused by differences in body fat distribution and functionality, with women having a higher prevalence for BAT.

3392 Board #: 261

June 2 9:30 AM - 11:00 AM

Forced PGC1a1 Expression Improves Oxidative Capacity And Partially Rescues Strength Following Volumetric Muscle Loss Injury

William M. Southern, Anna S. Nienchen, Anita E. Qualls, 1 Amelia Yin, 1 Hang Yin, 1 Sarah Greising, 1 Jarrod A. Calli. 1University of Georgia, Athens, GA. 2University of Minnesota, Athens, GA.

(Vol. 49 No. 5 Supplement)

No relevant relationships reported

Volumetric muscle loss (VML) is characterized by a large volume of muscle tissue being removed from the body due to surgery or severe trauma. The remaining muscle after VML has poor function and unknown adaptive potential during physical rehabilitation. PURPOSE: To investigate the metabolic plasticity of the remaining skeletal muscle after VML injury. METHODS: VML injury was performed on the gastrocnemius muscles of 8-week old C57BL/6 mice. Study 1: Unilaterally injured VML mice performed voluntary wheel running (WR). Study 2: PGC1a1 (CMV promoter) transfection was performed on control (CON) and bilaterally injured VML mice (VML). Mice were divided into three groups: CON+PGC1a1 overexpression, VML alone, and VML+PGC1a1 overexpression. For the voluntary wheel running (Study 1) or transfection interventions (Study 2), muscle strength and mitochondrial respiratory function (mitox) were assessed. RESULTS: Mitox was ~23% greater in the uninjured limb of VML+WR mice compared to VML alone, but mitox in the injured limb of VML+WR mice was not different from VML alone, suggesting VML injury prevents metabolic adaptations to exercise (ANOVA P<0.001). To determine if a faulty metabolic signaling cascade (i.e., PGC1a1) was responsible for impaired metabolic adaptation in the VML-injured muscle, direct muscle activation via sciatic nerve electrical stimulation was used to initiate oxidative gene transcription in CON and VML mice. The stimulated muscle in CON mice had ~4 fold greater PGC1a1 gene expression than the unstimulated muscle; however, there was no effect of stimulation on PGC1a1 expression in VML mice (Interaction; P=0.001) suggesting VML injury attenuates oxidative gene regulation. Endogenous PGC1a1 activation pathways were bypassed via forced expression of PGC1a1 in Study 2. Forced expression of PGC1a1 resulted in ~33% and ~31% greater mitox in CON+PGC1a1 and VML+PGC1a1 mice, respectively, compared to VML alone (P<0.001), and VML+PGC1a1 mice had 47% greater muscle strength than VML alone (P<0.001). CONCLUSION: PGC1a1 activation is the limiting factor impairing metabolic plasticity in VML-injured muscle; and improving oxidative capacity of the remaining muscle after VML injury improves recovery of strength.

3393 Board #: 262

June 2 9:30 AM - 11:00 AM

Myonuclear Transcriptional Rate Differences in Young versus Mature Muscle


No relevant relationships reported

Skeletal muscle fiber hypertrophy occurs in mature mice (>4 months old) in response to synergistic ablation overload in the absence of satellite cell-mediated myonuclear accretion, whereas young mice (2 months old) are not able to hypertrophy without satellite cells. We hypothesize that young mice have higher myonuclear transcriptional activity at rest than mature mice due to the demands of developmental muscle fiber growth. Age-related differences in transcriptional rate may in part explain why young mice cannot mount the robust myonuclear transcriptional response required for overload-induced hypertrophy without satellite cells. Purpose: To determine whether baseline myonuclear transcription differs between young (2 months) versus mature (5 months) mice. Methods: Young and mature mice (n=4 males/group) were pulsed with 5-ethyl uridine (EU), a modified uridine that incorporates into nascent RNA, via intraperitoneal injection then sacrificed after a 1-hour chase. Myonuclei were defined as DAPI-positive nuclei within the myofiber, delineated by dystrophin immunostaining. EU-labeled nascent RNA was detected histochemically on frozen muscle cross-sections, and myonuclear EU intensity was quantified with semi-automated thresholding software. Muscle fiber cross sectional area (CSA) was quantified via the detection of fiber borders using automated software. Results: The number of EU+ nuclei between young versus mature myofibers did not differ. The myonuclear transcriptional intensity per myonucleus was 10% higher in young versus mature mice, and muscle fiber CSA was 18% smaller (P=0.05). Myonuclear transcriptional rate normalized to muscle fiber size appeared 30% higher in young versus mature mice, but did not reach statistical significance (P=0.07). Conclusion: Likely due to lower normalized myonuclear transcription relative to young mice, mature mice may possess a transcriptional reserve that allows for hypertrophy in the absence of myonuclear accretion, as previously shown by our
Cerebral palsy (CP) is a non-progressive and permanent neurological disorder that is characterized by muscular weakness and soft tissue contracture or deformation. Adults with CP develop health risk factors and diseases, such as obesity and cardiovascular diseases, significantly more than the general population. Majority of the research focuses on interventions for children and adolescents with CP, and little is known about long-term health issues among adult CP population. Currently, limited information is available to identify the level of muscular strength in relation to the level of obesity in adults with CP.

**Purpose:** To determine relationships between muscular strength and body composition in adult individuals with and without CP.

**Methods:** We studied thirteen adults with and without CP. Leg muscular strength and power at 90, 150, and 210 degrees/sec were measured using Humac Norm isokinetic dynamometer. The range of motion at the knee joint was measured. Forearm muscular strength was measured using a handgrip dynamometer. Body mass index (BMI) from weight and height was calculated to identify the level of obesity.

**Results:** Compared to healthy control, individuals with CP had significantly lower knee extensor peak torque (11.8±2.3 CP vs. 68.0±12.5 control, foot-pounds, P<0.05) at 90 degrees/sec, (7.5±0.6 CP vs. 53.2±11.7 control, ft-lbs, P<0.05) at 150 degrees/sec, (7.3±1.1 CP vs. 49.2±9.7 control, foot-pounds, P<0.05) at 210 degrees/sec, lower knee flexor peak torque (6.3±1.6 CP vs. 43.8±7.9 control, ft-lbs, P<0.05) at 90 degrees/sec, (6.0±1.13CP vs. 35.8±6.88 control, ft-lbs, P<0.05) at 150 degrees/sec, (7.3±1.89 CP vs. 35.17±6.47 control, ft-lbs, P<0.05) at 210 degrees/sec. In control group, there was no relationship between BMI and extensor/flexor peak torque. However, there was a significant inverse relationship between BMI and torque in CP group.

**Conclusion:** These findings suggest that the level of obesity does not appear to influence muscular strength in healthy population. However, individuals with CP exhibit an inverse relationship between muscular strength and the level of obesity.

Supported by Central RSCA and Undergraduate Research Grant, SJSU.

Cerebral palsy (CP) is a neurological disorder caused by lesions in the brain that affect motor development. It is characterized by impaired motor function and atypical development of musculoskeletal structures and muscular weakness. Individuals with CP develop osteoporosis earlier in their age compared to the general population. Bone weakness has a detrimental effect on the muscular system, which causes the CP population to be more prone to bone fracture and further immobility. To date, it is still uncertain whether structural alterations in the skeletal system in CP population have an influence on bone mineral density (BMD) and muscular strength.

**Purpose:** To determine relationships between skeletal architecture, BMD, and muscular strength in adults with and without CP.

**Methods:** We studied 14 participants with and without CP. Dual energy X-ray absorptiometry was used to measure regional BMD and bone mineral content (BMC) at the lumbar spine, proximal femur, and forearm regions. Architectural differences were measured as angles from a center line through the femoral neck to top and bottom of greater trochanter, and lesser trochanter. Leg and forearm muscular strength was assessed by using Humac Norm isokinetic dynamometer, and handgrip dynamometer, respectively, to measure peak torque of the left leg.

**Results:** Individuals with CP had significantly different skeletal architectural angles presented by the top and bottom of greater trochanter (e.g., top, 56.4±4 CP vs. 72.3±3 control, degrees, p<0.05) BMC, BMD, T-scores, and Z-scores were all significantly different in the left femoral neck (e.g., T-score, -2.96±0.92 CP vs. -0.89±0.49 control, P<0.05) as well as in the forearm regions (e.g., radius 33%, T-score, 0.48±0.31 CP vs. -0.3±0.18 control, p<0.05). Individuals with CP had significantly lower knee extensor peak torque (e.g., at 90 degree/sec; 11.8±2.3 CP vs. 68.0±12.5 control, ft-lbs, P<0.05). Architectural angles of the femur were closely related to the level of BMD on femoral neck regions and leg muscular strength (p<0.05).

**Conclusion:** These findings suggest that femoral skeletal architecture (via reduced angles of top and bottom of greater trochanter) has an influence on BMD and muscular strength in adults who have CP.

Supported by Central RSCA and Undergraduate Research Grant, SJSU.
The Changes of IPT pre- and post-training (N*M)

<table>
<thead>
<tr>
<th></th>
<th>Control Group</th>
<th>FR group</th>
<th>ST group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-training</td>
<td>207.10±12.78</td>
<td>213.52±8.38</td>
<td>212.51±10.51</td>
</tr>
<tr>
<td>Immediately post-training</td>
<td>152.41±9.25**</td>
<td>157.31±7.14**</td>
<td>158.02±9.13**</td>
</tr>
<tr>
<td>24h post-training</td>
<td>155.94±9.84**</td>
<td>165.57±8.49**</td>
<td>163.25±8.81**</td>
</tr>
<tr>
<td>48h post-training</td>
<td>159.97±10.26**</td>
<td>193.71±7.57**</td>
<td>182.19±9.95****</td>
</tr>
</tbody>
</table>

3398 Board #: 267  June 2 9:30 AM - 11:00 AM

A Novel Application of Altitude Training Masks and High-Intensity Interval Training to Improve Exercise Performance


PURPOSE: This study seeks to examine the effects of altitude training masks (ATM, also known as respiratory fitness masks) used solely during recovery periods (low intensity intervals) during high-intensity interval training (HIIT).

METHODS: Participants underwent six weeks of HIIT (3 sessions per week) with each exercise bout consisting of eight, 60-second high-intensity intervals interspersed with eight, 90-second low-intensity recovery intervals. Workloads for the high-intensity intervals were individualized to elicit heart rates within 10 bpm of each participant’s maximal heart rate as assessed during a baseline graded exercise test. The low-intensity recovery intervals were prescribed at a fixed workload corresponding to approximately 10% of each participant’s baseline maximal oxygen consumption (VO₂max). Participants were assigned via block randomization to either a control group (CG) or a training mask group (TMG) that only wore the ATM during the low-intensity recovery bouts of the HIIT intervention. Participants performed a graded exercise test to volitional exhaustion at baseline and following the HIIT intervention as well as a vascular occlusion test to assess the tissue saturation index nadir (TSIN) of the gastrocnemius. Outcomes were VO₂max, oxygen consumption at anaerobic threshold (AT), and TSIN.

RESULTS: Twelve participants (7 women; 25.5±4.5 years; BMI: 23.6±1.5 kg/m²) have completed the study to date. VO₂max increased significantly in the TMG group (40.5±3.6 to 44.5±5.4 ml/kg/min, p=0.03) but not in the CG. TSI was significantly greater in the TMG group (-17.8±7.3 to -28.3±7.3% from baseline, p=0.05) with no significant change in the CG. No change in AT was observed in either group.

CONCLUSIONS: Implementing ATMs only during the low-intensity recovery intervals of HIIT training appears to improve key components of cardiorespiratory function not observed in our standard HIIT training group. These findings demonstrate a novel use of ATMs that has potential to change how ATMs are used by recreational and professional athletes. These results also have implications for the use of ATMs as potential adjunctive modalities for enhancing training effects in rehabilitative settings where improvements in short time periods are desirable.

3399 Board #: 268  June 2 9:30 AM - 11:00 AM

Novel Use of Respiratory Conditioning Masks during High-Intensity Interval Training to Improve Respiratory Function in Healthy Adults


PURPOSE: The purpose of this study was to examine the effects of respiratory conditioning masks (RCMs, also known as altitude masks) on lung function when used only during the low-intensity recovery intervals of high-intensity interval training (HIIT).

METHODS: A group of recreationally active healthy adults performed a 6-week HIIT protocol where half of the participants were randomly assigned to wear an RCM during the low-intensity rest intervals (Mask Group), or no mask (Control). Participants performed three HIIT bouts per week, where each bout included eight high-intensity intervals of 60s exercise performed within 10 beats of maximal heart rate for each subject obtained from a baseline graded exercise test to volitional exhaustion. Each high-intensity interval was immediately followed by a 90s low-intensity recovery interval at a work rate corresponding to 10% VO₂max for each participant at baseline. Pulmonary function testing was also performed at baseline and following a six week intervention period.

RESULTS: 12 subjects (7 women, ages: 25.5±4.5 yrs, BMI: 23.6±1.5 kg/m²) to date completed the study. Expiratory reserve volume was significantly larger in the mask group compared to the control group after training (1.5±0.5 vs. 0.8±0.4L, p=0.02). Resting VE/VCO₂ (41.8±6.9 vs. 28.3±3.7, p=0.001) and VE/VCO₂ (47.3±11.6 vs. 35.8±3.9, p=0.04) increased in the mask group compared to controls. In the mask group alone, at peak exercise VE/VCO₂ significantly increased at isowork rates (31.5±2.3 to 34.3±3.6, p=0.02) while the respiratory exchange ratio decreased (1.22±0.11 vs. 1.14±0.08, p=0.02). Resting PETCO₂ significantly increased in the mask group alone after exercise training (111.7±6.5 vs. 115.5±6.1 mmHg, p=0.02). No other changes were observed in forced vital capacity, total lung volume, or maximal inspiratory/expiratory pressures for both groups.

CONCLUSIONS: RCMs worn only during the low-intensity recovery intervals in a 6 week HIIT protocol appear to have a significant effect on select measures of respiratory and ventilatory function. VE/VCO₂ is an indicator of ventilatory drive, and changes in VE/VCO₂ have been shown to have prognostic significance for several clinical populations. Using RCMs is this novel fashion may play a role in modifying ventilatory drive.

3400 Board #: 269  June 2 9:30 AM - 11:00 AM

Feasibly Measuring Sitting And Physical Activity In The Office Using Bluetooth Sensing

Elisabeth A. Winkler¹, Nyyssad Hadgadri², Takemi Sagiya³, Bronwyn Clark¹. ¹The University of Queensland, Herston, Australia. ²Swinburne University, Melbourne, Australia. ³Australian Catholic University, Melbourne, Australia.

PURPOSE: The office is a key setting where sitting occurs and is intervened upon. Office-specific behaviour measurement may help evaluate workplace interventions, components, such as activity-permissive workstations. We tested whether a feasible Bluetooth sensing method can provide valid measures of office time and office-specific activities.

METHODS: Workers from one building (n=29, 72% female, age 23-68 years) wore, for one workday, the actiPAC3 on the thigh and the Bluetooth-enabled ActiGraph Link on the wrist and location. Location (office/not) was estimated by signal presence/absence at two beacons in the wearer’s office, with chest-worn video cameras (McCam) as the criterion. Accuracy in location classification was assessed (F-scores) and compared (generalized estimating equations) between 60 s and 10s sampling options (i.e., feasible versus high resolution, requiring daily recharging). The validity of 60 s Bluetooth-derived measures of total time spent in the office and in office-specific activities was assessed.

RESULTS: For both the wrist and thigh-worn Link, accurate classification of location (office/not) was obtained, with a significant (p<0.05) but negligible difference between the two sampling options (F-scores were all 0.99). Agreement with the criterion in daily totals showed only small mean differences (-0.2 to +6.1 min) and moderate individual differences (95% agreement limits ±30 min or ±10 min for stepping). Mean absolute percent error was very small for office time and office sitting time (<5%), moderate for standing (17-23%), and high for incidental stepping (30-49%) and purposes walking (57-86%) due to how little of these occurred.

CONCLUSIONS: The ActiGraph Link worn on the thigh or wrist can be used to validly measure office time and office activity (provided activity is measured validly) with a 60 s Bluetooth setting that facilitates multi-day measurement without recharging. Higher resolution improves accuracy but not to a meaningful degree.
condition. These results contrast those reported from endurance exercise training and therefore present important insight into the specific contributions of RET to cardiac adaptation, even with similar training efforts. Further studies should directly compare the effects of RET and endurance exercise on the structure and function of the heart, and determine whether combined training regimes exceed a health threshold in patient populations.

Funded by NSERC grants to MZM (DG-238819-13) and SMP (RGPIN-2015-04613).

Reduced peak VO_{2} in patients with hypertrophic cardiomyopathy (HCM) is a powerful predictor of adverse outcomes, including all-cause mortality and heart transplant. The risk of death or transplant is reduced by 21% for each 1 mL/kg/min increase in peak VO_{2}. A randomized clinical trial conducted by our group demonstrated 16 weeks of moderate intensity exercise training increased peak VO_{2} in HCM patients by 6% compared to usual activity. Whether exercise attenuates disease progression is unknown but is a critical question given the lack of disease modifying therapy. This is challenging to address in patients because disease typically progresses slowly and non-linearly over many years. Therefore, we propose a pre-clinical HCM model to determine the effects of exercise on phenotypic emergence and progression.

PURPOSE: To determine exercise capacity in a cardiac troponin T mutant (cTnT) mouse model of HCM through TT (protocol) and graded exercise test (GXT).

METHODS: C57BL/6 non-transgenic (NTG) (n=6 female, n=5 male) and ΔcTnT (n=4 female, n=8 male) mice (age 10-12 months) were subjected to a human parallel gum XWT/staged increases in inclination (0°-15°) and speed (30 km/h up to 60 km/h). Two sample t-tests were used for data analysis.

RESULTS: Baseline and peak VO_{2} were significantly lower in cTnT compared to NTG mice (baseline: 83.12 mL/kg/min ± 2.07 vs 95.88 mL/kg/min ± 3.61; p=0.001) and peak VO_{2} was 202.35 mL/kg/min ± 2.04 vs 191.20 mL/kg/min ± 5.37; p=0.01 in both comparisons). Compared to NTG mice, cTnT ran a shorter distance (201.33 m ± 6.40 vs 253.81 m ± 8.78; p<0.0001) and for less time (13.25 min ± 0.25 vs 15.22 min ± 0.31; p<0.0001). Respiratory exchange ratio and mean blood weights were not different between cTnT and NTG mice.

CONCLUSION: This is the first report of reduced peak VO_{2} in the cTnT pre-clinical model. These findings mirror reductions in peak VO_{2} observed in HCM patients, the magnitude of which is a strong predictor of adverse outcomes. Our observation validates the model as one in which the effects of an exercise intervention on phenotypic conversion and progression can be assessed. Support by UM.

3403 Board #: 272
June 2 9:30 AM - 11:00 AM
The Influence of EMG-Based Maximal Voluntary Contraction (MVC_{EMG}) Intensity on Middle Cerebral Artery Velocity
HeeYong Lee,1 Seongdaee Kim,1 Myungjin Oh,1 Ilgyu Jeong1,2
1Hannam University, Daejeon, Korea, Republic of; 2Baekseok University, Cheonan, Korea, Republic of.

It has been established that cerebral blood flow velocity (CBFV) might elevate due to the increase of exercise intensity determined by \%VO_{2 max} during a cardiopulmonary exercise test. But, the response of CBFV to EMG-based maximal voluntary contraction (MVC_{EMG}) during isolated muscle contraction remains unclear.

PURPOSE: To evaluate the influence and adaptability as the intensity index of MVC_{EMG} on middle cerebral artery velocity (MCA_{Fmean}) during isometric strength type exercise.

METHODS: Fourteen healthy male (24.1±1.4yrs) were asked to perform the 45° knee extension isometric contraction during 60 seconds. All participants performed three times in random order the isometric exercise of 100%, 80% and 60% MVC_{EMG}.

RESULTS: MVC_{EMG} of 100%, 80%, and 60% MVC_{EMG} were measured at rest, during exercise, immediately after exercise, 30 seconds recovery, 60 seconds recovery and 2 minutes recovery using transcranial-Doppler sonography. All data were analyzed using two-way ANOVA (3 intensities x 6 times) with repeated measures.

RESULTS: MVC_{EMG} in 80% MVC_{EMG} was significantly higher than MVC_{EMG} in 60% MVC_{EMG} (110±19 vs. 89±19 cm/s, p<0.05) immediately after exercise. MVC_{EMG} in 100% MVC_{EMG} was significantly higher than MVC_{EMG} in 60% MVC_{EMG} in 30 second recovery (114±71.10 cm/s, p<0.00) and 60 seconds recovery (97.16 vs. 73±12 cm/s, p<0.005). Heart rate in 100% MVC_{EMG} was significantly higher than in 80%, 60% MVC_{EMG} at immediately after exercise (128±26 vs. 106±15; 97±10 beats/ min, p<0.01) and at 30 seconds recovery (102±18 vs. 87±12; 80±9 beats/min, p<0.05).

CONCLUSIONS: These results suggest that the increase of isometric exercise intensity up to ~80% of MVC_{EMG} might induce the elevation of MCA_{Fmean}.

3404 Board #: 273
June 2 9:30 AM - 11:00 AM
Muscle Afferent Blockade Improves Endurance Exercise Performance When O_{2} Transport To Locomotor Muscles Is Preserved
Thomas J. Hureau1, Joshua C. Weavil2, Taylor S. Thurston2, Huan-Yu Wan, Jayson R. Gifford3, Jacob E. Jessop3, Michael J. Buys2, Russell S. Richardson2, Markus Ahamm3,4
1University of Strasbourg, Strasbourg, France; 2University of Utah, Salt Lake City, UT.

PURPOSE: During high intensity whole body endurance exercise, feedback from group III/IV locomotor muscle afferents restricts neural drive to the legs while, simultaneously, optimizing peripheral O_{2} transport. We attenuated feedback from these sensory neurons to investigate their limiting effects on endurance exercise performance while controlling for locomotor muscle O_{2} transport.

METHODS: Eight healthy men (VO_{2peak} = 55:6 ± 6 mL/min/kg) performed 5 km cycling time trials (TT) under control conditions and with lumbar intrathecal fentanyl impairing neural feedback from the lower limbs. To assure similar arterial oxygenation, O_{2} content (C_{O_{2}}) was raised by breathing 100% O_{2} during the control (HYP+) and the fentanyl (HYP-) TT. The TT was also performed in normoxia (NORM) with intact afferent feedback (NORM). After each TT, subjects performed a short, constant-load cycling bout at the mean power output achieved during the preceding TT while common femoral artery blood flow (Q_{F}) was quantified using Doppler ultrasound. Leg O_{2} transport was calculated as the product of C_{O_{2}} and Q_{F}. Using supramaximal electrical femoral nerve stimulation, peripheral and central fatigue were quantified via pre-to-post exercise changes in quadriceps twitch force (ΔQ_{F}) and voluntary activation (AVA).

RESULTS: Both Q_{F} (~16 mL/min) and C_{O_{2}} (~24 mL O_{2}/dL) were similar at the mean power output achieved during HYP+ and HYP- (P > 0.6), but significantly different from NORM (~4 mL/min and 22 ± 1 mL O_{2}/dL). Importantly, leg O_{2} transport was similar between HYP+ and HYP- (~0.36 ± 0.6 mL O_{2}/min) and significantly greater than NORM (0.33 ± 0.05 mL O_{2}/min). Although mean power output was augmented during HYP+ compared to NORM (287 ± 57 W and 261 ± 38 W, P = 0.05), ΔQ_{F} was similar between trials (~40%). Interestingly, HYP+ further increased mean power output (309 ± 17 W) and improved time trial performance (3.3 ± 0.9%) compared to HYP- (P < 0.05). This was associated with a greater ΔAVA (~54 ± 9%), but a similar ΔAVA (~4%) in HYP+ compared to HYP-.

CONCLUSIONS: Group III/IV muscle afferent feedback restricts endurance exercise performance and limits the development of peripheral fatigue. However, to expose the performance limiting aspect of these sensory neurons during whole body exercise, their impact on covective O_{2} transport needs to be controlled.

3405 Board #: 274
June 2 9:30 AM - 11:00 AM
Highly Cushioned Shoes Increase Leg Stiffness And Amplify Impact Loads During Running
Juh-Pekka Kulmala,1 Jukka Kosonen,2 Jussi Nurminen,1 Janne Aveila,2,3 Harvard University, Cambridge, MA; 2,3University of Jyväskylä, Jyväskylä, Finland; 4Helsinki University Hospital, Helsinki, Finland.

Shoe cushioning represents a standard way to manage impact loading and consequent injuries due to running. However, although modern shoes have become increasingly cushioned, running injuries have not decreased. The probable, but poorly understood explanation for this counterintuitive is that shoes with additional cushion have only limited ability to attenuate impacts during running, even though they can significantly reduce impact loads in vitro mechanical tests.

PURPOSE: The aim of this study was to investigate why shoes with additional cushion provide little or no reduction to the impact loads during running.

METHODS: Ground reaction forces (GRF) and the spring-like leg mechanics were examined among 12 healthy volunteer male runners while running at 4.0 m/s with a rearfoot striking pattern using normal (NORM, Brooks Ghost 6) and maximalist (MAX) cushion shoes (Hoka One One). We determined and compared vertical GRF impact peak (VIP) and average vertical loading rate (AVLR), as well as leg stiffness and leg compression between shoe conditions. RESULTS: GRF parameters illustrating the hardness of the impact showed significantly greater values when running with MAX shoes, as compared to running with NORM shoes (VIP (p = 0.01) and AVLR (p = 0.038) were 10.7% and 12.3% greater in the MAX shoe, respectively). The analysis of the spring-like leg function revealed that during running with MAX shoes runner’s leg became stiffer (p = 0.012) and compresses less (p = 0.006) when compared to running with NORM shoes.

CONCLUSIONS: The present findings suggest that increased landing stiffness may have contributed to the reduced impact attenuation, even when running with highly cushioned shoes.

Abstracts were prepared by the authors and printed as submitted.
be responsible for opposing the impact attenuation effect of extra shoe cushioning during running. In fact, highly cushioned MAX shoes can even amplify impact loading during running, which thus may increase the risk of impact-related running injuries.

<table>
<thead>
<tr>
<th></th>
<th>NORM shoe</th>
<th>MAX shoe</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring-like leg mechanics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leg stiffness (kN/m^2)</td>
<td>26.1 (7.1)</td>
<td>27.9 (8.2)</td>
<td>0.012*</td>
</tr>
<tr>
<td>Leg compression (cm)</td>
<td>8.3 (1.3)</td>
<td>8.0 (1.4)</td>
<td>0.006**</td>
</tr>
<tr>
<td>Impact loading</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertical GRF impact peak (BW)</td>
<td>2.01 (0.32)</td>
<td>2.25 (0.32)</td>
<td>0.001***</td>
</tr>
<tr>
<td>Vertical GRF loading rate (BW/s)</td>
<td>59.0 (15.2)</td>
<td>67.3 (14.6)</td>
<td>0.038*</td>
</tr>
</tbody>
</table>

Research from elite contact sports is suggesting an athlete may incur hundreds of repetitive head impacts over one season. However, the majority of studies to date have focused on elite level athletes. To date, little investigation has focussed on non-elite sports, particularly in Australia where the majority of sport is played at the community level where little attention is given to those players who may experience significant head trauma. This is the first study to present head impact data in community level football. PURPOSE: To quantify head impact data over a season of Australian Rules football (ARF) played at the community club level. METHODS: Twenty-five male players (mean age 24.9 ± 5.2 years) from one ARF club participated in 20 home and away matches in the regular season. During matches, head impact data was collected using individually fitted instrumented mouth guards (Nexus A9, Impact Technologies, Australia). Data was sampled at 1000 Hz, with a 500 Hz bandwidth. If the mouthguard exceeded the pre-determined 10 g linear acceleration threshold 100 milliseconds (ms) of data (10 ms pre-trigger and 90 ms post-trigger) were recorded to the on-board memory for later downloading. Outcome measures included mean impact number, mean peak linear and peak rotational acceleration, and injury severity profiles for linear (ISP_linear) and rotational (ISP_rotation) accelerations. RESULTS: A total of 2810 impacts were recorded. Individual players experienced an average of 162 ± 40.5 impacts over the course of the season resulting in mean of 8 ± 11 impacts per-player per match. Linear accelerations ranged from 10 g to a peak of 176 g; with a mean, media and 95th percentile value of 33 g, 25 g, and 76 g respectively. Rotational accelerations ranged from 87 rad/s^2 to a peak of 19831 rad/s^2 with a mean, median, and 95th percentile value of 4004 rad/s^2, 3109 rad/s^2, and 5953 rad/s^2 respectively. The ISP_linear profiles showed 86.6% were mild severity, 12.7% were moderate severity, and 0.7% were severe. The ISP_rotation profiles showed 69%, 19.8%, and 11.2% were mild, moderate and severe respectively. CONCLUSIONS: This novel study provides data to better inform medical personnel in the identification and evaluation of at-risk players for concussion at non-elite community level ARF.
<table>
<thead>
<tr>
<th>Author Name</th>
<th>Page Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almeida, K.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, N.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, R.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, S.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, V.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, W.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, X.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, Y.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, Z.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, A.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, B.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, C.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, D.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, E.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, F.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, G.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, H.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, I.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, J.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, K.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, L.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, M.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, N.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, O.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, P.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, Q.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, R.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, S.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, T.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, U.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, V.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, W.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, X.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, Y.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, Z.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, A.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, B.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, C.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, D.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, E.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, F.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, G.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, H.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, I.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, J.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, K.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, L.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, M.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, N.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, O.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, P.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, Q.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, R.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, S.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, T.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, U.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, V.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, W.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, X.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, Y.</td>
<td>2522, 2523, 2524</td>
</tr>
<tr>
<td>Almeida, Z.</td>
<td>2522, 2523, 2524</td>
</tr>
</tbody>
</table>
Numbers listed next to each individual represent the appearance of a different person's name on that page. Bold numbers represent primary authorship associated with the presentation.
Numbers listed next to each individual represent the presence associated with the presentation. Bolder numbers represent primary contributors.
Numbered lists next to each individual present the representation number associated with the presentation. Bold numbers represent primary author.
<table>
<thead>
<tr>
<th>Author</th>
<th>Presentation Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ye, Xin</td>
<td>1792, 2298</td>
</tr>
<tr>
<td>Yeager, Shelley</td>
<td>2858</td>
</tr>
<tr>
<td>Yeates, Paul E.</td>
<td>1347</td>
</tr>
<tr>
<td>Yeh, Byung Il</td>
<td>939</td>
</tr>
<tr>
<td>Yen, Yi-Ming</td>
<td>578</td>
</tr>
<tr>
<td>Yeo, Dongseong</td>
<td>869, 873, 1371</td>
</tr>
<tr>
<td>Yeoman, Carl</td>
<td>936, 937, 948</td>
</tr>
<tr>
<td>Yeomanis, Catriona A.</td>
<td>755</td>
</tr>
<tr>
<td>Yépez, Martha Cecilia</td>
<td>1823, 1825</td>
</tr>
<tr>
<td>Yi, Kyungsook</td>
<td>1992</td>
</tr>
<tr>
<td>Yi, Minqiung</td>
<td>211, 652</td>
</tr>
<tr>
<td>Yi, Naoyuki</td>
<td>352</td>
</tr>
<tr>
<td>Yi, Xiaojun</td>
<td>352, 1460</td>
</tr>
<tr>
<td>Yi, Yan</td>
<td>3310</td>
</tr>
<tr>
<td>Yin, Amelia</td>
<td>3392</td>
</tr>
<tr>
<td>Yin, Hang</td>
<td>3392</td>
</tr>
<tr>
<td>Yin, Jianchun</td>
<td>2537</td>
</tr>
<tr>
<td>Ying, Wu</td>
<td>2210</td>
</tr>
<tr>
<td>Yingling, Vanessa R.</td>
<td>1765, 1812, 2481</td>
</tr>
<tr>
<td>Yil-Papuri, Sami</td>
<td>2827</td>
</tr>
<tr>
<td>Yoh, Jaime</td>
<td>3402</td>
</tr>
<tr>
<td>Yogov-Seligmans, Galt</td>
<td>2531</td>
</tr>
<tr>
<td>Yohn, Haley N.</td>
<td>3398, 3399</td>
</tr>
<tr>
<td>Wolff, Mary M.</td>
<td>443, 1308</td>
</tr>
<tr>
<td>Yokoi, Hajime</td>
<td>2317</td>
</tr>
<tr>
<td>Yon, JuFu</td>
<td>2812</td>
</tr>
<tr>
<td>Yonemura, Ken</td>
<td>1535</td>
</tr>
<tr>
<td>Yonemura, Masahiro</td>
<td>2044</td>
</tr>
<tr>
<td>Yoo, Jaryeon</td>
<td>1456</td>
</tr>
<tr>
<td>Yook, Junghoo</td>
<td>2419</td>
</tr>
<tr>
<td>Youn, Sun Sun</td>
<td>998</td>
</tr>
<tr>
<td>Youn, Kun Ho</td>
<td>1344</td>
</tr>
<tr>
<td>Youn, Tejin</td>
<td>201, 1520, 2204</td>
</tr>
<tr>
<td>Yorio, Patrick</td>
<td>2977</td>
</tr>
<tr>
<td>Yoshitaka, Toshihito</td>
<td>2264, 2271</td>
</tr>
<tr>
<td>Yoshihisa, Toshiki</td>
<td>361</td>
</tr>
<tr>
<td>Yoshioka, Tomo</td>
<td>2226</td>
</tr>
<tr>
<td>Yoshioka, Aiko</td>
<td>908, 3317</td>
</tr>
<tr>
<td>Yoshikawa, Caroline A.</td>
<td>1301, 2372</td>
</tr>
<tr>
<td>Yoshitake, Yumiko</td>
<td>329, 370</td>
</tr>
<tr>
<td>Yost, Kyle</td>
<td>2691</td>
</tr>
<tr>
<td>Yost, Kyle H.</td>
<td>1722</td>
</tr>
<tr>
<td>You, Tongian</td>
<td>410, 2946</td>
</tr>
<tr>
<td>Youn, Alanna</td>
<td>2456</td>
</tr>
<tr>
<td>Young, Andrew J.</td>
<td>1177</td>
</tr>
<tr>
<td>Young, Heather</td>
<td>2357</td>
</tr>
<tr>
<td>Young, Hui-Jui</td>
<td>181</td>
</tr>
<tr>
<td>Young, Julie C.</td>
<td>2838</td>
</tr>
<tr>
<td>Young, Kaelyn C.</td>
<td>881, 2265</td>
</tr>
<tr>
<td>Young, Kathryn</td>
<td>2095</td>
</tr>
<tr>
<td>Young, Rya</td>
<td>2095</td>
</tr>
<tr>
<td>Youngoussi, Zobir</td>
<td>854, 854</td>
</tr>
<tr>
<td>Youngoussi, Zobir M.</td>
<td>1981</td>
</tr>
<tr>
<td>Yu, Bing</td>
<td>615</td>
</tr>
<tr>
<td>Yu, Carmen S.</td>
<td>1076</td>
</tr>
<tr>
<td>Yu, Hongjun</td>
<td>362</td>
</tr>
<tr>
<td>Yu, Lap-Fai</td>
<td>410</td>
</tr>
<tr>
<td>Yu, Yi-Zhen</td>
<td>1388</td>
</tr>
<tr>
<td>Yuan, Bing</td>
<td>639</td>
</tr>
<tr>
<td>Yue, Shi</td>
<td>1959</td>
</tr>
<tr>
<td>Yun, Jeokoo</td>
<td>2761</td>
</tr>
<tr>
<td>Yun, So Mi</td>
<td>2366</td>
</tr>
<tr>
<td>Yun, Somi</td>
<td>3222</td>
</tr>
<tr>
<td>Yang, Patrick</td>
<td>888</td>
</tr>
<tr>
<td>Yurkevics, Bea R.</td>
<td>822, 1383</td>
</tr>
</tbody>
</table>

**Author Index**

*Z*

Zaboronski, Alexander 1438
Zaborowska, Karolina 1026
Zabrocki, Hannah 2489
Zachariadis, Ilias 2748, 3171
Zachmeier, Nicholas B. 844
Zagardo, Michael 971
Zagatun, Baltzoglou 397, 385
Zahl, Frank 2904
Zak, Roksana 1387
Zakrzewski, Rebecca A. 313
Zalaksulu, Andrejs 3178
Zaldvar, Frank P. 177
Zaleski, Amanda 1194
Zaleski, Amanda L. 1210
Zalma, Brian 392
Zalma, Brian A. 1521
Zambolin, Fabio 2067
Zamboni-Ferraris, Fabio 1008
Zambruno, Jean C. 1518
Zambruki, Edward 2957
Zambruki, Edward J. 2950
Zamzow, Clare 1269, 2394
Zandoni, Bruna A. 1788, 2417

*Numbers listed next to each individual represent the presentation number associated with the presentation. Bold numbers represent primary author.*

ACSM May 29 – June 2, 2018  Minneapolis, Minnesota