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.

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 athletes (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.

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 7,819 concussion injuries in 7,789,818 Athlete-Exposures (AEs), for an overall incidence rate of 0.95 concussions per 1000 AEs. Football (n=3,118, 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 per 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.

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 1,000AE, 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 (92.5%). These concussions were reported across 467,278AE, for a concussion rate of 0.69/1,000AE. The concussion rate was higher in competition than practice (1.75 vs. 0.15/1000AE; IRR=11.51; 95%CI: 8.45, 15.68). Most concussions were due to contact with another player (47.1%), followed by contact with the boards/glass (31.5%). 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: 1.12, 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.

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.

Purposes and Duration Of Symptoms

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. Several 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 calculated.

RESULTS: Seven of the nine included studies individually reported higher rates of lower extremity MSK injury after concussion, while two reports noted no significant difference in injury risk between concussed athletes and non-concussed control athletes. Rates 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 multinomial 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, amnestic, 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 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 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 for remainder of season, respectively (p<0.05). CONCLUSIONS: Specific CSCs were significantly associated with return-to-play time in college athletes.

Risk of Lower Extremity Musculoskeletal Injury after Concussion: A Meta-Analysis

S2 Vol. 49 No. 5 Supplement

ACSM May 29 – June 2, 2018

Minneapolis, Minnesota

Wednesday, May 30, 2018

BOARD #5

May 30 9:30 AM - 11:30 AM

Purposes And Duration Of Symptoms

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 concussive 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 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.
Previous research has found an association between concussion and adverse health outcomes in former professional football players. Less is known about such an association in former players without professional football experience.

**PURPOSE:** Examine whether concussion history - without professional football exposure - was associated with adverse health outcomes in former college football players, 15 years following their collegiate playing career.

**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 ≥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 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, 5.0), 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)

**Board #8**

**Concussion Is Associated With Adverse Health Outcomes: A 15-Year Follow-Up Of Former College Football Players**

Zachary Y. Kerr1, Leah C. Thomas1, Janet E. Simon2, Michael McCrea1, Kevin M. Guskiewicz, FACSM1. 1University of North Carolina at Chapel Hill, Chapel Hill, NC. 2Ohio University, Athens, OH. Medical College of Wisconsin, Milwaukee, WI.

(Sponsor: Kevin Guskiewicz, FACSM)

(No relevant relationships reported)

**Board #9**

**Detection of Functional Overreaching in Endurance Athletes Using Proteomics**

David C. Nieman, FACSM1, Arnuod Green2, Artyom Pugachev2, Gianmarco Vacci1. 1Appalachian State University, Kannapolis, NC. 2ProteoQ Biosciences GmbH, Berlin, Germany. 1University degli Studi di Milano-Bicocca, Milan, Italy.

(No relevant relationships reported)

There is a strong demand for diagnostic tools to identify athletes in various training states. **PURPOSE:** To determine if a cluster of proteins could be identified through proteomics procedures that are linked to functional over-reaching (FOR) in male endurance athletes. **METHODS:** Participants (N=10, age 38.3±3.4 yr, VO2max=41.3±1.7 ml·kg⁻¹·min⁻¹) served as their own controls and in random, counterbalanced procedures to identify a cluster of 13 proteins linked to FOR (7.5 h of high intensity exercise). Proteins were considered for the FOR cluster if they were elevated during one of the two recovery days but not more than one of the exercise days (compared to rest).

The Generalized Estimating Equation (GEE) was used to identify proteins linked to FOR (between trial contrasts, P≤0.05 for proteins with CV>15%, P≤0.01 with CV>15%). **RESULTS:** TDS scores differed between FOR and rest trials, peaking on the first recovery day (9.8±3.8, 3.5±2.6, respectively, P=0.029). A total of 13 proteins was linked to FOR and of these, 11 were related to the immune system, and two to exercise-induced physiological responses. Immune-related proteins included those associated primarily with the acute phase response, complement activation, and granulocyte function. **CONCLUSIONS:** This study utilized targeted, GEE proteomics procedures to identify a cluster of 13 proteins linked to FOR (7.5 h of high intensity exercise over three days), and 85% of the proteins were related to immune system activation during the 2-day recovery period.

**Board #10**

**Changes In Functional Activation Of Memory T Cells Following Exercise: A Pilot Study**

Huner D. Peterson, Alexander K. Holbrook, Allyson Ahlenfeldt, Brad W. Macdonald, 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)

**Board #11**

**Memory T (Tₘ) cells function to provide long-lasting protection against re-exposure to pathogens. The recall response of Tₘ cells to foreign antigen is quicker and of a greater magnitude than a naïve T cell. How functional activation is altered in Tₘ 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 in memory T (CD4+CD45RO/CD45RA-) in humans. **METHODS:** Utilizing a cross over design, untrained subjects undertook a control and exercise visit. The control visit consisted of 30 min of seated rest while the exercise session entailed 3 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 conducted through negative selection using a Human CD4+ T cell enrichment kit. CD4+ T cells were plated at 1.5 x 10⁶ cells/ml in 200 μl of ImmunoCult T-cell expansion media directly after isolation and cultured through CD3/CD28 or no stimulation. Cells were incubated for 1 and 3 days at 37°C in a humidified incubator with 5% CO₂ and then analyzed by flow cytometry. Early (CD69), middle (CD25),
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 RMANOVA.s.

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 Treg 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 Treg 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.

99 Board #4 May 30 9:30 AM - 11:30 AM
Ultra-endurance Triathlon Performance And Markers Of Whole-body And Gut-specific Inflammation
Kyle A. Smith1, Jacob N. Kisoilek1, Margaret C. Morrisey1, Patrick G. Saracino2, Brandon D. Willingham2, Samantha M. Leyh1, Daniel A. Baur3, Marc D. Cook2, Michael J. Ormsbee, FACSM1. 1Florida State University, Tallahassee, FL. 2North Carolina Agriculture and Technical State University, Greensboro, NC.

(Purpose: To examine the influence of the Ultraman triathlon (3 days of non-continuous racing; stage 1: 10 km swim and 144.8 km cycle; stage 2: 275.4 km cycle; stage 3: 84.4 km run) on circulating plasma concentrations of whole-body (CRP, IL-6, and IL-10) and gut-specific inflammatory markers (IL-17 and IL-23) in trained participants (N = 17, 14 men, 3 women), and determine whether these variables influence performance. METHODS: Fourteen triathletes (age: 39 ± 8 years) were evaluated pre-race and post-race for circulating concentrations of CRP, IL-6, IL-10, IL-17, and IL-23. Blood samples were drawn two days prior to stage 1 (1600 h) and one day after stage 1 (1200 h). Plasma biomarker concentrations were determined by ELISA according to manufacturer’s instructions. Data were analyzed with SPSS. RESULTS: Plasma CRP significantly increased from pre-race (266.27 ± 276.18 ng/mL) to post-race (25,891.94 ± 12,888.65 ng/mL; p < 0.001). Plasma IL-10 increased from pre-race (3.46 ± 2.98 pg/mL) to post-race (5.15 ± 1.89 pg/mL). Pre-race concentrations of IL-6 were below detectable limits; post-race IL-6 concentrations were 4.00 ± 3.74 pg/mL. Both pre-race and post-race concentrations of IL-17 and IL-23 were below detectable limits. Pearson’s correlation between mean finish time and post-race CRP and post-race IL-10 was 0.35 and 0.54 (p < 0.05), respectively. CONCLUSIONS: The significant increase in CRP during the race may have been due to muscle damage. The greater anti-inflammatory capacity of the athletes likely led to increased clearance of IL-6, IL-17, and IL-23 the day after the race; the increase in IL-10 concentrations during the race reflect this anti-inflammatory response. A significant positive correlation between post-race IL-10 concentrations and mean finish time may indicate that a relationship between anti-inflammatory responses and performance exists. This study was supported by Florida State University.

100 Board #5 May 30 9:30 AM - 11:30 AM
Development Of A Consumer-oriented Microbiome Tracker
Shawn M. Talbott, FACSM1, Marc P. Oddou2, Bret J. Stephens2, 1EQQIL, Draper, UT. 2Wasatch Scientific Services, Murray, UT.

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(s): Currently, most laboratory methods to test the microbiome rely on 16S ribosomal RNA sequencing. This testing method has several drawbacks, including: slow turnaround time, inconclusive quantification of low abundance species, labor intensive library preparation, and relatively high cost. Furthermore, the output is generally geared toward the scientific community, and are not particularly intuitive for the general public (e.g. consumers, patients). Methods: Herein, we have developed 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 interventions (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.

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 markers of early, middle, and late stage activation in CD4+ cells. METHODS: Utilizing 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% 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 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 days at 37°C in a humidified incubator with 5% CO2 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 RMANOVA. 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 in large samples to define the exercise strategies targeting improvements 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.
The physical benefits of resistance exercise training (RET) are well documented. Less 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.

**Purpose:** To estimate the effect of RET on depressive symptoms, and to determine whether variables of logical, theoretical, and/or prior empirical relation with depressive symptoms account for significant variance in the overall effect.

**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 involved 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 Δ of 0.66 (95%CI: 0.48-0.83; z=7.75; p<0.001). Significant heterogeneity was indicated (Q_HtR=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, indicated (z=7.03, p<0.001). Significant heterogeneity was observed (z=103.54, p<0.001). Strong measurement agreement was observed for VO_2peak across conditions (ICC = 0.85, typical error = 2.37 ml/kg·min⁻¹, coefficient of variation = 4.6%). Time- and interval-dependent reductions in FS were observed with each interval condition, slightly higher in the HIIT-60 trial than other HIIT trials. When compared with moderate-intensity exercise, high-intensity exercise has been found to result in superior or equal improvements in cardiometabolic (CMB) health and body composition. However, individual differences exist in one’s ability to tolerate higher intensities of exercise which may put those with a lower tolerance at risk for less favorable CMB health and body composition. **Purpose:** To examine the associations of exercise intensity tolerance and individual CMB risk factors and body composition variables in young adult females. **METHODS:** The sample consisted of 25 non-obese [body mass index (BMI) < 30 kg/m²] apparently healthy females aged 22.6 ± 4.2 years examined in a cross-sectional study. After obtaining informed consent, each participant had measured exercise intensity tolerance using The Preference for and Tolerance of the Intensity of Exercise Questionnaire, individual CMB risk factors, and body composition including anthropometric and imaging assessments. Sperman’s Rho (r) was used to examine the bivariate correlations between exercise intensity tolerance and CMB risk factors and body composition variables. Statistical significance was set a priori at P<0.05. **RESULTS:** Exercise intensity tolerance was associated with a number of CMB risk variables including resting heart rate (p = 0.36, P < 0.01), systolic (p = -0.48, P = 0.01), diastolic (p = -0.57, P < 0.01) blood pressure; total cholesterol (p = -0.53, P < 0.01), triglycerides (p = -0.52, P < 0.01), and low-density lipoprotein (LDL) cholesterol (p = -0.48, P < 0.02). For body composition, exercise intensity tolerance was correlated with waist-to-height ratio (WHR) (r = -0.48, P < 0.02), and body fat percentage (r = -0.51, P < 0.01), and waist-to-hip ratio (WHR) (r = -0.48, P < 0.02).
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.

METHODS: Eighty female individuals with ATS dependence were randomly assigned to Tai Chi intervention (TC) and standard care (SC) for 6 months. The TC group was tutored for exercise intervention based on a simplified 24-Form Tai Chi, and the exercise activities in the SC group included 5 minutes of recreation activity (Guang Bo Ti Cao), 5 minutes of gesture language exercises, and self-study. Outcome measurements were applied with Pittsburg Self-rated Sleep Quality Index (PSQI), Self-rated Depression Scale (SDS), and fitness evaluation at the baseline, 3 months and 6 months. A follow-up relapse investigation was also conducted. The investigation content was relapse of ATS dependents who had completed treatment from Shanghai mandatory detoxification and rehabilitation center (SMIDRC). Pearson chi-square test was applied for categorical variables and independent sample t-test was applied for continuous variables at the baseline comparison, repeated measures analysis of variance was applied with year of drug dependence as the covariate.

RESULTS: 4 ATS dependents in TC and 10 ATS dependents in SC were found relapse, the relapse in the TC group was 9.5% and in the SC group was 26.3%. The cessation duration of ATS dependents from left SMIDRC to be found relapse was 517 days in TC and 219 days in the SC group, the numbers of relapse in TC was significantly less than that of in SC group tested by chi-square test. The PSQI scores of sleep duration, need for sleep medications, daytime dysfunction were found to have a significant difference by time × group interaction after 6 month. The SDS showed no significant difference between the two groups, but the score of SDS in TC decreased after 6 months intervention and no changes in SC. The pulse rate was significantly decreased in the TC group compared to the SC group after 6 months.

CONCLUSIONS: The 4 year follow-up study indicated that TC is a cheap and potential supplementary treatment for ATS dependents. The results provided an evidence that Tai Chi can reduce female ATS dependents relapse.

Topic 702: Cognition and Emotion
Title: Cognitive reappraisal improves psychological state during endurance exercise
Giles, G.E.1,2,3, Cantelon, J.A.1,2,3, Eddy, M.D.1,2,3, Bruney, T.T.1,2,3, Urry, H.L.1,2, Taylor, H.A.1,4, Mahoney, C.R.1,2,3, Kanarek, R.B.1
1US Army Natick Soldier Research, Development, and Engineering Center 2Center for Applied Brain and Cognitive Sciences 3Tufts University

PURPOSE: To determine whether emotion regulation strategies, specifically cognitive reappraisal and distraction, influence psychological state and prefrontal cortex oxygenation during endurance exercise.

METHODS: Twenty four individuals (15 female; age 18-33 years) participated. All on three separate occasions, participants ran for 90 minutes at 75-85% age-adjusted maximum heart rate while employing one of three emotion regulation strategies: no instruction, cognitive reappraisal, i.e. reevaluating the running experience to reduce felt negative emotions, and distraction, i.e. re-directing attention by focusing on neutral thoughts unrelated to the running experience. Participants completed subjective measures of valence (very bad to very good), arousal (low "alow arousal" to "high arousal") and perceived exertion ("no exertion at all" to "maximal exertion") before, every 30 minutes during, and after exercise. Functional near-infrared spectroscopy (fNIRS) was used to quantify changes in prefrontal cortex oxygenation (O2Hb).

RESULTS: Participants felt lower emotional arousal and physical exertion when instructed to utilize cognitive reappraisal than when given no emotion regulation instruction, although not when instructed to utilize distraction. No differences in emotion 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.

**Board #8**
May 30 9:30 AM - 11:30 AM
Examining The Effects of Functional Resistance Training on Affect, State Anxiety and Enjoyment in College-Age Females
Jamie Faro1, Phil Gona1, Marisa Hastie2, Laura L. Hayman1, Julie Wright1, Jessica Whiteley.1 1University of Massachusetts Boston, Boston, MA. 2Lasell College, Newton, MA.

Funding: None

PURPOSE: To compare the effects of continuous exercise at self-selected intensity and high-intensity interval training (HIIT) on physiological, perceptual, and affective responses in overweight women. METHODS: Twenty-eight overweight or obese women were randomly assigned to 1 of 2 groups: continuous exercise at self-selected intensity (SS, n = 14) or high-intensity interval training (HIIT, n = 14; 10 x 60 s). Both groups underwent 4 weeks of training, 3 days/week, 20 min each session, on a cycle ergometer. Rating of perceived exertion (RPE; OMNI-Cycle), affective responses (pleasure/displeasure; Feeling Scale), and heart rate (HR) were recorded during each session. Peak oxygen uptake (VO2max), body mass, and maximal power were assessed pre- and post-intervention. RESULTS: A two-way ANOVA revealed no effect of the intervention on BMI and maximum power output in both groups. VO2max increased similarly in both groups (SS pre: 22.9 ± 2.9 ml·kg⁻¹·min⁻¹; post: 25.4 ± 4.5 ml·kg⁻¹·min⁻¹; HIIT pre: 24.8 ± 3.9 ml·kg⁻¹·min⁻¹; post: 26.9 ± 4.2 ml·kg⁻¹·min⁻¹) (p < .05). Across the 4 weeks of the intervention, %HR (week 1: 77.7 ± 7.1; week 2: 75.9 ± 7.6; week 3: 54.8 ± 8.2; week 4: 76.6 ± 6.3) and RPE (week 1: 4.7 ± 1.2; week 2: 4.8 ± 1.2; week 3: 4.5 ± 1.6; week 4: 4.5 ± 1.7) were lower compared to HIIT (week 1: 83.3 ± 5.6; week 2: 82.1 ± 5.5; week 3: 82.4 ± 6.2; week 4: 81.7 ± 6.1) and (week 1: 5.4 ± 1.6; week 2: 5.7 ± 1.5; week 3: 5.4 ± 1.6; week 4: 5.1 ± 1.6) (p < .05). CONCLUSION: Four weeks of SS or HIIT had similar effects on cardiorespiratory fitness. SS was perceived as less strenuous, however, both groups exhibited similar affective responses.

College-aged females, who are less likely to meet ACSM resistance training (RT) guidelines than males, face a number of barriers to RT adoption and maintenance. Females experience more perceived barriers to RT (such as enjoyment, pleasure, embarrassment and anxiety) suggesting that programs could be developed to address these barriers. Functional RT (FRT) uses multi-joint exercises similar to activities of daily life and has yet to be compared to traditional RT using machines (TRT) to determine the effects of acute sessions in this population. PURPOSE: To compare the effects of an acute bout of both a functional and traditional RT program on affect, state anxiety (SA) and enjoyment. METHODS: Female students (n= 27) ages 18-35 years (26±4.3 years; BMI=25.2±3.5 kg/m²) not currently meeting RT guidelines completed 4 trainer-led RT sessions (2 FRT, 2 TRT) within 4 weeks (2-7 days apart) in a randomized crossover design. Session 1 of each RT type familiarized participants to the exercises, while session 2 consisted of 2 sets of 10 repetitions at a moderate intensity (using RPE scale) and collection of assessment measures. Affect and SA were assessed pre, post, and 15 minutes post, while enjoyment was assessed at post. RESULTS: RPE did not differ significantly between types of training (FRT 8 ± 2; TRT 6 ± 1; p > 0.05). Repeated measures ANOVA revealed no significant differences in change scores pre to post or 15 minutes post in affect (both p > 0.05) nor SA (both p > 0.05) between FRT and TRT; however, pre to post-exercise changes in affect were positive and greater in FRT (d = 0.87) compared to TRT (d = 0.77), and greater in decreases in SA (FRT, d = 33; TRT, d = 43). Between group results indicate enjoyment levels were significantly greater following FRT compared to TRT (p < 0.05). Secondary outcomes reveal within-group increases in positive affect and decreases in SA pre to post and 15 minutes post-exercise (all p < 0.05) in both types of RT. CONCLUSION: While no differences in affect or SA were found between types of RT, participants had significantly greater enjoyment levels following the FRT session.
PHYSICAL ACTIVITY PROMOTES AN OSTEOREGULATING RESPONSE LEADING TO GREATER BONE MINERAL DENSITY (BMD). PREVIOUS STUDIES SUGGEST THAT 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 FRONTAL (FDI) MUSCLES. RESULTS: THERE WERE No SIGNIFICANT DIFFERENCES BETWEEN OC USERS (n=14) AND NON-USERS (n=35) FOR AGE, WEIGHT, FAT MASS, AND BONE FREE MASS. OC USERS HAD GREATER ENDOSTEAL CIRCUMFERENCE (p≤0.047). ROWERS WHO REPORTED FRACTURES IN THE 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 FRACURES HAD SIGNIFICANTLY LOWER RIB ABMD, NON-DOMINANT TRANTHER Z-SCORES, AND 66% TIBIAE MUSCLE CROSS-SECTIONAL AREA COMPARED TO ROWERS WHO DID NOT REPORT FRACURES (p≤0.049). CONCLUSIONS: ROWERS WHO USE OC HAD GREATER BONE DENSITY AND QUALITY AT MOST SITES AS COMPARED TO NON-USERS. OUR FINDINGS SUGGEST THAT IN THIS POPULATION, OC USAGE DOES NOT IMPEDE SKELETAL HEALTH.

CONCLUSIONS: OC USERS HAD GREATER ENDOSTEAL CIRCUMFERENCE (p≤0.047). ROWERS WHO REPORTED FRACTURES IN THE 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 FRACURES HAD SIGNIFICANTLY LOWER RIB ABMD, NON-DOMINANT TRANTHER Z-SCORES, AND 66% TIBIAE MUSCLE CROSS-SECTIONAL AREA COMPARED TO ROWERS WHO DID NOT REPORT FRACURES (p≤0.049). CONCLUSIONS: ROWERS WHO USE OC HAD GREATER BONE DENSITY AND QUALITY AT MOST SITES AS COMPARED TO NON-USERS. OUR FINDINGS SUGGEST THAT IN THIS POPULATION, OC USAGE DOES NOT IMPEDE SKELETAL HEALTH.

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>0.935 ± 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

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 IN MUSCLE COMPOSITION AND MOTOR UNIT FIRING RATES IN COLLEGIATE FEMALE ROWERS.

METHODS: NINE MALES (MEAN±SD: AGE = 22±3.3 YEARS, WEIGHT = 73.4±10.3 KG, BMI = 22.5±3.3 KG/M²) AND 11 FEMALES (MEAN±SD: 164.23±7.3 CM, WEIGHT = 63.65±3.3 KG, BMI = 23.6±1.1 KG/M²) WERE RECRUITED BASED ON AERobic FITNESS LEVELS OF 5 OR ABOVE. A 5 MIN ISOMETRIC WRIST EXTENSION AT 60% OF MAXIMAL VOLUNTARY CONTRACTION WAS COMPLETED TO DETERMINE ISOMETRIC MOTOR UNIT THRESHOLDS (MUT) AND MEAN FIRING RATES (MFR). CONCLUSIONS: SEX-RELATED DIFFERENCES IN MUSCLE COMPOSITION AND MOTOR UNIT FIRING RATES WERE OBSERVED IN THE FIRST DORSAL INTEROSSAEUS MUSCLE. MALES HAD A SIGNIFICANTLY HIGHER MUSCLE CS AND MORE CONTRACTION AREA, GENERATING MORE FORCE. DURING THE 70% MVC, FEMALES HAD SIGNIFICANTLY LOWER MUSCLE CS AND A LOWER CONTRACTION AREA, GENERATING LESS FORCE. DURING THE 70% MVC, BOTH FEMALES AND MALES HAD A LOWER CONTRACTION AREA. DURING THE 70% MVC, FEMALES HAD A LOWER CONTRACTION AREA. DURING THE 70% MVC, BOTH FEMALES AND MALES HAD A LOWER CONTRACTION AREA. DURING THE 70% MVC, BOTH FEMALES AND MALES HAD A LOWER CONTRACTION AREA.
1) voluntary wheel running would not protect mice lacking estrogen receptor α in skeletal muscles (skmERαKO) against fatigue and 2) treatment with progesterone after ovariotomy would protect against fatigue. **Methods:** Study 1: 32 skmERαKO mice and WT (Flox) littermates were randomized into 4 groups: skmERαKO-Run, skmERαKO-Ran, skmERαKO-Run, and skmERαKO-Ran. 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 were 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 skmERαKO groups compared to WT (p < 0.02). Additionally, muscles of skmERαKO mice had greater fatigue (p < 0.001) and did not recover strength as well as WT mice (p < 0.001). Study 2: After 60 fatigue 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: skmERαKO mice produce less force regardless of physical activity. Although 20 wks of wheel running partially prevented force loss during fatigue in skmERαKO mice, force production during recovery remained low, indicating that estrogen 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. Straight, John D. Chase, Philip A. Ades, Michael J. Toth, Mark S. Miller.1 University of Massachusetts Amherst, Amherst, MA. 2 University of Vermont, Burlington, VT. (No relevant relationships reported)

**PURPOSE:** Adiposity adversely affects physical function in older adults, but the mechanism underlying this relationship remains largely unknown. 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 in 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. Colson3, David D. Thomas4, Dawn A. Lowe, FCASM.1 University of Jyväskylä, Jyväskylä, Finland. 2 University of Minnesota, Minneapolis, MN. 3 University of Arizona, Tucson, AZ. (Sponsor: Dawn A. Lowe, FCASM) (No relevant relationships reported)

Muscle weakness is consistently reported as an independent risk factor for high mortality in aged individuals. In aging females, ovarian hormone deficiency that occurs during menopause has a role in the loss of skeletal muscle strength. At the molecular level, the loss of muscle force production may be attributed to the slowing of myosin-actin cross-bridge kinetics and different structural states of the myosin head is key. There are three distinct functional states of the myosin head: active, states, relaxed (RX) and super-relaxed state (SRX). The SRX state is emerging as an important factor in muscle mechanics and regulation, yet its possible role in aging process has remained elusive. A previous study showed that estradiol-mediated signaling reversibly regulated ATP turnover in SRX state, which in turn contribute to the age-related decline in muscle strength and function in females. **PURPOSE:** To further evaluate the role of ovarian hormones in SRX regulation during aging, we measured 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 these from young mice (SRX: female 81 ± 177 x 95; p = 0.033 and RX: 18 ± 15 vs 22 ± 22, 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 SRX and RX 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-A26160, 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, Janneet Kaur, Karolina J. Koziol, Bianca A. R. Galletti, Debra A. Bemben, FACSM, Michael G. Bemben, FACSM. 1 University of Oklahoma, Norman, OK. (Sponsor: Michael G. Bemben, FACSM) (No relevant relationships reported)

**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 byWRV (30 Hz of magnitude and 3 mm of amplitude) for 30 s each with 1 min between trials. Field tests were used to measure mobility, fatigue, and flexibility and included timed-up and go test, 500 m walk, and seat reach. Two-way repeated measures ANOVA were used to test for group and time main effects.

**RESULTS:** Acute WBV did not improve postural balance, stability or mobility any in women with RRMS. A significant group*time interaction (p<0.05) reviewed that CON improved flexibility, while CON decreased. Additionally, a significant group*time interaction (p<0.05) showed that WBV group presented greater stability than the WBV group, at week 5. Chronically, WBV group presented greater stability than the WBV group, at week 5. Chronically, WBV group presented greater stability than the WBV group, at week 5.

**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±5.0 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 = 3665±1417; dominant = 3660±1735) while running compared to healthy individuals. Decreased movement variability manifests as more predictable movement in the involved relative to the uninjured limb (3406±2625) relative to the involved limb (3550±1619). There was a moderate relationship (r = .598, 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.

---

**Biomechanics of Walking in Healthy Adults at Different Gait Speeds**

Matt Preble1, Siddhartha Sikdar2, Oladipo Eddo3, Stuart McCrory1, Shane Caswell4, Ana M. Azevedo5, Nelson Cortes5, George Mason University, Manassas, VA; 1University of Lisbon, Portugal; 2 (No relevant relationships reported)

Lower extremity biomechanical parameters during gait are of interest in degenerative pathologies, such as knee osteoarthritis. However, few investigations have looked at the effect of walking speed on knee biomechanics (e.g., moments). Methods: 10 healthy volunteers (25.6±5.0 years, 1.68±0.11 m, 73.1±18.0 kg) completed 3 trials each of walking at 4 different speeds (preferred [PS], fast [FS], slow [SS], & very slow [VSS]). The range for each speed was determined by measuring a percentage of the participants PS: FS = (120 ± 5%), SS = (80 ± 5%), and VSS = (50 ± 5%). Speed was determined using timing gates (Power Systems Bower) placed 2.4 meters apart. Data was collected using a motion capture system (VICON, 200Hz) while participants walked across a ~6-meter walkway; 4-in-line force plates (Bertec, 100Hz) captured ground reaction force. Sagittal and frontal plane kinematics and kinetics at the knee were calculated for the 4 speeds using Visual 3D. Differences between the 4 speeds were analyzed using a repeated-measures GLM with pairwise comparisons (p<0.05).

---

**Thematic Poster - Walking Biomechanics**

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

Room: CC-Lower level L100H

Chair: Jean L. McCrory, FACSM, West Virginia University, Morgantown, WV

(No relevant relationships reported)

---

**Board #1**

May 30 9:30 AM - 11:30 AM

**Decreased Gait Variability Following Anterior Cruciate Ligament Reconstruction Negatively Impacts Patient Function**

Terry L. Grindstaff1, Meredith Chaput1, Brooke Farmer1, Kayla Anderson1, Amelia S. Lanier2, Brian A. Kuarr1, Christopher Wichman1, Kimberly A. Turman1, 1Creighton University, Omaha, NE; 2University of Nebraska at Omaha, Omaha, NE; 3University of Nebraska Medical Center, Omaha, NE. GIKK Ortho Specialists, Omaha, NE. (Sponsor: Joan Eckerson, FACSM)

(No relevant relationships reported)

---

**Board #2**

May 30 9:30 AM - 11:30 AM

**Biomechanics of Walking in Healthy Adults at Different Gait Speeds**

Matt Preble1, Siddhartha Sikdar2, Oladipo Eddo3, Stuart McCrory1, Shane Caswell4, Ana M. Azevedo5, Nelson Cortes5, George Mason University, Manassas, VA; 1University of Lisbon, Portugal; 2 (No relevant relationships reported)

---

**Board #3**

May 30 9:30 AM - 11:30 AM

**Impact of Lower-Extremity Gait Mechanics on Energy Cost of Walking in Younger and Older Adults**


(No relevant relationships reported)
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 conditions (p=0.18). However, time to peak vGRF (CAI: 148.47±17.9; 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 men and women are affected differently by military load carriage has become more operational relevant. Some studies have reported lighter loads have shown no differences in spatiotemporal (S-T) parameters between men v. women, while limited work comparing the effect of heavier carried loads (>30 kg) has resulted in observed S-T sex differences. However, none of these studies have systematically controlled for anthropometric differences. which may have contributed to those discrepancies. **PURPOSE:** To examine the effect of carrying light to heavy loads on S-T parameters in anthropometrically matched male and female Soldiers. **METHODS:** Eight male and 8 female Soldiers were matched on height and body weight (differences < 2.54 cm and 4.54 kg). All participants walked unloaded (BW), and with vest-borne loads of 15, 35, and 55 kg. Each load was carried for 10 min while walking on a level treadmill at 1.34 m/s, with kinematics collected after 5 min. 2-way ANOVA RM compared the effects of load carriage on S-T variables between men and women. **RESULTS:** Several significant differences were observed as a function of increasing load (stride rate and % double support increased, stride length decreased), but no significant differences between men and women were observed (Table 1). **CONCLUSIONS:** Our results did not show the same discrepancies at the heaviest loads as reported in previous studies, suggesting that S-T differences may disappear at higher loads when anthropometry is tightly matched. **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.

**Table 1. Spatiotemporal parameters for different loads and genders.**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Gender</th>
<th>BW</th>
<th>15 kg</th>
<th>35 kg</th>
<th>55 kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gait cycle</td>
<td>M (sec)</td>
<td>F</td>
<td>1.04±0.04</td>
<td>1.04±0.03</td>
<td>1.04±0.04</td>
</tr>
<tr>
<td>Stride rate</td>
<td>(steps/min)</td>
<td>M</td>
<td>80.4±1.0</td>
<td>74.4±1.0</td>
<td>68.2±1.0</td>
</tr>
<tr>
<td>Stride length</td>
<td>(cm)</td>
<td>M</td>
<td>6.13±0.02</td>
<td>6.03±0.02</td>
<td>5.93±0.02</td>
</tr>
<tr>
<td>Stride width</td>
<td>(cm)</td>
<td>M</td>
<td>1.04±0.02</td>
<td>1.04±0.02</td>
<td>1.04±0.02</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>vGRF</th>
<th>CAI: 5.69±0.62N/kg/s; Control: 5.29±0.44N/kg/s, p=0.034</th>
</tr>
</thead>
</table>

**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.

**MAT LOCATED OVER THE FORCE PLATE.** Participants completed 3 trials with both left and right feet (total: 60 trials). A multi-segment foot marker set was used to calculate movement of M1 relative to the midfoot. The plantar pressure data was used to identify the entire metatarsal region, as well as each individual metatarsal. Peak load in the metatarsals and percent of peak carried in each metatarsal were then calculated. A linear regression was used to determine the relationship between M1 ROM and percent peak load carried in each metatarsal. **RESULTS:** Peak load in the metatarsals was 1.25 (± 0.25) % body weight. At peak loading, M1, M2, M3 carried 19.14 (± 7.89), 24.53 (±3.92), and 28.37(±4.09) % of the load, respectively. Average ROM for M1 relative to midfoot was found to be 7.84 (± 2.60°). There was not a significant difference between M1 ROM and percent load under M1 (R² = 0.05, p = 0.22). M2 (R² = 0.01, p = 0.70), or M3 (R²= 0.02, p = 0.25). **CONCLUSION:** Our results do not support the hypothesis that M1 hypermobility increases loading of M2 and M3. Future studies should examine whether other aspects of dynamic M1 mobility instead of simple ROM may be related to increased loading of M2 and M3.

**MAT LOCATED OVER THE FORCE PLATE.** Participants completed 3 trials with both left and right feet (total: 60 trials). A multi-segment foot marker set was used to calculate movement of M1 relative to the midfoot. The plantar pressure data was used to identify the entire metatarsal region, as well as each individual metatarsal. Peak load in the metatarsals and percent of peak carried in each metatarsal were then calculated. A linear regression was used to determine the relationship between M1 ROM and percent peak load carried in each metatarsal. **RESULTS:** Peak load in the metatarsals was 1.25 (± 0.25) % body weight. At peak loading, M1, M2, M3 carried 19.14 (± 7.89), 24.53 (±3.92), and 28.37(±4.09) % of the load, respectively. Average ROM for M1 relative to midfoot was found to be 7.84 (± 2.60°). There was not a significant difference between M1 ROM and percent load under M1 (R² = 0.05, p = 0.22). M2 (R² = 0.01, p = 0.70), or M3 (R²= 0.02, p = 0.25). **CONCLUSION:** Our results do not support the hypothesis that M1 hypermobility increases loading of M2 and M3. Future studies should examine whether other aspects of dynamic M1 mobility instead of simple ROM may be related to increased loading of M2 and M3.

**Table 1. Spatiotemporal parameters for different loads and genders.**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Gender</th>
<th>BW</th>
<th>15 kg</th>
<th>35 kg</th>
<th>55 kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gait cycle</td>
<td>M (sec)</td>
<td>F</td>
<td>1.04±0.04</td>
<td>1.04±0.03</td>
<td>1.04±0.04</td>
</tr>
<tr>
<td>Stride rate</td>
<td>(steps/min)</td>
<td>M</td>
<td>80.4±1.0</td>
<td>74.4±1.0</td>
<td>68.2±1.0</td>
</tr>
<tr>
<td>Stride length</td>
<td>(cm)</td>
<td>M</td>
<td>6.13±0.02</td>
<td>6.03±0.02</td>
<td>5.93±0.02</td>
</tr>
<tr>
<td>Stride width</td>
<td>(cm)</td>
<td>M</td>
<td>1.04±0.02</td>
<td>1.04±0.02</td>
<td>1.04±0.02</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>vGRF</th>
<th>CAI: 5.69±0.62N/kg/s; Control: 5.29±0.44N/kg/s, p=0.034</th>
</tr>
</thead>
</table>

**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.
Clinical Case Slide - Hip and Pelvis I

Wednesday, May 30, 2018, 9:30 AM - 11:10 AM
Room: CC-200E

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

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

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

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

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

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

May 30 10:30 AM - 11:10 AM
Novel Treatment of Anterolateral Thigh Pain-Triathlon
Ciara Johnson, McCasey Smith, Neil Segal. University of Kansas Medical Center, Kansas City, KS.

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

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 cst - 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-expected range) MRI Hip wo cst, 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

OUTCOMES: 1. Conservative treatment - protected weight-bearing with crutches, analgesia, and supportive, and PT.
2. Calcium and vitamin D supplementation. 3. On 4 week follow-up, she was upgraded to WBAT 4. On 2 month follow-up, 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.
increased weakness with running. Pregabalin, naproxen, 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 Analogue 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, temporary therapeutic benefit. At presentation, Visual Analogue Scale pain score was 6-8/10.
3. Hip flexor strain
4. Hip adductor tear
5. Hip labral tear

Tests and Results:

WBC: 16.0 (H)
CRP: 4.6 cm hematoma over left adductor muscles.

Physiotherapy:
Tenderness to palpation over pubic symphysis 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 scrot tests positive on the right. FABER and log roll negative bilaterally.

Differential Diagnosis:
1. Athletic pubalgia
2. Hip flexor strain
3. Hip adductor tear
4. Hip labral tear

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 fevers. She had left hip dysplasia and left femoral and obturator nerve palsy since birth. Now she described constant stabbing pubic symphysis pain with radiation into her right medial thigh. Pain intensity was 9/10 and worse with hip flexion, adduction, and walking. She required a walking stick for ambulation.

Physical Examination:
Tenderness to palpation over pubic symphysis 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 scrot tests positive on the right. FABER and log roll negative bilaterally.

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, temporary therapeutic benefit. At presentation, Visual Analogue Scale pain score was 6-8/10.
3. Hip flexor strain
4. Hip adductor tear
5. Hip labral tear

Tests and Results:

WBC: 16.0 (H)
CRP: 4.6 cm hematoma over left adductor muscles.

Physiotherapy:
Tenderness to palpation over pubic symphysis 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 scrot tests positive on the right. FABER and log roll negative bilaterally.

Differential Diagnosis:
1. Athletic pubalgia
2. Hip flexor strain
3. Hip adductor tear
4. Hip labral tear

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:
General - No acute distress, well-appearing
HEENT - Sclera anicteric, tympanic membranes normal
Neck - Supple. Thyroid palpable, no enlargement or nodules
Respiratory - Clear to auscultation bilaterally, no dyspnea
Cardiovascular - Regular rate and rhythm, no murmur
Abdomen - Soft, non-tender, non-distended, no mass, bowel sounds present
GU - No testicular mass

DIFFERENTIAL DIAGNOSIS:
1. Mononucleosis
2. Neoplasm
3. Hyperthyroidism
4. HIV
5. Vitamin B12 or D Deficiency
6. Diabetes mellitus

TESTS AND RESULTS:
Initial Labs:
TSH - <0.01
Urinalysis - 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 Phos 81, Bil 0.6
CBC - Wbc 8.1, Hgb 13.3, Hct 39, Plt 39, Po2 38
CK - 675
ESR - 20
CRP - 0.2
Monospot - Negative
Vitamin B12 - 792
Vitamin D (25OH) - 25
Follow-Up Labs:
Free T4 - 4.65
Free T3 - >20
Thyrotropin Receptor Ab - 11
Thyroid Stimulating Ig - 5.8
Hepatitis Panel - Negative

FINAL/WORKING DIAGNOSIS:
1. Hyperthyroidism due to Grave’s Disease

TREATMENT AND OUTCOMES:
The patient was held from practice and referred to endocrinology for further evaluation and management. His increased liver enzymes were likely due to the hyperthyroidism. He was started on methimazole 20mg daily and iodoral 10mg three times per day, with a plan to check thyroid and liver function tests every 2-4 weeks. He returned to football activities and did well until he started to lose weight and methimazole dosage had to be lowered due to elevated alk phos. A baseline EKG will be obtained to ensure he is not...
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, bupropion 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.

140

May 30 10:10 AM - 10:30 AM
Exercise Intolerance-cycling
Devon E. Hutton, Sean C. Robinson. Oregon Health and Science University, Portland, OR.

(Sponsor: Diane L Elliot, FACSM)

(No relevant relationships reported)

HISTORY: A 55-year-old competitive male cyclist presented with one year of progressive exercise intolerance, increased dyspnea on exertion, and four weeks of bilateral ankle edema. He also reported chest discomfort with exertion, orthostasis, and weight gain. On review, he initially reported exercise intolerance with fatigue eight months earlier with EKG showing sinus arrhythmia and normal labs except low total protein. Cycling stress test with VO2 max showed ST depression in inferior leads and VO2 max of 27.6ml/kg/min. Follow up stress echo was negative for wall motion abnormalities.

PHYSICAL EXAMINATION: Examination revealed regular rate and rhythm without extra sounds, clear lungs bilaterally, and 1+ pitting edema up to the knees.

DIFFERENTIAL DIAGNOSIS: Ischemic cardiomyopathy, Hypothyroidism, Malignancy

TEST AND RESULTS: Labs: Cr 0.81mg/dL, Total protein 5.9g/dL, Albumin 3.0g/dL, Hemoglobin 15.0g/dL, Ferritin 111ng/mL, TSH 2.05mU/L, Testosterone 434ng/dL, Cortisol 14.6ug/dL, 24hr Urine protein 2773mg/24hr.

ECHOCARDIOGRAM: LV size and LV EF normal. Severe LV hypertrophy by area length method 144g/m2. RV size and RVEF normal. RV hypertrophy present. Moderate biventricular enlargement. Suggests infiltrative cardiomyopathy.

FINAL WORKING DIAGNOSIS: AL Amyloidosis with infiltrative cardiomyopathy.

TREATMENT AND OUTCOMES: Ordered MR Cardiac w/wg: Biventricular hypertrophy with preserved right and left ventricular systolic function. Dilated right atrium. Mild to moderate mitral and moderate tricuspid regurgitation. Small pericardial effusion. Abnormal late gadolinium enhancement of basal LV myocardium and both atria. Suggests cardiac amyloidosis. Ordered UPEP/SPED-UP: Urine protein conc: 82 mg/dL. Urine monoclonal protein free lambda light chains; SPED: Serum lambda light chain 1230mg/L, Serum kappa/lambda ratio 0.006. Referred to Heme/One-Bone marrow biopsy: Monoclonal plasmacytosis, negative for amyloid deposition; Kidney biopsy: Amyloidosis, AL-type, with predominant glomerular involvement;

Started Andromeda Clinical Trial—CyBorD, and Daratumumab;
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 size and strength 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 muscle 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 training 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 protocol consisted of the back barbell squat with either 20% 1RM 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 barbell 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±7.5 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.

163 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
Ethan C. Hill, Terry Housh, FACSM, Cory Smith, Joshua Keller, Richard Schmidt, Glen Johnson, FACSM. University of Nebraska - Lincoln, Lincoln, NE. (Sponsor: Terry Housh, FACSM)
(No relevant relationships reported)

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 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 dynameter at a velocity of 120°·s⁻¹. 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 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.

164 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 Alonso2, Yasser Alakhdar3, Moisés Picón1. 1University of Alicante, Alicante, Spain. 2International Hypopressive and Physical Therapy Institute, Vigo, Spain. 3University of Valencia, Valencia, Spain. (No relevant relationships reported)

Low-intensity resistance exercise associated with blood flow restriction (LI-BFR) has demonstrated to be an effective strength training methodology with similar hypertrophy gains than conventional resistance exercise (RE). PURPOSE: To compare the acute effects of high intensity RE (HI), low intensity RE (LI) and low intensity RE with blood flow restriction (LI-BFR) on heart rate (HR) and blood pressure (BP) in healthy subjects. METHODS: 52 subjects (27±3.7 years; BMI: 27.3±3.1) were assigned into three groups: High intensity (HI, 75%-1RM; n=15); low intensity (LI, 30%-1RM; n=13); and low intensity with blood flow restriction training (LI-BFR, 30%-1RM and 30% of total vascular restriction; n=24). All participants performed 4 sets of plantar flexion in the leg press machine with 1 set of 30 repetitions following 3 sets of 15 (for LI and LI-BFR group) or 10 repetitions (HI group). Blood flow restriction was achieved using a cuff positioned on the dominant calf. The cuff was inflated at 30% of total vascular restriction of each individual (mean: 47.6 ± 19.8 mmHg). Cardiovascular variables were obtained during and after the session. RESULTS: Results indicated that HR increased significantly during the 4 exercise set for all groups (p < 0.05), although the highest increases were found during the last set for the HI group (pre: 70.0±10.0 bpm; post: 81.6±11.7 bpm; p < 0.001) and during the first set for the LI-BFR group (pre: 66.1±12.9 bpm; post: 73.7±15.1 bpm; p < 0.001). There were no significant differences in BP for any group. However, significant intergroup differences were observed in systolic BP during the first set for HI and LI-BFR groups (p = 0.03), HI and LI-BFR promoted significant systolic BP reductions (p < 0.001) 30min post-exercise (pre: 126.1±11.7 mmHg; post: 112.3±14.0 mmHg), 45min post-exercise (pre:126.1±11.7 mmHg; post:113.1±10.2 mmHg) and for HI group post-15min (pre: 123.6±15.7 mmHg; post: 115.0±15.9 mmHg), 45min post-exercise (pre:123.6±15.7 mmHg; post:114.1±16.7 mmHg) and post-60min (pre: 123.6±15.7 mmHg; post:113.1±14.7 mmHg). There were no significant changes (p > 0.05) for diastolic BP and HR of the LI-BFR group. CONCLUSION: LI-BFR resistance training is able to generate an acute hemodynamic and cardiovascular response similar to HI and LI resistance exercise. HI and LI-BFR seem to promote a hypotensive post-exercise response.

165 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 Alonso2, 1University of Alicante, Alicante, Spain. 2International Hypopressive and Physical Therapy Institute, Vigo, Spain. (No relevant relationships reported)

Recently, it has been suggested that resistance exercise (RE) can be applied for cardiovascular function, maintenance and/or for rehabilitation purposes. PURPOSE: To compare the acute effects of high intensity RE (HI), low intensity RE (LI) and low intensity RE with blood flow restriction (LI-BFR) on heart rate (HR) and blood pressure (BP) in healthy subjects. METHODS: 52 subjects (27±3.7 years; BMI: 27.3±3.1) were assigned into three groups: High intensity (HI, 75%-1RM; n=15); low intensity (LI, 30%-1RM; n=13); and low intensity with blood flow restriction training (LI-BFR, 30%-1RM and 30% of total vascular restriction; n=24). All participants performed 4 sets of plantar flexion in the leg press machine with 1 set of 30 repetitions following 3 sets of 15 (for LI and LI-BFR group) or 10 repetitions (HI group). Blood flow restriction was achieved using a cuff positioned on the dominant calf. The cuff was inflated at 30% of total vascular restriction of each individual (mean: 47.6 ± 19.8 mmHg). Cardiovascular variables were obtained during and after the session. RESULTS: Results indicated that HR increased significantly during the 4 exercise set for all groups (p < 0.05), although the highest increases were found during the last set for the HI group (pre: 70.0±10.0 bpm; post: 81.6±11.7 bpm; p < 0.001) and during the first set for the LI-BFR group (pre: 66.1±12.9 bpm; post: 73.7±15.1 bpm; p < 0.001). There were no significant differences in BP for any group. However, significant intergroup differences were observed in systolic BP during the first set for HI and LI-BFR groups (p = 0.03), HI and LI-BFR promoted significant systolic BP reductions (p < 0.001) 30min post-exercise (pre: 126.1±11.7 mmHg; post: 112.3±14.0 mmHg), 45min post-exercise (pre:126.1±11.7 mmHg; post:113.1±10.2 mmHg) and for HI group post-15min (pre: 123.6±15.7 mmHg; post: 115.0±15.9 mmHg), 45min post-exercise (pre:123.6±15.7 mmHg; post:114.1±16.7 mmHg) and post-60min (pre: 123.6±15.7 mmHg; post:113.1±14.7 mmHg). There were no significant changes (p > 0.05) for diastolic BP and HR of the LI-BFR group. CONCLUSION: LI-BFR resistance training is able to generate an acute hemodynamic and cardiovascular response similar to HI and LI resistance exercise. HI and LI-BFR seem to promote a hypotensive post-exercise response.
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. 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.

**CONCLUSIONS**: 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. **PURPOSE**: The purpose of this study was to investigate the effect of different exercise modalities on QTd in sedentary women. METHODS: A total of 26 volunteers were recruited and randomized into an aerobic exercise group (n=16; 35±2.2 years) and a resistance exercise group (n=10; 36.3±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 decreases 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 from 17.3±5.3 to 8.3±3.7 ms (p<0.01). For the resistance exercise group, QTd decreased from 50±15.0 to 26.2±11.4 ms, and a resistance exercise group (p<0.05), but not significantly in CSG. 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

**CONCLUSIONS**: Heat 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 (s.d.=27.8) milliseconds and 68.3 (s.d.=28.8) milliseconds, respectively. We observed an ICC of 0.947 (95% confidence interval 0.803-0.987). We calculated the minimal detectable difference to be 18.4 milliseconds. **CONCLUSIONS**: HRV measurements taken from a heart rate strap and android phone application appear reliable in young, healthy subjects at rest as indicated by a relatively high ICC. However, a daily change in RMSSD needs to be considered with respect to innate measurement error in order to reflect meaningful change, which for the Polar H7 sensor and HRV Elite application pairing appears to be slightly greater than eighteen seconds.

**Elevation training masks (ETM) have become popular in professional & recreationally active populations to enhance performance via purported adaptations associated with high elevation training (HET) and respiratory muscle training (RMT).** **PURPOSE**: To compare the effect of training with (TM) to without (CON) wearing the ETM. **METHODS**: 8 healthy recreationally active adults (TM: M=2, F=2; 26.25±1.50; 25.05±1.42 kg/m²; CON: M=3, F=1; 31.56±0.95 yr; 24.92±1.83 kg/m²) were recruited & provided consent for this study. VO2max and time to exhaustion (TTE) were assessed (Bruce protocol GXT, w/ & w/o ETM). Anaerobic endurance was assessed using two consecutive 300-yrd shuttle sprints (separated by 5min). Pulmonary function was assessed using a metabolic cart (FVC, MVV, FEV1). Following group assignment (TM and CON), subjects trained 3d/wk for 12 wks alternating between steady state running (Progression: 65->85% VO2max, 30->45min) and intense sprint conditioning every other session with VO2max reassessment following wk 6. The TM group performed all sessions wearing the ETM at manufacturer reported simulated altitude of 9,000 ft. A) group x (2)time ANCOV A followed by a Tukey's post-hoc test was used to detect within group and between group differences following training. Type I error set at α=0.05. **RESULTS**:
### TABLE 1

<table>
<thead>
<tr>
<th>GROUPS</th>
<th>Aerobic Capacity</th>
<th>% Change</th>
<th>Masked Time to Exhaustion</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Train-</td>
<td>Pre- Training</td>
<td>Post- Training</td>
<td>Pre- Training</td>
<td>Post- Training</td>
</tr>
<tr>
<td>TM</td>
<td>37.10 ± 5.23</td>
<td>42.35 ± 4.08</td>
<td>14.12 ± 4.93</td>
<td>62.86 ± 46.89</td>
</tr>
<tr>
<td>CON</td>
<td>40.25 ± 1.3</td>
<td>32.60 ± 3.49</td>
<td>25.32 ± 4.28</td>
<td>671 ± 26.71</td>
</tr>
</tbody>
</table>

**AEROBIC CAPACITY**

<table>
<thead>
<tr>
<th>Body Composition</th>
<th>% Body Fat</th>
<th>Post-Training</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td></td>
</tr>
<tr>
<td><strong>Train-</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TM</td>
<td>33.35 ± 0.76</td>
<td>28.65 ± 3.85</td>
</tr>
<tr>
<td>CON</td>
<td>27.84 ± 1.80</td>
<td>25.68 ± 1.75</td>
</tr>
</tbody>
</table>

**BODY COMPOSITION**

### RESULTS

Changes in Vascular Function of Female University Students at Different Types of Walking

Peizhen Zhang,1 Xiangrong Shi, FACSMD2 Beijing Sport University, Beijing, China. UNT Health Science Center, Fort Worth, TX.

(NO relevant relationships reported)

### CONCLUSION

The validity of photoplethysmography-measured heart rate (PPG-HR) device 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=24.1±4.5y, height=1.71±0.06m, body fat=19.4±6.5%) dosed 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 above indexes were recorded every 5 minutes till 30 minutes.

### RESULTS

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.

**PURPOSE:** To reveal effect of different types of walking on vascular function of female university students at the same amount of exercise.

**METHODS:** Thirty normal weight female university students (age: 20.9±1.5years) participated in the study. They were randomly divided into two groups (IW group and CW group). There were fifteen female students in each group. Each group did exercise at the intensity of 65% heart rate reserve. CW(continuous walking) group walked continuously for 30 minutes without rest. IW(intermittent walking) group had 3-minute rest between two 15-minute walk. The blood pressure, heart rate, pulse wave velocity (PWV) and ankle brachial index (ABI) were determined before exercise. After exercise above indexes were recorded every 5 minutes till 30 minutes.

**RESULTS:** 30 minutes after intermittent walking, the blood pressure(SBP: 99±8.6 vs 104.8±7.5mmHg, DBP: 59±8.6 vs 65.3±9.3mmHg) and heart rate(62.1±7.6 vs 68.2±3.99pm) of IW group decreased significantly compared with pre-exercise(P<0.05). 5 minutes after exercise(SBP: 98.1±8.6 vs 100.6±7.1cm/s) and 30 minutes after intermittent walking, PWV of IW group declined significantly compared with pre-exercise(P<0.05). 30 minutes after continuous walking, the blood pressure(SBP: 100.8±4.8 vs 108.4±8.2mmHg, DBP: 59.6±6.1 vs 64.7±5.0mmHg) and heart rate(63.5±1.14 vs 70.3±9.78pm) of CW group declined significantly compared with pre-exercise(P<0.05). 5 minutes and 30 minutes after continuous walking, PWV(978.1±93.8 vs 1012.5±91.5cm/s) and DBP(61.2±6.1 vs 68.2±5.7mmHg) of IW 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.
exercise groups and the control group. Furthermore, a significant interaction between hypertension class and group was found for diastolic BP, F(2, 2.537) = 3.59, p = .034 but not for systolic BP. When the data were analyzed 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 the groups. The control group was more responsive, no response. Continued research is needed to uncover potential benefits for students engaging in movement and meditation courses over the course of an academic semester.

**RESULTS**

Frequency of stress of dancers.

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 practice 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:** Nineteen subjects (20 ± 1.1 years) 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 by CardioSoft software utilizing a 12-hour session, with significant 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 in the proportion difference of p < .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) 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 practice 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 also undertaken for variability over the course of an academic semester.

**RESULTS:** heart rate (92.8 ± 1.7bpm) and second (94.0 ± 0.6bpm, ES=0.33) pre-show recordings compared to baseline. Both HR and RMSDD 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 corresponded to dance performances in a comparable manner to other athletic populations approaching intense competition, experiencing decreased parasympathetic activity, while returning to baseline values within 24 hours of performance. This is indicative of ideal preparation and recovery from the weekend dance performances.

Heart rate variability (HRV) analysis offers insight into health status, where greater HRV is associated with better cardiovascular function. Unlike most HRV techniques, which require stationarity of data (e.g., rest), detrended fluctuation analysis (DFA) does not. However, DFA may require a larger data set for reliable results. DFA captures both short- (DFAα1) and long-term fluctuations (DFAα2). A reliable technique to measure HRV using a brief, submaximal exercise session could serve as a simple method of assessing health and adaptability. **PURPOSE:** To compare HRV using DFA during a 3-min steady state (SS) run versus a longer graded exercise test (GXT).

**METHODS:** Forty recreational runners (21.1 ± 1.6 years, 27f) completed a 2-mile (3.218-km) time trial (TT) prior to, and after 18 weeks of training for a 42.2-km marathon. Subjects performed an SS run at 75% of VT velocity for 6 min following an incremental exercise test through the manipulation of volume and load, HRV increases or decreases proportionally, directly or inversely.

Heart rate variability (HRV) analysis offers insight into health status, where greater HRV is associated with better cardiovascular function. Unlike most HRV techniques, which require stationarity of data (e.g., rest), detrended fluctuation analysis (DFA) does not. However, DFA may require a larger data set for reliable results. DFA captures both short- (DFAα1) and long-term fluctuations (DFAα2). A reliable technique to measure HRV using a brief, submaximal exercise session could serve as a simple method of assessing health and adaptability. **PURPOSE:** To compare HRV using DFA during a 3-min steady state (SS) run versus a longer graded exercise test (GXT).

**METHODS:** Forty recreational runners (21.1 ± 1.6 years, 27f) completed a 2-mile (3.218-km) time trial (TT) prior to, and after 18 weeks of training for a 42.2-km marathon. Subjects performed an SS run at 75% of VT velocity for 6 min following an incremental exercise test through the manipulation of volume and load, HRV increases or decreases proportionally, directly or inversely.

Heart rate variability (HRV) analysis offers insight into health status, where greater HRV is associated with better cardiovascular function. Unlike most HRV techniques, which require stationarity of data (e.g., rest), detrended fluctuation analysis (DFA) does not. However, DFA may require a larger data set for reliable results. DFA captures both short- (DFAα1) and long-term fluctuations (DFAα2). A reliable technique to measure HRV using a brief, submaximal exercise session could serve as a simple method of assessing health and adaptability. **PURPOSE:** To compare HRV using DFA during a 3-min steady state (SS) run versus a longer graded exercise test (GXT).

**METHODS:** Forty recreational runners (21.1 ± 1.6 years, 27f) completed a 2-mile (3.218-km) time trial (TT). 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 < .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) 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 variability (HRV) analysis offers insight into health status, where greater HRV is associated with better cardiovascular function. Unlike most HRV techniques, which require stationarity of data (e.g., rest), detrended fluctuation analysis (DFA) does not. However, DFA may require a larger data set for reliable results. DFA captures both short- (DFAα1) and long-term fluctuations (DFAα2). A reliable technique to measure HRV using a brief, submaximal exercise session could serve as a simple method of assessing health and adaptability. **PURPOSE:** To compare HRV using DFA during a 3-min steady state (SS) run versus a longer graded exercise test (GXT).

**METHODS:** Forty recreational runners (21.1 ± 1.6 years, 27f) completed a 2-mile (3.218-km) time trial (TT). 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 < .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) 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) 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; TM 156.8 ± 0.8 bpm). During the first 10 minutes, all participants perceived the CE challenge as more strenuous compared to the TM (RPE: 13.9 ± 0.1 vs. 11.3 ± 0.4). The maximum HR reached during the last 10-min (11.7 ± 0.5 vs. 12.5 ± 0.0). Immediately following the exercise, lactate was greater in CE (5.9 ± 1.4 mmol/L) vs TM (3.1 ± 1.3 p<.032). Leukocytes were significantly elevated (p<.003) immediately after exercise for both CE and TM, with no difference between exercise modes (monocytes; CE 53.3 %, TM 62.5%, granulocytes; CE 33.5%, TM 42.7%, lymphocytes; CE 11.8%, TM 70.9%). However, a moderate effect size (d = .486) 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 P01HD-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 be more feasible for busy college athletes. PURPOSE: To compare the effects of two off season endurance-training protocols on Training Load (TL), as well as time spent in Heart Rate Zone (HRZ) during in season training. METHODS: During off seasons, players (N=19) were randomly assigned to either HIIT or END. The HIIT group performed five maximal protocols on Training Load (TL), as well as time spent in Heart Rate Zones (HRZ) during in season training. Results: A repeated measures analysis of variance was used to analyze the data. Significant negative changes across the eight-year assessment period occurred in all dependent variables measured. Conclusion: In general, these data suggest a negative trend in certain cardiovascular risk markers for a group of local firefighters over time. These findings support the need for required health and fitness programs for firefighting personnel.
**Purpose:** To assess the relation between training load and performance improvement in a homogeneous group with a differentiated training programme.

**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 aerobic lactate threshold (ALT), the anaerobic lactate threshold (ANLT) and the maximum power output (MPO). Internal training load was calculated using individualized TRIMP (tTRIMP), Lucia TRIMP (LuTRIMP), 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 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 ± 25.0 and MPO from 273.5 ± 23.7 to 290.9 ± 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 progression 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 in time each in all 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.

**Purpose:** To investigate the accuracy of the prediction by the Wattbike, and to compare the results obtained from different determination methods.

**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 determination 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.

**Purpose:** To assess the ability of the Wattbike cycle ergometer to predict maximal oxygen consumption.

**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 cm, and mass of 75±12.5 kg. At the first lab visit, a 10-min self-paced VO2peak test (SVT) 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. Subjects 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 (V̇e)). A one-way repeated-measures ANOVA was used to compare the VO₂ values provided by the metabolic cart during the Wingate test to the values provided by the metabolic cart during the Wingate test given by the Wattbike to the values provided by the metabolic cart for the SPV and the 3-min test. Significant group differences were observed between groups at IS (CE 8.70±15.1 vs. NCE 2.87±2.62), OBLA, or PO (P<0.005). However, significant differences were not observed between groups at IS (CE 9.73±14.3 vs NCE 4.31±3.20), and PO (P=1.21±14.4 vs. NCE 5.48±3.57).

Conclusion: Cadence selection was not significantly related to the level of asymmetry for power output during cycling, but significant differences did exist between the groups for power asymmetry. Cycling performance is closely related to the ability to produce higher power outputs (3-min: 93±23 vs. 56±9 W). Further research is needed to understand this relationship as well as potential training interventions to reduce levels of asymmetry observed during cycling.

There is 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 7.8 competitions in the past year. 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 postures: a neutral thoracic spine position (NC) or the flexed thoracic spine position (FC) for one sprint to another. However, there was no effect of thoracic position on VO₂ (d=0.062) or the ΔMP (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 Wingate Anaerobic Test (WAnT) has been used extensively for decades for lower-extremity anaerobic power determination in various populations. While multiple devices are advertised with WAnT capability, reliability and validity data are less available.

**PURPOSE:** To determine if the Lode Excalibur Sport cycle ergometer (Groningen, Netherlands) is a reliable and valid instrument to conduct the 30-s WAnT compared to the Monark 894e Peak Bike (Vansbro, Sweden).

**METHODS:** Recreationally active male individuals age 18-45 participated in the current study. Participants were grouped into two groups, cycling experience (CE=8) and no cycling experience (NCE=12). Subjects 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 fatiguer 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 23.5±0.4 vs. 21.3±0.5 W; V̇e 3.00±0.51 vs. 3.19±0.54 L; VCO₂ 3.28±0.25 vs. 3.26±3.60 L/min; AMP -20.7±10.7 vs. -28.8±19.0 W; AFI 0.59±0.2 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 HR (d=0.03), V̇e (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.

**RESULTS:** There were no significant differences between groups and conditions.

**CONCLUSIONS:** These results show that the Wattbike 3-min test elicited a VO₂ peak value similar to that of the SPV, and it was able to successfully predict VO₂ peak.

---

**Board #26**

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

**Validity and Reliability of the Lode Excalibur Sport Cycle Ergometer for the Wingate Anaerobic Test**

William R. Lunn, Southern Connecticut State University, New Haven, CT. (Sponsor: Robert Axtell, FACSM)

(No relevant relationships reported)

---

**Board #27**

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

**Evaluation of Asymmetry in Power Production During Cycling**

John W. Farrell III, Daniel Blackwood, Brian Pribble, Rebecca Larson, University of Oklahoma, Norman, OK.

(No relevant relationships reported)

---

**Board #28**

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

**Posture Influence on Recovery Intervals in Sprint Cycling**

Deanna Emmott, Lorrie Brilla, FACSM, Harsh Buddhadev, Wren McLaughlin, Western Washington University, Bellingham, WA. (Sponsor: Lorrie Brilla, FACSM)

(No relevant relationships reported)
and SS cadences for AE and TTE (p > 0.05). No significant differences were observed at the different cadences for VO2peak.

CONCLUSION: Cadence selection appears to have a significant effect on AE and TTE, but not on VO2peak. 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.

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 intensity exercise (HII and LIE) period improves performance over a low-intensity taper period. Performance variables, HR, RPE, and HI were completed in a crossover repeated measures design. Subjects rested the day before FAM, HII, and LIE sessions.

Eight subjects (6 males/ 2 females, 29.6±4.5 yrs, VO2max 62.3±2.1 ml kg-1 min-1) completed two simulated 40km time trials following the familiarization 40km TT (FAM). The FAM trial was completed 5-10 d 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 trials.

METHODS: Eight subjects (6 males/ 2 females, 29.6±4.5 yrs, VO2max 62.3±2.1 ml kg-1 min-1) completed two simulated 40km time trials following the familiarization 40km TT (FAM). The FAM trial was completed 5-10 d 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 trials.

RESULTS: The time to completion nor average power differed between HII and LIE trials (63.2±3.51 min vs. 62.9±4.09 min, p=0.545, 219±36.3 wt vs. 222±38.6 wt, p=0.374). The time taken to reach each 5km point over the 40km distance did not differ between trials (p=0.362). The pattern of change in VO2, 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, VO2, RER, and RPE did not differ in trained cyclists during 40km time trials completed 24hr after HII and LIE sessions.

CONCLUSIONS: The results show that exercise intensity has no effect on the association between external TL (kJ spent) and internal TL estimated by sRPE or luTRIMP. However, exercise intensity did significantly affect the association between external TL and internal TL estimated by TSS. External TL is underestimated during low intensity and overestimated during high intensity sessions by TSS, compared to the kJ spent, possibly due to the quadratic influence of IF in the calculation of TL by TSS.

The IF was statistically different (p=0.05) in training compared to racing (0.59±0.03 vs. 0.73±0.03). For sRPE and luTRIMP in association with external TL no significant interactions with IF level were observed (p = 0.288 and p=0.905, respectively). However, for TSS a significant (p=0.001) interaction with IF level was seen.

CONCLUSIONS: The results show that exercise intensity has no effect on the association between external TL (kJ spent) and internal TL estimated by sRPE or luTRIMP. However, exercise intensity did significantly affect the association between external TL and internal TL estimated by TSS. External TL is underestimated during low intensity and overestimated during high intensity sessions by TSS, compared to the kJ spent, possibly due to the quadratic influence of IF in the calculation of TL by TSS.

During self-paced time trials, cyclists show unconscious non-random fluctuations in power output (PO) up to 10% above and below average. It is unknown what the effect of fluctuations of this magnitude is on physiological variables and rating of perceived exertion (RPE).

PURPOSE: 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.
Determining maximal oxygen consumption (VO\textsubscript{2max}) 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\textsubscript{2max} 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\textsubscript{2max} from \(W_{\text{peak}}\) attained during an ICT with a high initial power output (HIPO); and 2) to compare VO\textsubscript{2max}, 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 h/wk) completed both the HIPO and LIPO trials to measure VO\textsubscript{2max} and \(W_{\text{peak}}\). For the HIPO trial, initial power output (PO) was 2.5 or 3.5 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. 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\textsubscript{2max} with the HNEQ. **Results:** There was a significant difference (p<0.001) between the mean VO\textsubscript{2max} value measured during the HIPO trial (50.56 ± 7.28 mL/kg/min) and the predicted mean VO\textsubscript{2max} 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\textsubscript{2max} 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\textsubscript{2max} in recreationally trained participants. However, because the HIPO and LIPO protocols resulted in VO\textsubscript{2max} values that were not statistically different, either protocol can be used to determine VO\textsubscript{2max} in recreationally trained cyclists.

**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 resistance exercise (RE) interspersed with arm cycling (AC). A RE consisted of three blocks of 10 reps of arm exercises, performed with a resistance band at a consistent tempo (3,0,3). The first round was a warm-up, the second used a light resistance band (L), and the third a heavy resistance band (H). AC were 2 min blocks performed at 30% of peak power and ≥ 60 rpm. PA during the CRT was quantified via measurements of VO\textsubscript{2}, HR, EMG, and upper body kinematics. **RESULTS:** Kinematics were not significantly different between conditions (P< 0.05). Both VO\textsubscript{2} and HR increased in the H condition for AB and SCI (P< 0.000). HR was much higher than VO\textsubscript{2}. The increase in AB between RE conditions of 198% (L) and 206% (H). In SCI, the increase was 206% for L and 258% H conditions. Estimates of energy expenditure (EE) and METS derived by ACC and IC had similar trends during L in (AB by 33% kcal and 44% METS; Whereas SCI had 25% kcal and 140% METS). Switching to H during RE resulted in an underestimation by ACC in both groups (AB by 74% kcal and 75% METS, SCI by 32% kcal 154% METS). Magnitude of EMG increased during RE with H compared to L. **CONCLUSION:** Early analyses indicate that HR measures tended to underestimate EE for upper body work whereas ACC tended to underestimate work performed with H resistance. EMG better related to cardio-metabolic changes. **SUPPORT:** 2017-18 Sally Casanova Pre-Doctoral Scholarship. The D.R.E.A.M Project NIDLRR Project Number: 90IFT0001

**PURPOSE:** To clarify the electromyography (EMG) activity of various movement on aerobic exercise using Swiss-ball (SB exercise), we compared the EMG activity between walking and SB exercise. **METHODS:** Nine healthy men performed walking and SB exercise. EMG activity, respiratory metabolism and hart rate was measured during SB exercise and walking. During walking subjects walked at 6 km/h on treadmill ergometer. During SB exercise, subjects were sitting on the Swiss-ball and bouncing with upper and lower limb movements. The movements consisted of four patterns of upper and lower limb movements. **RESULTS:** The exercise intensity during SB exercise (4.8±0.6 Metrs) was nearly identical with walking at 6 km/h (4.5±0.4 Metrs). Compared with walking, the EMG activity in biceps fomoris (46±23%, p<0.001), gastrocnemius (78±37%, p<0.001) and gluteus maximus (70±29%, p<0.001) was significantly lower during SB exercise. On the other hand, the EMG activity in rectus abdominis during SB exercise (198±68%, p<0.001) significantly higher compared with walking. The EMG activity in vastus lateralis and latisimus dorsi during SB exercise were nearly identical with walking. **CONCLUSIONS:** The exercise intensity was nearly identical during SB exercise and walking at 6km/h. However, the EMG activity during SB exercise was significantly lower in lower limb muscles and significantly higher in rectus abdominis muscle compared with walking.
**Board #37 May 30 9:30 AM - 11:00 AM**

**Force and Electromyographic Responses during Sustained Isometric Muscle Actions anchored by RPE Values**

Joshua L. Keller, Terry J. Housh, FACSM, Ethan C. Hill, Cory M. Smith, Richard J. Schmidt, Glen O. Johnson, FACSM, University of Nebraska - Lincoln, Lincoln, NE. (Sponsor: Terry Housh, FACSM)

(No relevant relationships reported)

**PURPOSE:** Anchoring exercise intensity with ratings of perceived exertion (RPE) can be used to examine the mechanisms underlying the perception of effort during fatiguing tasks. The purpose of the present study was to examine the fatigue-related patterns of responses for force and electromyographic amplitude (EMG AMP) during sustained isometric, leg extension muscle actions anchored by RPE. **METHODS:** Ten recreationally active men (mean ± SD: 22.9 ± 2.7 y) performed 3 randomly ordered, sustained submaximal isometric leg extension muscle actions (ankle joint ≈ 120°) anchored at RPE values of 2, 5, and 8 (OMNI-RES-10-point scale) to volitional exhaustion or a maximum time limit of 5 min. Maximal voluntary isometric contractions (MVIC) were performed prior to and immediately following each sustained isometric muscle action and bipolar surface EMG signals were recorded from the vastus lateralis muscle during the sustained muscle actions. Linear regression analyses were used to examine the force and EMG AMP vs. time relationships during each sustained isometric muscle action. **RESULTS:** The pretest MVIC values (62.1 ± 14.4, 62.6 ± 14.7, and 65.5 ± 12.7 kg) were highly reliable (ICC=0.90) and were not significantly (p=0.930) different. The posttest MVICs were significantly (p=0.001) less than pretest for each sustained isometric muscle action. There were significant (p=0.001) differences between all the mean times for the sustained muscle actions (RPE 2 = 300.0 ± 0.0 s; RPE 5 = 202.0 ± 95.5 s; RPE 8 = 72.7 ± 27.6 s). Furthermore, the percent decline in force was higher with each increase in RPE (percent decline for RPE 2 = 61.0 ± 18.5%; RPE 5 = 47.4 ± 19.6%; RPE 8 = 24.9 ± 13.2%). For normalized EMG AMP, there were significant negative, linear relationships for RPE=2 (p=0.006) and RPE=5 (p=0.003) vs. time of the sustained isometric leg extension. **CONCLUSION:** For the RPE=2 and RPE=5 trials, EMG AMP and force decreased and, therefore, were dissociated from RPE. At RPE=8, however, EMG AMP was unchanged, but force decreased. Thus, EMG AMP tracked RPE, but was dissociated from force. Together, these findings suggested that the perception of effort during sustained, submaximal isometric leg extension muscle actions were not mediated by fatigue-related changes in force or EMG AMP. 

---

**Board #38 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. (Sponsor: Robert M. Otto, FACSM)

(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 Bicep 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, 7♀ 5♂) volunteered to perform a 1:3-1:3 sec repetition duration during all trials. All trials were randomly assigned and terminated at MMF. **Results:** Statistical analysis by ANOVA (p<0.05) with repeated measures was applied to these data. Percent MVC for the concentric portion of the final repetition were 62.5±27.8, 71.7±24.0, 72.8±18.4, and 79.6±18.0 at 40, 60, 80, and 100% IRM, respectively, with NSD among 60, 80 and 100%IRM. With the exception of the 40% trial, all trials revealed similar peak MU recruitment, despite different loading. The recruitment of ~70% of MVC at MMF may, in part, be attributed to the level of resistance training of the subject’s and their ability to activate MU’s. **Conclusion:** The size principle of MU recruitment is supported, in that peak recruitment of motor units can be achieved at any workload greater than 60% 1 RM, provided MMF is achieved. Intensity is best defined by the final repetition, as opposed to the initial repetition (i.e. % of IRM).
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 (CMJ) jumps. During all jumps, kinematic and kinetic data were obtained from 14 reflective markers (Plug-in-Gait marker set) and with two force plates, respectively. Hip, knee, and ankle joint powers of the right leg were calculated with inverse dynamics methods. In addition, jump heights were calculated from pelvis markers during each jump. EUR’s (CMj/SJ [unitless]) were calculated from the three-trial average peak joint powers of the hip, knee, and ankle joint (joint-specific EUR) and from jump heights (whole-body EUR) of the CMJ and SJ. Joint-specific EUR’s were compared 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 1.040±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 1.111±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 = GM 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 hip and ankle joints do not appear to contribute much at all.

It has been recently shown that while walking, old males produced significantly less power of the plantar flexors than young males. Additionally, old males have lower absolute and relative rate of torque development (RTD) of the plantar flexors, along with smaller pennation angle of the GM and less power of the plantar flexors than young males. Additionally, old males have lower absolute and relative rate of torque development (RTD) of the plantar flexors, along with smaller pennation angle of the GM and less power of the plantar flexors than young males. PURPOSE: To compare muscle structure and neuromuscular function of the plantar flexors in middle-aged women and young women.

METHODS: There were no differences in MVIC strength and normalized by weight. Independent samples t-tests were used to examine 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 EUR’s for both sets of data. The mean and standard deviation were 0.69 ± 0.79. 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 in two different hand positions. The 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.

Rock climbing is a sport that requires finger flexor strength and endurance to maintain isometric contractions during an ascent. It has been shown that climbers have higher finger flexion strength and endurance than the general population at the proximal interphalangeal joint (PIP). What is unclear, however, is if years of training and conditioning have caused these adaptations to occur bilaterally in both the dominant (D) and non-dominant (ND) arms of elite level rock climbers. It is essential for climbers to have equal, bilateral finger flexor strength and endurance capacity as rock climbing stresses both sides of the body. Weakness on one side may result in a fall or failure to complete a route. PURPOSE: To analyze change in average force production in D and ND finger flexors of elite-level rock climbers over the course of 30 min of climbing.

METHODS: 8 elite-level (age: 29.4 ± 4.7 y; climbing experience: 11.1 ±
5.2 y, mean project grade: 9.7 ± 0.3 UAA) rock climber’s D and ND finger flexor strength was tested using a mounted force transducer. A 20-sec isometric contraction was performed with the arm fixed at 90° elbow flexion and 120° of horizontal shoulder abduction. Subjects were given two warm up contractions on each hand before the 20-sec MVIC. Subjects then climbed on a treadmill for six 5-min intervals. Total climbing time was 30 min. The treadmill rotated at 6 m/min with a 6° overhang. The isometric force assessment was repeated at the end of each interval and kept to less than 3 min to prevent recovery. Force data were analyzed by removing the first and last 10% of the contraction and averaging the remaining 16 sec. Data were expressed both in absolute (N) and as a percentage of the initial MVIC trial (relative). A paired t-test was used to compare the pre-MVIC to the MVIC at 30 min. RESULTS: No statistical differences were found for change in absolute force between D (29.1 ± 26.1 N) and ND (41.5 ± 63.6 N) hands or in relative force between D (8.05 ± 7.5%) and ND (12.99 ± 11.7%) hand. Mean change in force relative to BW after 30 min of climbing: D (0.44 ± 0.39 N/kg BW), ND (0.62 ± 0.96 N/kg BW). CONCLUSION: Elite-level rock climbers do not show a bilateral deficit between their D and ND hands typically seen in other sports. This could be due to years of symmetrical training and the stresses that are applied to both limbs while rock climbing.

205  Board #46 May 30 9:30 AM - 11:00 AM Effects Of Postactivation Potentiation On Subsequent 40-yard Sprint Performance In 16- To 23-year-old Male Athletes

Cody Yates1, Peter J. Chometowski2, Mark Flury3, Steven M. Howell1, Anthony Deldin2, Frank R. Wojan1, Jamal Roper3, Jeremy Armstrong4. 1Northern Illinois University, DeKalb, IL. 2Loyola University Chicago, Chicago, IL. 3XCEL Sport Science & Fitness, Nicholasville, KY.

Postactivation potentiation (PAP) is a physiological adaptation which enables the muscles’ contractile properties to optimally perform. PAP is engendered through pre-performance conditioning activities, such as parallel back squats performed prior to a vertical jump test. PURPOSE: The purpose of this study was to determine the effects of postactivation potentiation on subsequent 40-yard sprint performance in 16- to 23-year-old male athletes, specifically, the effects of hexagonal bar deadlifts (HBD) and weighted sled sprints (WSS) as PAP-loading protocols. METHODS: Thirty-one male subjects (age, 16.9 ± 1.4 years; height, 180.2 ± 6.2 cm; weight 83.4 ± 19.2 kg) participated in this study. Testing sessions included two different visits, a control trial and a PAP-loading protocol trial separated by ~48-hours, counterbalanced, allowing each subject to act as his own control. The HBD (n = 8) group performed four sets of HBD as the PAP-loading protocol, using body weight (BW) to calculate estimated one repetition max (1RM). The WSS (n = 23) group performed four sets of WSS for 15-yards, using WSS loads of 25%, and 50% BW. Both PAP-loading protocols were followed by a 6-minute rest period and concluded with two later-timed 40-yard sprint performances. Control trials for both groups consisted of identical time intervals as the PAP trial, with active movement utilized instead of the PAP-loading protocol. RESULTS: The PAP trials had faster average 40-yard sprint times (5.35 ± 0.44 s) compared to the control trials (5.39 ± 0.39 s) for all subjects. The average difference for the PAP trials (-0.04 ± 0.10) was statistically significant (p < 0.029). However, there was statistical significance (p = 0.035) between PAP-loading groups, with WSS being the only group to improve in sprint time for the PAP trial. The WSS group improved in 40-yard sprint time for the PAP trial (5.33 ± 0.45 s) compared to the control trial (5.40 ± 0.41 s) with a PAP difference of -0.06 ± 0.10 s for 40-yard sprint. CONCLUSION: The use of a PAP-loading protocol enhances 40-yard sprint performance, with the use of WSS proving to generate faster sprint times compared to control trial (5.40 ± 0.41 s) with a PAP difference of -0.06 ± 0.10 s for 40-yard sprint.

206  Board #47 May 30 11:00 AM - 12:30 PM Altered Arginase Activity Following Ischemic Stroke: The Role Of Metabolic Syndrome

Shinichii Asano1, Paul D. Chanter1, Taura L. Bart1, 1Fairmont State University, fairmont, WV. 2West Virginia University, Morgantown, WV. 3Vältari Bio Incorporated, Morgantown, WV.

Animal models of human pathology are important to elucidate the underlying pathophysiologic mechanisms and examine novel interventions with stroke. However, there is on-going controversy surrounding the validity of rodent models in inflammation mediated diseases. A number of successful rodent models have failed to translate the findings into clinical research. Epidemiological studies suggest the metabolic syndrome (MetS) is strongly associated with poor stroke outcomes. Our laboratory has demonstrated altered plasma arginase 1 (ARG1) expression in stroke patients. ARG1 has an important role in immune system regulation and is correlated with stroke outcome. However, how ARG activity is regulated after the stroke in a rodent model of stroke and if metabolic syndrome affects these processes are not well understood. PURPOSE: The purpose of this study was to determine plasma ARG activity pre, and at 4hrs and 24 hrs post-stroke in lean (LZR) and obese (OZR, a model of metabolic syndrome) zucker rats. We hypothesized that OZR have altered ARG1 activity compared to LZR after the stroke. METHODS: Stroke was induced by middle cerebral artery occlusion (MCAO) for 60 min in LZR and OZR. Laser Doppler flowmetry was used to detect regional cerebral blood flow during occlusion and reperfusion. Venous blood samples were drawn from rat tail vein before MCAO, 4 and 24 hrs post-MCAO. Plasma was isolated, and ARG activity was measured by enzyme linked immunosorbent assay. RESULTS: In the OZR, ARG activity (Unit/L: ± SD) decreased (p<0.05) from pre (31.4±6.9 unit/L) - to 24hrs (20.6±4.9 unit/L) post-stroke in the OZR. No differences were noted at 4hrs post-stroke (24.3±5.1 unit/L). In contrast, no significant differences were noted in ARG activity pre and up to 4hrs post-stroke in the LZR. However, LZR generally presented with lower ARG activity levels than OZR.

CONCLUSIONS: These data suggest that ARG response in OZR appears to be different compared to LZR after experimental ischemic stroke insults. Further studies, a more stratified time course and biomarkers analysis of specific “inflammatory phase” of stroke in specific populations, are urgently required.
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 cardiacmyocyte 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 control (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 thus; pups nursed by LP females experience a global nutrient deficit. Following birth, pups were reorganized to 8 pups/ female. After birth, day 1 (PN1) until day 21 (PN21) the PUN nursed and received milk from females fed the LP diet, the CON mice nursed from females being fed the 20% protein diet. At PN21 the hearts were collected from the CON and PUN mice and cardiac tissue was frozen in liquid nitrogen. Two-dimensional dimensional in-gel electrophoresis (2D DIGE) is 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. Protein expression differences as a result of early life undernutrition have yet to be studied and protein networks remain unidentified.

CONCLUSION: Identified proteins allow for a proposed mechanism that may explain the cellular changes 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.

---

Calcitonin Gene-Related Peptide (CGRP) is a 37-amino acid peptide produced by peripheral and central neurons. It is found in a variety of organs and systems, regulating important functions in the target tissues. The nCGRP isoform is present in sensory neurons and it has been suggested to play a role in preventing hypertension, pulmonary hypertension, and ultimately acting as a potent vasodilator, improving mitochondrial fusion/fission event mechanisms will be discussed.

METHODS: All experiments were conducted according to IACUC at Michigan State University. FVB mouse dams were fed either a semi-purified control (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 thus; pups nursed by LP females experience a global nutrient deficit. Following birth, pups were reorganized to 8 pups/ female. After birth, day 1 (PN1) until day 21 (PN21) the PUN nursed and received milk from females fed the LP diet, the CON mice nursed from females being fed the 20% protein diet. At PN21 the hearts were collected from the CON and PUN mice and cardiac tissue was frozen in liquid nitrogen. Two-dimensional dimensional in-gel electrophoresis (2D DIGE) is 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. Protein expression differences as a result of early life undernutrition have yet to be studied and protein networks remain unidentified.

CONCLUSION: Identified proteins allow for a proposed mechanism that may explain the cellular changes 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 been 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, 63.2±5.9 kg in weight, 12.2±1.3% in %FAT, 53.2±5.4 ml/min/kg in VO\textsubscript{2}max) signed informed consent and participated in this study. Each individual performed two VO\textsubscript{2}max tests on cycle ergometer, and they had 7 wks of regular camp training between the two tests. Fasting blood samples were drawn before each VO\textsubscript{2}max 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 (4.32±1.80 ng/ml) (H). We found blood red cell count (RBC) (4.98±0.22 vs 4.65±0.31 *10\textsuperscript{12}L\textsuperscript{-1}, 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 in M (47.5±6.5 vs 42.5±2.8 ml/min/kg, p=0.05). Similarly, we found H had higher VO\textsubscript{2}max than L (59.6±4.7 vs 51.6±6.7 ml/min/kg, p=0.05) and higher workload at VT (L:13.2±3.7 vs 11.1±1.7 Watts, p=0.05). The RBC (5.20±0.18 vs 4.65±0.31 *10\textsuperscript{12}L\textsuperscript{-1}, p=0.01), Hb (158.8±4.2 vs 141. 5±8.1 g/L, p=0.01), and HCT (47.4±1.5 vs 43.1±2.6%, p=0.01) were also higher in H than in L. Correlation analysis demonstrated that VO\textsubscript{2}max (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 predicted that human serum MG53 level might be positively correlated with cardiorespiratory fitness. Supported by NSFC 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 measured in 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 (193%, p<0.01), whereas ATP content and OCR were significantly increased in PHB1 overexpression cells. Compared with the control group, the ATP content of PHB1 overexpression group was increased by 80% (p<0.01), but it was increased 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. 31470601).

**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>ALSTGK</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 that satisfied all five criteria were identified as frail. The onset of frailty occurred at 23 months of age and was set at 1.5 SD below the mean. If a mouse had two criteria scores below the cutoff points, the mouse was identified as frail, while a mouse with two criteria scores identified in the frail mice, all criteria included in the frailty assessment were considered 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 negative outcomes in mice. It provides the framework to develop interventions for preventing or delaying the frailty.
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 tibial 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 adult (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 and peak eccentric torques. **Results:** Although older female mice weighed more than adults (30.7 ± 4.9 g vs. 24.1 ± 0.4 g), there were no age-related differences in the weights of the TA (old=41.2 ± 1.9 g; adult=40.1 ± 0.7 g) and EDL (old=10.0 ± 0.6 g; adult=9.6 ± 0.4 g) muscles, or isometric tetanic torque before injury (old=2.5 ± 0.1 N·mm; adult=2.4 ± 0.1 N·mm) and peak eccentric torque of the 1st contraction (old=4.1 ± 0.2 N·mm; adult=4.4 ± 0.2 N·mm). However, older female mice experienced less isometric torque deficits after the injury than adult mice (old=40.7 ± 1.1%; adult=46.6 ± 1.1%), but had similar developed eccentric contraction deficits after 50 (old=25.3 ± 2.7%; adult=21.4 ± 3.0%), 100 (old=26.6 ± 4.4%; adult=26.2 ± 2.8%) and 150 (old=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.
### 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 = 0.4141 in men and r = 0.4138 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.

### METHODS:
Ten female collegiate athletes (n = 26) aged 20.5 ± 1.8 years and weighed 61.3 ± 9.8 kg were recruited. Participants were not menstruating at baseline as confirmed by a negative pregnancy test. They were divided into four groups according to sex and quartiles of irisin levels.

### RESULTS:
The proportion of participants with sarcopenia was 10.2% in the lowest irisin quartile and 29.3% in the highest quartile. 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).

### 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.

### METHODS:
Ten female collegiate athletes (n = 26) aged 20.5 ± 1.8 years and weighed 61.3 ± 9.8 kg were recruited. Participants were not menstruating at baseline as confirmed by a negative pregnancy test. They were divided into four groups according to sex and quartiles of irisin levels.

### RESULTS:
The proportion of participants with sarcopenia was 10.2% in the lowest irisin quartile and 29.3% in the highest quartile. 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).

### 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.

### METHODS:
Ten female collegiate athletes (n = 26) aged 20.5 ± 1.8 years and weighed 61.3 ± 9.8 kg were recruited. Participants were not menstruating at baseline as confirmed by a negative pregnancy test. They were divided into four groups according to sex and quartiles of irisin levels.

### RESULTS:
The proportion of participants with sarcopenia was 10.2% in the lowest irisin quartile and 29.3% in the highest quartile. 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).

### 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.

### METHODS:
Ten female collegiate athletes (n = 26) aged 20.5 ± 1.8 years and weighed 61.3 ± 9.8 kg were recruited. Participants were not menstruating at baseline as confirmed by a negative pregnancy test. They were divided into four groups according to sex and quartiles of irisin levels.

### RESULTS:
The proportion of participants with sarcopenia was 10.2% in the lowest irisin quartile and 29.3% in the highest quartile. 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).

### 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.

### METHODS:
Ten female collegiate athletes (n = 26) aged 20.5 ± 1.8 years and weighed 61.3 ± 9.8 kg were recruited. Participants were not menstruating at baseline as confirmed by a negative pregnancy test. They were divided into four groups according to sex and quartiles of irisin levels.

### RESULTS:
The proportion of participants with sarcopenia was 10.2% in the lowest irisin quartile and 29.3% in the highest quartile. 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).

### 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.

### METHODS:
Ten female collegiate athletes (n = 26) aged 20.5 ± 1.8 years and weighed 61.3 ± 9.8 kg were recruited. Participants were not menstruating at baseline as confirmed by a negative pregnancy test. They were divided into four groups according to sex and quartiles of irisin levels.

### RESULTS:
The proportion of participants with sarcopenia was 10.2% in the lowest irisin quartile and 29.3% in the highest quartile. 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).

### 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.

### METHODS:
Ten female collegiate athletes (n = 26) aged 20.5 ± 1.8 years and weighed 61.3 ± 9.8 kg were recruited. Participants were not menstruating at baseline as confirmed by a negative pregnancy test. They were divided into four groups according to sex and quartiles of irisin levels.

### RESULTS:
The proportion of participants with sarcopenia was 10.2% in the lowest irisin quartile and 29.3% in the highest quartile. 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).

### 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.

### METHODS:
Ten female collegiate athletes (n = 26) aged 20.5 ± 1.8 years and weighed 61.3 ± 9.8 kg were recruited. Participants were not menstruating at baseline as confirmed by a negative pregnancy test. They were divided into four groups according to sex and quartiles of irisin levels.

### RESULTS:
The proportion of participants with sarcopenia was 10.2% in the lowest irisin quartile and 29.3% in the highest quartile. 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).

### 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.

### METHODS:
Ten female collegiate athletes (n = 26) aged 20.5 ± 1.8 years and weighed 61.3 ± 9.8 kg were recruited. Participants were not menstruating at baseline as confirmed by a negative pregnancy test. They were divided into four groups according to sex and quartiles of irisin levels.

### RESULTS:
The proportion of participants with sarcopenia was 10.2% in the lowest irisin quartile and 29.3% in the highest quartile. 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).

### 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.

### MEDICINE & SCIENCE IN SPORTS & EXERCISE®

#### Table: BMD by Sport Type

<table>
<thead>
<tr>
<th>Sport</th>
<th>Weight (kg)</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>68.3 (±7.8)</td>
<td>1.21 (±0.14)</td>
<td>1.0 (±0.11)</td>
<td>1.21 (±0.11)</td>
<td>1.31 (±0.13)</td>
</tr>
<tr>
<td>Ballet</td>
<td>55.7 (±5.6)</td>
<td>1.17 (±0.15)</td>
<td>0.9 (±0.94)</td>
<td>1.1 (±0.11)</td>
<td>1.22 (±0.16)</td>
</tr>
<tr>
<td>Cheerleading</td>
<td>60 (±9.7)</td>
<td>1.06 (±0.17)</td>
<td>0.83 (±0.11)</td>
<td>1.04 (±0.14)</td>
<td>1.25 (±0.12)</td>
</tr>
<tr>
<td>Swimming</td>
<td>61.7 (±8.3)</td>
<td>1.06 (±0.13)</td>
<td>0.80 (±0.12)</td>
<td>1.04 (±0.13)</td>
<td>1.16 (±0.12)</td>
</tr>
<tr>
<td>Sedentary</td>
<td>57 (±10.7)</td>
<td>1.0 (±0.13)</td>
<td>0.78 (±0.10)</td>
<td>1.01 (±0.11)</td>
<td>1.14 (±0.12)</td>
</tr>
</tbody>
</table>
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; Interleukins and TNF-a; Tumor necrosis factor-alpha), 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 = 0.001) but, post-hoc analysis showed no significant effect of group interaction effect for CTx (F = 223, p = 0.006) 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 = 0.000) and OPG (r = 0.244, p = 0.021). In addition, study shows that Vitamin D had a negative correlation with RANKL (r = -0.323, p = 0.004) and OPG(r = -0.278, p = 0.008), and had a positive correlation with IL-6 (r = 0.391, p = 0.022).

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.

PURPOSE: The purpose of this study was to determine 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 (IPAQ, average of past and current IPAQ) 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 IPAQ calculator (www.fitbydesign.com/IPAQ/). The X-scan plus II (Hospital body Composition Analyzer, Jawon Medical Korea) was used to measure height (cm), weight (kg), fat mass (FFM, kg), and % body fat. RESULTS: Spearman’s correlation showed no significant relationships between the frequency of alcohol intake and TH 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), TH (r=0.415, 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 IPAQ 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 IPAQ. 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.

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 performance of MVPA was assessed in 44 young women (r=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. Muscle 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: sex-specific extended recommended levels of MVPA (89.14 ± 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 (pSSI) was completely mediated through two discrete pathways: 1) thigh lean mass (Coef= −1.11, LCI 0.48, UCI 1.96), and 2) thigh lean mass and knee extensor force in sequence (Coef = −0.26, LCI 0.08, UCI 0.65).

However, in sex-specific models the effect of MVPA on pSSI was mediated through thigh lean mass in females (Coef = 0.95, LCI 1.18, UCI 2.18) and knee extensor force in males (Coef = 0.78, LCI 0.04, UCI 1.52). Bootstrapped confidence intervals confirmed the ratio’s (95% CI). Supported by NRF Grant 2015S1A5A2A0101501.

Race/ethnicity is a major 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=6), East-Asian (EA; n=4), Hispanic (His; n=6), and African-American (AA; 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<0.05. RESULTS: Based on the entire sample (n=27), both total body BMC and BMD 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=0.08). Analysis of the entire sample revealed a significant positive relationship between MET minutes/week vs. 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=0.001). 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=0.01). 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.

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 ± 3.9yrs; height: 176.4 ± 6.9cm; mass: 64.9 ± 8.5kg) and 18 male (age: 23.9 ± 2.4yrs; height: 178.9 ± 6.5cm; mass: 79.6 ± 9.2kg) performed a high load jump (maximal vertical jump height: 43.3 ± 7.5 cm) on a force platform while their Achilles tendon was loaded with approximately 12% of their body mass through a preload. Conventional tendon stiffness was calculated from the vertical load- vs. displacement response using a linear model. RESULTS: The mechanical properties of the Achilles tendon was not significantly different between sexes, however, there was a significant time effect for all variables with a greater tendinous stiffness and strain in the 60min post treatment condition. In contrast, similar responses were observed for mechanical power and energy conversion efficiency with the exception of the male group who demonstrated a greater negative strain in the 60min post treatment condition. Conclusions: The findings of this study reveal that low-load jumping exercises (43.3 ± 7.5 cm) increase the mechanical properties of the Achilles tendon in both males and females without any differences between sexes. Further, recovery of mechanical properties following the jump exercise was dependent on the sex of the individual.
ACL reconstruction in order to eliminate asymmetry in PC.

CONCLUSION: Improved PC on injured leg (SSa = 1748.63±78.81 mm, SSb = 1281.75±62.70 mm, p < .01) revealed a significant effect on PC both for BS (Time*Leg: F2,60=22.8, p<.01; Leg: F1,30=7.5, p<.05, η2=0.21) and modulus compared to males, however both genders responded to heavy loading exercise similarly. This indicates that baseline differences in tendon properties, and not distinctive responses to loading, may help to explain the disparity in injury risk. Future research should examine tendon properties in response to loading in patients with Achilles tendinopathy.

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 effective 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 rehabilitation intervention, five months (b), and 10 months (c) following ACL reconstruction. Mixed design RM ANOVA, Bonferroni’s post hoc tests and partial eta square (ŋ2) were used for statistical assessment. RESULTS: The main factor (Time) revealed significant effect on PC both for BS (F2,60=56.39, p<.01; ŋ2 = .65) and SS (F2,40=40.37, p<.01; ŋ2 = .57). Post-hoc test revealed significant improvement of PC improvement after intervention (BSa = 151.34±84.81 mm, BSb = 127.00±56.56 mm, p<.01) as well as follow-up effect (BSa = 127.00±56.56 mm, BSb = 127.00±56.56 mm, p<.01). We found a significant interaction effect between observed factors (Time*Leg) within observed time (F2,60=24.81, p<.01; ŋ2 = .45). Participants significantly improved PC on injured leg (SSa = 1748.63±78.81 mm, SSb = 1281.75±62.70 mm, p<.01; however, postural control SSb was non-significant compared to SSB (p=.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.

Individuals with anterior cruciate ligament reconstruction (ACLR) are at a significant greater risk of knee osteoarthritis (OA). The heelstrike transient (HST) during gait is indicative of impulsive/high-rate loading, which has been implicated in cartilage degradation and knee OA development. The quadriiceps attenuates loading during gait, and quadriiceps dysfunction following ACLR may contribute to impulsive loading and knee OA risk. PURPOSE: To determine the differences in quadriiceps function between impulsive loading 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 7-58] months post-ACLR). Quadriiceps function in the ACLR limb was quantified during maximal isometric contraction at 90° of knee flexion via the peak torque, rate of torque development (RTD) from 20% to 80% of the interval from onset to peak torque, RTD from onset to 100 ms, and RTD from 100ms to 200ms. All values were normalized to body mass. Gait biomechanics were assessed during overground walking at a self-selected pace. A trial was classified as possessing an HST if the ratio of the vertical ground reaction force peak immediately following heelstrike to the impending local minimum exceeded 1.2. Subjects were classified as “Impulsive” loaders if a HST was identified in at least 3 of 5 trials. Independent t-tests and correlations were utilized for the analysis.

RESULTS: 31% of the subjects were identified as Impulsive loaders. However, there were no significant differences between Impulsive and Normal loaders for RTD (max - 0.4±0.6 vs. 0.4±0.4, p=.96), RTD (max - 1.9±6.5 vs. 1.6±6.6, p=.21), RTD (max - 127.00±6.56 mm, BSc =109.63±6.18 mm, p<.01) as well as follow-up effect (BSb =127.00±6.56 mm, BSc =109.63±6.18 mm, p<.01). There were no significant correlations between the %trials with HST and the quadriiceps function indices (r=-0.043±0.172, p=0.258±0.952).

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 quadriiceps function. Future research is necessary to determine the role of the HST in knee OA development and the factors that contribute to its presence.

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 the impending local minimum exceeded 1.2. Subjects were classified as “Impulsive” loaders if a HST was identified in at least 3 of 5 trials. Independent t-tests and correlations were utilized for the analysis.

RESULTS: 31% of the subjects were identified as Impulsive loaders. However, there were no significant differences between Impulsive and Normal loaders for RTD (max - 0.4±0.6 vs. 0.4±0.4, p=.96), RTD (max - 1.9±6.5 vs. 1.6±6.6, p=.21), RTD (max - 127.00±6.56 mm, BSc =109.63±6.18 mm, p<.01) as well as follow-up effect (BSb =127.00±6.56 mm, BSc =109.63±6.18 mm, p<.01). There were no significant correlations between the %trials with HST and the quadriiceps function indices (r=-0.043±0.172, p=0.258±0.952).

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 quadriiceps 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: Ultrasonic Shear Wave Elastography determined shear modulus of the ST tendon on 10 ACL reconstructed individuals (age: 21.61±1.6 years, height: 171.6±8.5cm, mass: 71.6±13.8kg, Tegner scale: 5.6±1.1). Time since ST harvest averaged 4.3 years (range: 0.75-12.6 years) and all individuals were since cleared to return to return to level IV activity by a 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 regression analysis determined the relationship between ST tendon shear modulus and reporting CRKS.

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. Isokinetic strength at 180° (r=0.39, p=0.01) was associated with GRF LSI. 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=0.0101) compared to involved limbs.

CONCLUSIONS: ACLR limbs had smaller GRF and KFM compared to uninvolved limbs. This may indicate a compensatory strategy to understand the involved limb during landing. The weak correlations between quadriceps strength LSI and KFM and GRF LSI. Pair samples t-tests were used to compare dependent variables between limbs (α = 0.05).

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: Ultrasonic Shear Wave Elastography determined shear modulus of the ST tendon on 10 ACL reconstructed individuals (age: 21.61±1.6 years, height: 171.6±8.5cm, mass: 71.6±13.8kg, Tegner scale: 5.6±1.1). Time since ST harvest averaged 4.3 years (range: 0.75-12.6 years) and all individuals were since cleared to return to return to level IV activity by a 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 regression analysis determined the relationship between ST tendon shear modulus and reporting CRKS.

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. Isokinetic strength at 180° (r=0.39, p=0.01) was associated with GRF LSI. 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=0.0101) compared to involved limbs.

CONCLUSIONS: ACLR limbs had smaller GRF and KFM compared to uninvolved limbs. This may indicate a compensatory strategy to understand the involved limb during landing. The weak correlations between quadriceps strength LSI and KFM and GRF LSI. Pair samples t-tests were used to compare dependent variables between limbs (α = 0.05).

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: Ultrasonic Shear Wave Elastography determined shear modulus of the ST tendon on 10 ACL reconstructed individuals (age: 21.61±1.6 years, height: 171.6±8.5cm, mass: 71.6±13.8kg, Tegner scale: 5.6±1.1). Time since ST harvest averaged 4.3 years (range: 0.75-12.6 years) and all individuals were since cleared to return to return to level IV activity by a 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 regression analysis determined the relationship between ST tendon shear modulus and reporting CRKS.

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. Isokinetic strength at 180° (r=0.39, p=0.01) was associated with GRF LSI. 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=0.0101) compared to involved limbs.

CONCLUSIONS: ACLR limbs had smaller GRF and KFM compared to uninvolved limbs. This may indicate a compensatory strategy to understand the involved limb during landing. The weak correlations between quadriceps strength LSI and KFM and GRF LSI. Pair samples t-tests were used to compare dependent variables between limbs (α = 0.05).

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: Ultrasonic Shear Wave Elastography determined shear modulus of the ST tendon on 10 ACL reconstructed individuals (age: 21.61±1.6 years, height: 171.6±8.5cm, mass: 71.6±13.8kg, Tegner scale: 5.6±1.1). Time since ST harvest averaged 4.3 years (range: 0.75-12.6 years) and all individuals were since cleared to return to return to level IV activity by a 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 regression analysis determined the relationship between ST tendon shear modulus and reporting CRKS.

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. Isokinetic strength at 180° (r=0.39, p=0.01) was associated with GRF LSI. 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=0.0101) compared to involved limbs.

CONCLUSIONS: ACLR limbs had smaller GRF and KFM compared to uninvolved limbs. This may indicate a compensatory strategy to understand the involved limb during landing. The weak correlations between quadriceps strength LSI and KFM and GRF LSI. Pair samples t-tests were used to compare dependent variables between limbs (α = 0.05).
and decreased peak pressure ($F_{\text{p}} = 20.98$, $p < 0.001$). 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 ($F_{\text{p}} = 11.27$, $p < 0.002$).

**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.

### 235 Board #76 May 30 11:00 AM - 12:30 PM Lesser Mechanical Loading During Walking Gait Associates with Worse Proteoglycan Density 6 months Following Anterior Cruciate Ligament Reconstruction

Steven J. Pfeiffer, Jeffrey Spang, Daniel Nissman, David Lalish, Kyle Wallace, Matthew Harkey, Laura Stanley, Randy Schmitz, Troy Blackburn, Brian Pietrosimone, FACSM. 1University of North Carolina, Chapel Hill, NC. 2Tufts Medical Center, Boston, MA. 3University of North Carolina at Greensboro, Greensboro, NC. 

(No relevant relationships reported)

**METHODS:** Twenty-nine individuals (52% female, BMI = 24±3 kg/m²) with a unilateral patellar-tendon autograft ACLR participated in this study. Five trials of walking gait at self-selected speed were performed 6 months following ACLR. Peak vGRF and instantaneous vGRF loading rate (vGRF-LR) during walking gait 6 months following ACLR.

**RESULTS:** In the ACLR limb, lesser vGRF during gait was associated with lesser proteoglycan density in the posterior (ΔR\(_T\) = 0.12, $P=0.05$) and central MFC (ΔR\(_T\) = 0.22, $P<0.05$) 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\(_T\); $P<0.05$).

**RESULTS:** In the ACLR limb, lesser vGRF during gait was associated with lesser proteoglycan density in the posterior (AR\(_T\) = 0.22, $P<0.02$) and central LFC (AR\(_T\) = 0.22, $P<0.02$), as well as the posterior (AR\(_T\) = 0.12, $P<0.05$) and central MFC (AR\(_T\) = 0.21, $P<0.01$), 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 deteriorating cartilage health. Understanding how loading affects joint health is critical to developing interventions to delay PTOA onset.

### 236 Board #77 May 30 11:00 AM - 12:30 PM Assessment of Torsional Knee Stiffness in Individuals Following Anterior Cruciate Ligament Reconstruction During Running

Kylie Davis, Caleb A. Jacobs, Mary L. Ireland, FACSM, Darren L. Johnson, Brian Noehren, FACSM. University of Kentucky, Lexington, KY. (Sponsor: Brian Noehren, FACSM)

(No relevant relationships reported)

**PURPOSE:** To determine torsional knee stiffness in individuals with anterior cruciate ligament reconstruction (ACLR) during running, which has previously been speculated upon but not yet assessed.

**METHODS:** 17 individuals with ACLR (19 ± 5.2 years, 16 F, 22.6 ± 2.4 kg/m², 6.4 ± 0.5 months post-surgery) and 17 control subjects (23 ± 1.5 years, 16 F, 22.7 ± 2.1 kg/m²) participated. Instrumented gait analysis was used to obtain knee angles and moments during running. Stiffness was calculated as the ratio of change in knee extensor moment to knee flexion angle over the period of initial contact (IC) to peak knee flexion angle (P1) as well as the first 60 ms after IC (P2). Isometric knee extension strength was also tested. An independent two-sample t-test ($a = 0.05$) was used to compare stiffness between groups. The Pearson correlation coefficient ($r$) was used to quantify the relationship between stiffness and peak knee extensor torque (KET), and between stiffness and knee extensor rate of torque development (RTD).

**RESULTS:** Torsional knee stiffness was significantly greater in the surgery limb compared to the control limb during P1 ($p = 0.049$) and P2 ($p = 0.0057$). No correlation was found between stiffness and peak KET ($r = 0.04$), or between stiffness and knee extensor RTD ($r = 0.088$).

**CONCLUSION:** Individuals with ACLR had greater knee stiffness in running compared to control subjects but it is unknown whether this difference was present before, or resulted after injury. Increased stiffness has been suggested as a risk factor for developing osteoarthritis, which is known to be prevalent in this population. Based on the lack of correlation between strength and stiffness, increased stiffness observed in the ACLR group is likely an issue of control but further scrutiny is needed.

### 237 Board #78 May 30 11:00 AM - 12:30 PM Quadriceps Force Steadiness following Anterior Cruciate Ligament Reconstruction during a Maximum Voluntary Isometric Contraction

Alex Spence, Cale Jacobs, Kylie Davis, Darren Johnson, Mary L. Ireland, FACSM, Brian Noehren, FACSM. University of Kentucky, Lexington, KY. (Sponsor: Brian Noehren, FACSM)

(No relevant relationships reported)

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 or strength 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 MVC’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 ± 0.51% 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 ($p<0.001$).

**CONCLUSION:** The results show a significant disparity in an ACL 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, Fp=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 of 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.

---

**Board #80**

**May 30 11:00 AM - 12:30 PM**

**Examining the Relationships Between the Mode of Quadriceps Contraction and Clinical Outcomes After ACL Reconstruction**

Steven M. Davi, Adam S. Lepley, Julie P. Burland, Lindsey K. Lepley, University of Connecticut, Storrs, CT.

(No relevant relationships reported)

Quadriceps strength is a useful clinical predictor of physical function and patient reported outcomes after anterior cruciate ligament reconstruction (ACLR). However, it remains unknown which mode of muscle contraction (isometric, concentric or eccentric) is most important for optimal physical and patient reported recovery, creating uncertainty amongst clinicians as to the most ideal strength assessment tool.

**PURPOSE:** Examine the association between the mode of quadriceps muscle contraction (isometric, concentric and eccentric) and functional performance and patient reported outcomes. **METHODS:** Ten individuals with history of unilateral ACLR volunteered (22.4±1.9yrs; 1.66±0.08m; 65.62±12.10kg; years from surgery, 5.88±1.96yrs). Peak concentric and eccentric quadriceps force production at 60% of MVC and peak isometric force production with the knee positioned at 90° were assessed via an isokinetic dynamometer and normalized to body mass. Objective clinical hop tests were evaluated for maximal distance during the single leg hop for distance (SLHD), cross-over hop (CH) and triple hop (TrH). Patient reported outcomes were assessed using the International Knee Documentation Committee (IKDC) form. Association between quadriceps strength outcomes and all functional and patient reported outcomes were assessed using Pearson product moment correlations.

**RESULTS:** Peak concentric strength was only associated with maximal CH distance (r=0.733, P=0.018). Peak eccentric strength was only associated with maximal SLHD (2.82±0.78Nm/kg, 4.16±0.72m; r=0.733, P=0.018). Peak isometric strength was associated with maximal CH distance (3.06±0.59Nm/kg, 4.35±0.70m; r=0.696, P=0.025) and IKDC (84.9±11.0; r=0.803, P=0.005).

**CONCLUSION:** No single mode of quadriceps contraction was associated with all clinical outcome measures. Hence, a multimodal approach to strength re-training and evaluation may be important for the development of proper quadriceps function and progression of optimal clinical outcomes. Clinicians should consider adding a multimodal strength program during ACLR rehabilitation to promote positive outcomes across a variety of clinical measures.
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.

242 Board #83 May 30 11:00 AM - 12:30 PM
Sex and Speed Influence Joint Moment Impulses During Running

(NO relevant relationships reported)

Following lower extremity surgery, athletes demonstrate altered running mechanics particularly with regard to lower extremity joint moment impulses. The effect of sex 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_{EXT}), knee extensor (K_{EXT}), and ankle plantarflexor (A_{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_{EXT}, K_{EXT}, and A_{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 < 0.01) for K_{EXT} was observed. Females exhibited greater K_{EXT} than males at all speeds (mean difference range, 6.8 to 15.2%). Among females, K_{EXT} decreased significantly at each speed (-21 ± 0.05 Nms/kg, -21.04 ± 0.04 Nms/kg, -19.13 ± 0.03 Nms/kg at 2.68, 3.35, and 4.47 m/s, respectively, p < 0.05). There were no significant speed effects among males (p ≥ 0.08). No significant interactions (p ≥ 0.08) were present for H_{EXT} or A_{PF}, though there were significant sex and speed main effects. Females demonstrated smaller H_{EXT} and A_{PF} than males (mean difference, 20.2% and 14.6% for H_{EXT} and A_{PF}, respectively, p < 0.01). Across sexes, H_{EXT} increased significantly with speed (p < 0.01) at 4.47 m/s was significantly lower than all other speeds (-39.5 ± 0.05 Nms/kg, -39.5 ± 0.05 Nms/kg, -38.5 ± 0.5 Nms/kg at 2.68, 3.35, and 4.47 m/s, respectively; p < 0.01). CONCLUSIONS: Both sex and speed must be considered when evaluating the relative contribution of the hip, knee, and ankle during running. Females demonstrate greater KEXT than men at the same running speed but smaller HEXT and APF, 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. Chemistek, 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, Warrenner 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 in sex differences in endurance running. Sex differences in pelvic dimensions in females may explain higher rates of running related overuse injury (RROI). PURPOSE: To determine whether pelvic dimensions and age PA began are sex and speed related factors for RROI. METHODS: 6 male and 4 female collegiate cross country runners completed 2 12 minute steady state, submaximal (mean RER = 0.87 ± 0.01) treadmill trials one of which involved receiving real-time feedback on pelvic oscillation with the instruction to reduce the displayed value. Breath-by-breath VO_{2} data was averaged over the last minute of the trial and expressed as kcal·kg^{-2}km^{-1}. Vertical oscillation data was averaged over the entire trial. Repeated-measures ANOVAs were applied to VO_{2} and vertical oscillation data to test for significant effects of real-time feedback. RESULTS: B.15±0.5 kg, reduced vertical oscillation (10.04 ± 1.99 cm vs. 8.78 ± 2.03 cm, p < 0.008), but did not improve running economy (1.10 ± 0.09 kcal·kg^{-1}·km^{-1} vs. 1.07 ± 0.10 kcal·kg^{-1}·km^{-1}, p = 0.072). 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 ± 0.01) treadmill trials one of which involved receiving real-time feedback on pelvic oscillation with the instruction to reduce the displayed value. Breath-by-breath VO_{2} data was averaged over the last minute of the trial and expressed as kcal·kg^{-1}·km^{-1}. Vertical oscillation data was averaged over the entire trial. Repeated-measures ANOVAs were applied to VO_{2} and vertical oscillation data to test for significant effects of real-time feedback. RESULTS: B.15±0.5 kg, reduced vertical oscillation (10.04 ± 1.99 cm vs. 8.78 ± 2.03 cm, p < 0.008), but did not improve running economy (1.10 ± 0.09 kcal·kg^{-1}·km^{-1} vs. 1.07 ± 0.10 kcal·kg^{-1}·km^{-1}, p = 0.072). CONCLUSION: Reduction in vertical oscillation did not produce an improvement in the economy of trained runners.
selected pace. Subsequently, they performed a graded exercise test to exhaustion followed by a second incremental run. Pressure insoles placed in the shoe of the subject’s dominant leg recorded ground reaction forces and pressure distribution of the foot before and after the fatigue protocol. Results: A two-way repeated ANOVA (time x speed) showed that there was a main effect of speed for most independent variables, while there was a main effect of fatigue (p=0.04) only for pressure at the lateral part of the shoe. Post hoc analysis revealed that the peak impact force and pressure (total, forefoot, heel, medial and lateral side of the foot) were significantly greater at higher running speeds. In addition, there was a tendency for a shift in pressure distribution from the medial to the lateral side of the foot with increased speeds. Conclusion: These preliminary findings suggest that peak impact force was not affected by fatigue. However, running at faster speeds placed more stress on the foot, as shown by both the impact forces and pressure, which may predispose runners to injury.

247 Board #88 May 30 11:00 AM - 12:30 PM Association Between Tibial Acceleration and Vertical Loadrates in Runners of All Footstrike Patterns

Todd Hayano,1 Adam Tenforde,2 Steve Jamison1, Irene Davis, FACSM.1 1Spaulding Rehabilitation Hospital/Harvard Medical School, Charlestown, MA. 2Spaulding Rehabilitation Hospital/Spaulding National Running Center/Spaulding Cambridge Hospital, Charlestown, MA. (Sponsor: Irene Davis, FACSM)

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±11.4 yrs) presenting at a Harvard Medical School and Spaulding National Running Center/Harvard Medical School, Cambridge, MA. (No relevant relationships reported)

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 vertical tibial acceleration is a reliable surrogate for loadrates.

248 Board #89 May 30 11:00 AM - 12:30 PM Increased Foot And Tibial Angles at Footstrike Decrease Vertical Loadrates in Runners

Haylee E. Donaghe Borgstrom1, Adam S. Tenforde2, Robert Diaz1, Steve T. Jamison1, Irene S. Davis, FACSM1, 1Spaulding Rehabilitation Hospital, Harvard Medical School, Boston, MA. 2Spaulding Rehabilitation Hospital, Spaulding National Running Center, Harvard Medical School, Boston, MA. (Sponsor: Irene Davis, FACSM)

Abstracts were prepared by the authors and printed as submitted.

WEDNESDAY, MAY 30, 2018
Vol. 49 No. 5 Supplement S37

Increased Resisted Sprinting Load Decreases Bilateral Symmetry in Sprinting Kinetics
Jacob A. McNabb, Trisha A. VanDusseldorp, Garret M. Hester, Yuri Feito, FACSM, Gerald T. Mangine. Kennesaw State University, Kennesaw, GA. (Sponsor: Yuri Feito, FACSM)

Sprint performance is affected by technical and kinetic symmetry of the lower limbs. Sprint training against resistance may affect kinematics if the load is too great, and thus negatively impact performance. Although information exists regarding the effect of sprinting resistance on the bilateral kinematics, little is known regarding its effect on the vertical loadrates in both healthy and injured runners. Increased resisted sprinting load was strongly associated with the outcome measures for both healthy and injured runners.

Unilateral load asymmetry existed at various stages of a sprint (i.e., acceleration, peak velocity), it may also be more appropriate to assess the symmetry of sprinting kinematics separately in stages.

PURPOSE: To investigate the effect of resisted sprinting load on the bilateral kinetic variables across a 40-m sprint, METHODS: Following a standardized warm-up, 16 male, collegiate rugby players (21.2±1.7 yrs; 89.5±16.4 kg; 178.4±6.7 cm) performed 3 maximal, 40-m resisted sprint trials while tethered to a robotic resistance device. The first two sprints (S1 and S2) were performed against minimal resistance (1-kg) with S1 being used as a familiarization trial. The final sprint (S3) used 15-kg of resistance. During S2 and S3, peak and average power (PP and AVG), velocity (V), and peak rate of force development (RFD) were recorded for each leg and used to calculate bilateral percent differences (%DIFF). Paired-samples t-tests were performed to compare S2 and S3 during the first 5 sprinting strides (SPRS), from start to peak velocity (SPR-V), and the total sprint (SPR), for each bilateral kinetic variable. RESULTS: A greater (p<0.05) number of strides to reach V (4.2±1.4 strides) and complete SPR (8.3±5.7 strides) were observed during S3. Additionally, S3 reduced %DIFF in FFD and RFD during SPR (Fob: -8.1±3.3%; RFD: -8.9±10.9%), SPR-V (Fob: -6.6±5.9%; RFD: -7.2±8.6%), and SPR (Fob: -6.6±5.4%; RFD: -6.9±8.4%). Significant (p<0.05) reductions in %DIFF during S3 were not observed for
S38 Vol. 49 No. 5 Supplement}

MEDICINE & SCIENCE IN SPORTS & EXERCISE®

**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**

Nicolle K. Rendos1, Moataz Eltoukhly2, Wesley N. Smith3, Christopher M. Kuenze4, Joseph F. Signorile1

**Andrews Research & Education Foundation, Gulf Breeze, FL.** University of Miami, Coral Gables, FL. Michigan State University, East Lansing, MI.

(No relevant relationships reported)

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 provide 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 ± 0.7m, mass 67.3 ± 11.7 kg, age 26.8 ± 5.1 yr) were recruited and were classified as HI (n = 10) 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 (F(1,23) = 6.8, p = .016) where PEAK occurs later in the gait cycle during LSD in LO (9.0% HI vs. 9.3% LO). A significant interaction was seen in GM AMP (AMP: F(3,38) = 1.852, p = .15, Power = .44) or in running (F(3,37) = 1.4, 9.0 ± 1.0 hr/wk). 3D motion capture (8-cameras, Vicon, 120Hz) during participant running at self-selected speeds (speed = 2.8 ± 0.3, 2.6 ± 0.4m/s) and maximal trunk rotation task (F (3,38) = 1.5) or in running (F(3,37) = 1.852, p = .15, Power = .44) were used. Differences in gait parameters during walking and running with advancing age can be significant factors affecting trunk rotational ROM necessary to run safely at self-selected speeds. A potential explanation is our participants being healthy, active individuals and may not exhibit the structural spinal changes that we expect with advancing age as those expected in a sedentary population. Alternately, running trials at self-selected speeds may not be fast enough to elicit potential age-related changes. The overall lack of differences in trunk movement during running could support the safety and efficacy of running at self-selected paces with advancing age.

**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. Tome1, Yumeng Li2, Kathy J. Simpson1

1Ithaca College, Ithaca, NY. 2California State University, Chico, Chico, CA. 3University of Georgia, Athens, Athens, GA.

(No relevant relationships reported)

PURPOSE: Differences in gait parameters during walking and running with advancing age have been reported, though little is understood of the effects on age of 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 understanding how gains in ROM improve running mechanics. However, the influences of direction of locomotion to tailor feedback in gait retraining and investigate 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 can be used to classify FSP. IMU based systems could serve as a tool in gait retraining to provide real-time feedback on FSP and are easily scalable to larger populations likeRCTs. PURPOSE: To classify and investigate inter- and intra-individual differences in FSP between the left and right foot on a treadmill, using an angular velocity based classification technique. METHODS: Data was collected as part of a larger study. Data of 5 healthy experienced runners (5 M, age 27.3 +/- 5.9 yrs; height 181.8 +/- 5.7 cm; weight 71.3 +/- 4.8 kg) were used to confirm that runners had different stride patterns at 3.9 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, minAV<8 rad/s), a mid foot strike (MFS, maxAV<4, minAV>8-10 rad/s) or fore foot strike (FFS, maxAV>10, minAV>8 rad/s). For each participant, 50 steps were used to calculate the 95% confidence regions for the left foot, right foot and the group data of both feet. RESULTS: Two runners showed a FFS, one runner a MFS and two runners a RFS. (Fig 1) The 95% confidence regions of the left and right leg show no overlap for S01, S04 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.

**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 Maar tens1, Max Paquette2, Claire E. Milner, FACSM3, Jaap Bururke1, Jasper Reenalda1

1Roessingh Research and Development, University of Twente, Enschede, Netherlands. 2University of Memphis, Memphis, TN. 3Drexel University, Philadelphia, PA.

(No relevant relationships reported)

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. Research has shown that spinal mobility, decreases with advancing age as those expected in a sedentary population. Alternately, running trials at self-selected speeds may not be fast enough to elicit potential age-related changes. The overall lack of differences in trunk movement during running could support the safety and efficacy of running at self-selected paces with advancing age.
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 (40.0 ± 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 directions) 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 Hancock2. 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 ages 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 = 3499.35 METmin, SD = 2931.34), F(2, 34) = 58.27, p < 0.001; however, step counts did not improve for either group from baseline to final testing. Mean difference in step counts were 1,937 steps and 1,514 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 ml · kg⁻¹·min⁻¹), F(2, 30) = 13.016, p = 0.001. 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.

255 Board #96 May 30 9:30 AM - 11:00 AM Lifestyle Behaviors and Muscular Strength in Young Adults
Henry Pascik, Kristoffer S. Wisniewski, Gabrielle M. Brennan, Sara D. Dieterich, 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 Pascik, Kristoffer S. Wisniewski, Gabrielle M. Brennan Sara D. Dieterich, 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:585±21 (kg), W:399±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<0.02) 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 Boraxbeck, 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 actiPals®. 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<0.01) and 1645 steps per day (p<0.05), respectively, versus controls. Concomitantly, they decreased their PA with 13 minutes per day (p<0.01) at weekdays at 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. 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. 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 maintaining, MVPA levels.
BACKGROUND: According to the World Health Organization (2016) cardiovascular diseases are the main cause of death in the world population. In Mexico it represents 45% 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 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 triglyceride 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.

RESULTS: There were no group differences in outcome measures at baseline. Following the intervention both treatment groups lost non-significant amounts of weight (p=0.33) while WLC maintained their weight (FTMI: 88.5 ± 24.3 vs 87.7 ± 16.0 kg). Effect size calculations demonstrated a moderate difference between both treatment groups and 23.5, FT: 86.9 ± 17.2 vs 85.6 ± 16.3, WLC: 78.9 ± 15.8 vs 78.8 ± 15.4 kg). Effect size calculations demonstrated a moderate difference between both treatment groups and 23.5, FT: 86.9 ± 17.2 vs 85.6 ± 16.3, WLC: 78.9 ± 15.8 vs 78.8 ± 15.4 kg). Effect size calculations demonstrated a moderate difference between both treatment groups and 23.5, FT: 86.9 ± 17.2 vs 85.6 ± 16.3, WLC: 78.9 ± 15.8 vs 78.8 ± 15.4 kg). Effect size calculations demonstrated a moderate difference between both treatment groups and 23.5, FT: 86.9 ± 17.2 vs 85.6 ± 16.3, WLC: 78.9 ± 15.8 vs 78.8 ± 15.4 kg). Effect size calculations demonstrated a moderate difference between both treatment groups and 23.5, FT: 86.9 ± 17.2 vs 85.6 ± 16.3, WLC: 78.9 ± 15.8 vs 78.8 ± 15.4 kg). Effect size calculations demonstrated a moderate difference between both treatment groups and 23.5, FT: 86.9 ± 17.2 vs 85.6 ± 16.3, WLC: 78.9 ± 15.8 vs 78.8 ± 15.4 kg). Effect size calculations demonstrated a moderate difference between both treatment groups and 23.5, FT: 86.9 ± 17.2 vs 85.6 ± 16.3, WLC: 78.9 ± 15.8 vs 78.8 ± 15.4 kg). Effect size calculations demonstrated a moderate difference between both treatment groups and 23.5, FT: 86.9 ± 17.2 vs 85.6 ± 16.3, WLC: 78.9 ± 15.8 vs 78.8 ± 15.4 kg). Effect size calculations demonstrated a moderate difference between both treatment groups and 23.5, FT: 86.9 ± 17.2 vs 85.6 ± 16.3, WLC: 78.9 ± 15.8 vs 78.8 ± 15.4 kg). Effect size calculations demonstrated a moderate difference between both treatment groups and 23.5, FT: 86.9 ± 17.2 vs 85.6 ± 16.3, WLC: 78.9 ± 15.8 vs 78.8 ± 15.4 kg). Effect size calculations demonstrated a moderate difference between both treatment groups and 23.5, FT: 86.9 ± 17.2 vs 85.6 ± 16.3, WLC: 78.9 ± 15.8 vs 78.8 ± 15.4 kg). Effect size calculations demonstrated a moderate difference between both treatment groups and 23.5, FT: 86.9 ± 17.2 vs 85.6 ± 16.3, WLC: 78.9 ± 15.8 vs 78.8 ± 15.4 kg). Effect size calculations demonstrated a moderate difference between both treatment groups and 23.5, FT: 86.9 ± 17.2 vs 85.6 ± 16.3, WLC: 78.9 ± 15.8 vs 78.8 ± 15.4 kg). Effect size calculations demonstrated a moderate difference between both treatment groups and 23.5, FT: 86.9 ± 17.2 vs 85.6 ± 16.3, WLC: 78.9 ± 15.8 vs 78.8 ± 15.4 kg). Effect size calculations demonstrated a moderate difference between both treatment groups and 23.5, FT: 86.9 ± 17.2 vs 85.6 ± 16.3, WLC: 78.9 ± 15.8 vs 78.8 ± 15.4 kg). Effect size calculations demonstrated a moderate difference between both treatment groups and 23.5, FT: 86.9 ± 17.2 vs 85.6 ± 16.3, WLC: 78.9 ± 15.8 vs 78.8 ± 15.4 kg). Effect size calculations demonstrated a moderate difference between both treatment groups and 23.5, FT: 86.9 ± 17.2 vs 85.6 ± 16.3, WLC: 78.9 ± 15.8 vs 78.8 ± 15.4 kg). Effect size calculations demonstrated a moderate difference between both treatment groups and 23.5, FT: 86.9 ± 17.2 vs 85.6 ± 16.3, WLC: 78.9 ± 15.8 vs 78.8 ± 15.4 kg).
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 Movbnd<sup>®</sup>. The resistance group (N=5) (42.9±8.3yr, 197.4±22.6lb body wt, BMI=33.8±2.2 kg/m<sup>2</sup>; mean±SD) exercised for (15.0±3.5 min) which consisted of eight different routines: upper- and lower extremity, 2 cardio segments, 2 total body, yoga and abdominal exercises. The step group (N=7) (48.4±9.6yr, 197.2±22.6 lb body wt, BMI=32.1±1.9 kg/m<sup>2</sup>; mean±SD) increased their steps up to 10,000 for 12 weeks. Relative (%o 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±2.1, 13.1±1.3 vs. 12.5±2.0, 12.2±0.9; 36.0±3.1,42.4±2.1 vs. 35.0±2.1, 34.6±2.2; 42.1±1.5, 42.1±2.7 vs. 41.0±2.2, 41.0±2.7; 45.6±1.9,44.9±2.0 vs. 44.6±2.7,44.0±3.0; 25.0±2.4, 24.8±1.7 vs. 24.4±1.5, 24.2±1.5 in, 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±2.7 vs. 41.5±1.7, 41.0±2.2%; 25.0±2.4, 24.8±1.7 vs. 24.4±1.5, 24.2±1.5 in, 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.

---

**DOES KNOWLEDGE OF PHYSICAL ACTIVITY RECOMMENDATIONS CHANGE AFTER A PHYSICAL ACTIVITY INTERVENTION?**

K.D. DuBose, FACSM, Deirdre Dlugonski. East Carolina University, Greenville, NC.

**Purpose:** To determine if a physical activity (PA) intervention improved parent’s knowledge of adult and child PA recommendations. **Methods:** Twenty-six parents participated in an 8-week PA intervention with their 1 – 5 year old child. The parents were randomly placed into an intervention (n=19) or control (n=7) group. As part of the intervention, parents received information about adult and child PA recommendations. Knowledge of PA recommendations for adults and children was assessed through questionnaires pre- and post-intervention. **Results:** On average, the parents were 35.6±6.0 years of age and were overweight (29.2±1.7 kg/m<sup>2</sup>). The majority were Caucasian, women, had at least a college education, and worked outside of the house. Among all parents, 61% had not heard of the PA recommendations. Further, 54% and 96% did not know the moderate and vigorous PA recommendations for adults. Regarding children’s PA recommendations, 62% and 81% of parents did not know the appropriate amount of PA for children <5 years old and ≥ 6 years, respectively. The knowledge of these PA recommendations did not differ by group status at baseline p>0.5. There was a 15% - 18% increase in the percentage of intervention group participants who increased knowledge of adult PA recommendations and a 11 – 33% increase for knowledge of child PA recommendations. In contrast, there was no change in the control group. These findings were not statistically significant. **Conclusions:** Overall parents do not know either adult or children’s PA recommendations. A short PA intervention can improve parent’s knowledge of PA recommendations. Understanding the knowledge of parents before an intervention could be useful to deliver appropriate content during the intervention period.

Supported by: Research/Creative Activity Award, East Carolina University Character count (without spaces): 1494 max: 2,000
The Effect of Early Life Undernutrition on Voluntary Physical Activity in Mice. Eric C. Leszczynski, Ashley N. Tripplett, David P. Ferguson, Michigan State University, East Lansing, MI. (No relevant relationships reported)

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 during adulthood. 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 (2935.625 ± 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.

266 Board #107 May 30 9:30 AM - 11:00 AM Squatting With Elastic Bands Facilitates More Weight Used And Time Under Muscle Tension

Nico L. Rogers¹, Javier Gene², Alvaro Juesas⁴, Pedro Gargallo⁴, Andres Gene⁵, Rosario Salvador⁶, Juan C. Colado³, Michael E. Rogers, FACSM¹, ²University of Valencia, Valencia, Spain. (Sponsor: Michael E. Rogers, FACSM) (No relevant relationships reported)

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 understood. 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±7.4 years) 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 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 scale 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%). Conditions C and D employed 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.

267 Board #108 May 30 9:30 AM - 11:00 AM Effect Of Kinesitherapy And Massage To Injury Skeletal Muscle Repair’S Histomorphology And C-reactive Protein

Pin Lu¹, qinglong liu², ¹Anhui Normal University, wuhu, China. ²Tianjin Vocational College of Sports, tianjin, China. (No relevant relationships reported)

Abstract

Purpose: This project is based on mice acute blunt contusion model. And we use muscle histomorphometry 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 histomorphometry. 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: Massage Therapy Group, Kinesitherapy Group and Massage Therapy with Kinesitherapy Group C-reactive protein level back to normal time and degree compare with Spontaneous Recovery Group have showing significant difference(p < 0.05). Massage Therapy 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.

268 Board #109 May 30 9:30 AM - 11:00 AM Changes In Cortisol Levels With An Aquatic Resistance Workout Versus A Weight Workout

Juan C. Colado¹, N. Travis Tripplett¹, Jorge Flandez¹, Joaquin Madera¹, Victor Tella¹, Nicole L. Rogers², Michael E. Rogers, FACSM¹, ²University of Valencia, Valencia, Spain. ³Appalachian State University, Boone, NC. ⁴Austral de Chile, Valdivia, Chile. ⁵Wichita State University, Wichita, KS. (Sponsor: Michael E. Rogers, FACSM) (No relevant relationships reported)

Aquatic resistance 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 adduction, horizontal elevation and descent, and chest fly; (b) 6 sets of traditional resistance exercises. Blood samples were obtained before the test, 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 differences (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 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 gathering firewood” and “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 gathering firewood (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 gathering firewood (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. PURPOSE: The primary aim of the present study was to investigate if a short-term intervention of isometric RT, with brief EC and sustained maximum voluntary contractions (MVC), increased both maximum and explosive strength. The second aim was to investigate the joint angle specificity of adaptations in strength and neural drive. METHOD: Twenty-five healthy males completed 4 weeks of either RT (RT group; n=13; 22 ± 3 years; 1.78 ± 0.07 m; 73 ± 7 kg) or habitual activity (CON group; n=9; 23 ± 3 y; 1.79 ± 0.08 m; 75 ± 8 kg). All training sessions were performed isometrically (65° knee joint angle where 0° is full knee extension; 14 sessions) performing unilateral knee extension (EC [3x10 repetitions (−1)∼1]) followed by MVC [3x6 repetitions (3s)]. Isometric pre- and post-training measurements of torque were made at five different joint angles (-35°, 0°, 5°, 56°, 65°) and evoked twitch contractions. Surface electromyography (EMG) amplitude measurements from the quadriceps femoris during voluntary contractions were normalised to maximum peak-to-peak compound muscle action potential. RESULTS: Changes in MVC were higher for RT than CON at the training angle (65°; P<0.001) and the two more extended angles (5°, −35°) (P<0.001). Normalized EMG at MVC increased more, or had a tendency to increase more, for RT vs CON at these same angles (50°, P=0.023; 35° and 65°, P<0.007). Explosive torque, EMG during EC and twitch contractions did not show time x group interactions (P>0.125). CONCLUSION: Resistance training with brief EC and sustained MVC increased MVC and associated neural drive, but did not increase explosive strength or neural drive during the explosive phase of contraction. We also found angle specific changes in neural drive that appeared to underpin the joint angle specificity of MVC improvements after isometric RT.

PURPOSE: Smartphone applications provide an opportunity for implementing physical activity (PA) interventions remotely. However, little research has been published to date on their effects. The purpose of the study was to test the effectiveness of efithuddy, a theory-based PA smartphone application, on young adults’ PA and motivational beliefs through a four-week intervention. METHODS: A quasi-experimental design with control group was used to examine the effects of efithuddy 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 Efithuddy and used it daily for four weeks. Efithuddy 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 pretost 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. Willk’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 x Gender (Wilks’s A = 0.685, F = 0.996, F (6, 269) = 0.001) and more hours spent collecting water (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.
INTRODUCTION: Non-communicable diseases represent a significant threat to human health and well-being, and carry significant implications including decreased quality of life and increased incidence of chronic disease. 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 (56.3% male; age (mean ± SD) 64.8 ± 6.5 yr) with coronary artery disease, (n=119); chronic obstructive pulmonary disease, (n=101); peripheral arterial disease, (n=53); or type 2 diabetes, (n=43) 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. Attendees 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, minutes of 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-attendees at 12 months. There was no significant difference at baseline for the number of sedentary bouts < 20 min, weight (kg), waist circumference and SAR. However, all values were significantly different between attenders and non-attendees 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 BFIR 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 Ulku S. Karabulut1, Zasha Romero2, Paloma Mendoza3, Ricardo Parra4, 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, 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 Dunsiger2, Katie Schuver3, Joe Ciccolo4, Carrie Terrell1, Melissa Avery1. 1University of Minnesota, Minneapolis, MN; 2Brown University & The Miriam Hospital, Providence, RI; 3Columbia 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 depressive symptoms on the efficacy of exercise on preventing postpartum depression and stress.

METHODS: Participants were low active participants (n=450; average age = 30.7 years) who had a history of depression and anxiety. Participants were low active (93%), had at least some college (93%), and were Caucasian (75%). There was a trend for group differences in age (80–100) and depressive symptoms (p=0.03), so these variables were included as covariates in the models. Using generalized estimating equations (for binary regression and general regression for depressive symptoms and perceived stress) we explored potential moderators of the association between exercise and outcomes (treatment assignment was controlled). Among older participants (based on a median of 30.5 years), greater exercise was associated with lower median stress at 9 months controlling for baseline (b=−4.74, SE=1.69, p=.005). Effects were not significant among younger participants.

CONCLUSIONS: Low exercise levels appear to be a risk factor for depression among young postpartum women. Regarding stress, unlike older postpartum women, younger postpartum women may need strategies in addition to exercise for preventing stress.

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 Qi1, Jiajin Tong1, Senlin Chen2, Shuchang He1, Peking University, Beijing, China; 2Louisiana 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 again after taking the physical activity class. A randomized block design with 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 significantly increased greater increase in mindfulness (yoga group: ΔM = 64, fitness group: ΔM = 31; F196 = 4.08, p < .05) and greater decrease in stress (yoga group: ΔM = 70; fitness group: ΔM = 35; F196 = 5.96, p = .02). CONCLUSIONS: This study confirmed the positive effect of physical activity classes 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 from mindful behaviors and manage stress.

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 Iurriaga2, Maria Ayuso2, Elizabeth Jury3, Lou Atkinson4, Steve Mann1, Gary Liguori4, ACSM, Alfonso Jimenez1. 1Coventry University, Coventry, United Kingdom; 2GOFi Lab, Madrid, Spain; 3Aston University, Birmingham, United Kingdom; 4ukactive Research Institute, London, United Kingdom. (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±11.5 years; 20 females, age 42.9±7.6 years) 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=14], for a 12-week intervention. All participants were categorized as “at risk” according to ACSM Risk Stratification Screening 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 (p<.028; S1.13, post=200.4.04), FREE:
CONCLUSIONS: Programmes of aerobic exercise, resistance and flexibility training for 12-weeks are effective in improving cholesterol levels in healthy, sedentary adults. The exercise intervention used here was shown to be effective, but no better than other exercise options or controls. A larger sample should be used in future research to confirm if combined, structured exercise is more effective at lowering cholesterol levels.

METHODS: Obese adults (N=25) were randomized to an aerobic training group or an aerobic training and increasing non-aerobic exercise activity group. Both groups performed supervised aerobic training (50%-75% VO2 max) for 24 weeks at a dose of 12 kcal per kg per week. Non-aerobic exercise activity (total steps, minutes in light, moderate to vigorous [MVPA] physical activity) was quantified during the entire intervention using Fitbit One accelerometers (removed during supervised exercise sessions). Cardiometabolic assessments included lipids, glucose, insulin, 2-hour glucose/insulin from an oral glucose tolerance test, fitness, and body composition measures (% body fat, weight, and waist circumference). Linear regression models were run with change in the cardiometabolic variable as the dependent variable and baseline value, age, race, sex, supervised exercise time, adherence to exercise dose, change in non-aerobic physical activity variables (change in total steps, minutes in light intensity and minutes in MVPA) as predictor variables.

RESULTS: Change in total steps was a significant predictor for change in weight (r2 = 0.17, p < 0.04), percent weight loss (r2 = 0.18, p < 0.03, waist circumference (r2 = 0.31, p = 0.004), triglycerides (r2 = 0.30, p < 0.01) and relative fitness (r2 = 0.19, p < 0.03). Change in total steps approached significance as a predictor for absolute fitness (p = 0.052) and body fat (p = 0.059). Change in minutes in low intensity was a significant predictor of the change in 2-hour glucose (r2 = 0.20, p = 0.03). Change in MVPA was not associated with change in any cardiometabolic variables (all p > 0.05). Change in non-aerobic exercise activity did not predict changes in glucose, insulin, 2-hour insulin, low density lipoprotein, high density lipoprotein, total cholesterol, or lean mass levels (all p > 0.05).

CONCLUSIONS: Change in non-aerobic exercise activity outside of aerobic training was associated with changes in several cardiometabolic variables. Increasing total steps or minutes in low intensity may represent a clinical target to maximize the health benefits of aerobic exercise training in obese adults.

EFFECTS OF ACCUMULATED SHORT-BOUT EXERCISE ON OBESITY INDEX: A META-ANALYSIS

Hee narc Kim1, Joel Reece1, Minsoo Kang, FACSM1, 2, Middle Tennessee State University, Murfreesboro, TN. Brigham Young University—Hawaii, Laie, HI. The University of Mississippi, University, MS.

(No relevant relationships reported)

Recent exercise guidelines allow individuals to perform accumulated short-bout exercise throughout the day rather than a continuous long-bout of activity. The guidelines may make it easier for individuals to comply with recommended amounts of physical activity. However, the effect of accumulated short-bout exercise on reducing the obesity index is uncertain. PURPOSE: To determine the effect of accumulated short-bout exercise on the obesity index. METHODS: A systematic literature search (key terms: short-bout, accumulated, exercise, obesity) was conducted using electronic databases (PubMed, PsycINFO, CINAHL, Cochran Library) to identify relevant studies. Studies were included if they met the following criteria: (1) at least one group had short-bout exercise intervention; and (2) obesity index [e.g., Body Mass Index (BMI), waist circumference (WC), body fat percentage, etc.] was measured at pre- and post-intervention. The mean and standard deviation of obesity index change scores (the difference between pre- and post-intervention) were extracted to calculate effect sizes (ESs). A random effects model was used to provide an overall ES and 95% confidence interval (CI). Moderator analyses were conducted to evaluate the effects of exercise days/week (e.g., ≤ 5 times, > 5 times), total exercise mins/week (e.g., < 150 mins/w, ≥ 150 mins/w), 100 to 200 mins/w [incremental increases], and intervention length (e.g., ≤ 10 weeks, 11 to 20 weeks, > 20 weeks) on overall ES. Heterogeneity was evaluated using Cochran’s Q statistic. ESs, sample size, and moderator variables were entered into Comprehensive Meta Analysis (Version 2.2). RESULTS: The searches yielded 2,535 articles. After initial screening of titles and abstracts, 159 potentially relevant studies were reviewed in full, 17 studies were included, and 51 ESs were calculated. Overall mean ES was significant [ES = 0.47 (near medium), CI = 0.34, 0.59], and intervention length (e.g., ≤ 10 weeks, 11 to 20 weeks, > 20 weeks) on overall ES. Heterogeneity was evaluated using Comprehensive Meta Analysis (Version 2.2). RESULTS: The searches yielded 2,535 articles. After initial screening of titles and abstracts, 159 potentially relevant studies were reviewed in full, 17 studies were included, and 51 ESs were calculated. Overall mean ES was significant [ES = 0.47 (near medium), CI = 0.34, 0.59]. Moderator analyses indicated that the mean ES was influenced by the three moderator variables: exercise days/week, Q = 4.54, df = 1, p = 0.033; total exercise mins/week, Q = 9.61, df = 2, p = 0.008; intervention length, Q = 7.662, df = 2, p = 0.022. CONCLUSION: In this meta-analysis, there is sufficient evidence to conclude the accumulated short-bout exercise is effective in reducing obesity index among adults.

A WEEKLY STRUCTURED PHYSICAL ACTIVITY PROGRAM ENHANCES SHORT-TERM RETENTION OF MIDDLE-AGED ADULT FITNESS CENTRE USERS

Jorge Lopez-Fernandez1, Brett Staniland1, Isabel Sanchez2, Tamara Iuriarraga3, Maria Ayuso4, Elizabeth Horton5, Steven Mann6, Gary Liguori, FACSM7, Lou Atkinson8, Alfonso Jimenez1. 1Coventry University, Coventry, United Kingdom. 2GO fit LAB, Madrid, Spain. 3ukactive Research Institute, London, United Kingdom. 4University of Rhode Island, Kingston, RI. 5Aston University, Birmingham, United Kingdom.

(No relevant relationships reported)

A weekly structured physical activity program enhances short-term retention of middle-aged adult fitness centre users Lopez-Fernandez, J., Staniland, B., Sanchez, I., Iuriarraga, T., Ayuso, M., Horton, E., Mann, S., Liguori, G., Atkinson, L., Jimenez, A. Fitness centres can play a key role in addressing physical inactivity, yet several studies reveal low retention rate in fitness centres. Few centres, however, use a structured approach by providing a weekly physical activity (PA) program meeting ACSM guidelines.
**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 (44.32 ± 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, VO2 max, 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 center 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, haematocrit, 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 ± 6.82) during the 12 weeks (+7.93 days; p<0.001; 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 centres providing structured daily programs to enhance retention.

285 Board #126 May 30 9:30 AM - 11:00 AM Exercise Training in ‘at Risk’ Black and White Women: A Comparative Cohort Analysis Megan Bowdon, Pamela Marcovitz, Susanna K. Jain, Judith Boura, Kaitlin Liroff, Barry Franklin, FACSM. Beaumont Health, Royal Oak, MI. (Sponsor: Barry Franklin, PhD, FACSM) (No relevant relationships reported)

**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 ≥30 min/session for 6 months. 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-versus 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 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 screeners, 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 = 108) demonstrated the greatest decrease in PHQ-9 scores, average 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 participants achieved the same exercise levels below those recommended by contemporary Physical Activity Guidelines.

286 Board #127 May 30 9:30 AM - 11:00 AM Association Between Stage Of Behavior Change With Cardiovascular Risk, Perception Of Health And Quality Of Life Among Professionals From Health Institutions Amauri dos Santos, João Pedro da Silva Júnior, Victor Keihan Rodrigues Matsudo. CELAFICS, Sao Paulo, Brazil. (No relevant relationships reported)

**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.

**Factors associated with irregularly active stages of behavior change (Pre-Contemplative, Contemplative, Preparation)***

<table>
<thead>
<tr>
<th>Variable</th>
<th>Significant OR</th>
<th>IC 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>&lt;.38</td>
<td>.73</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(15-24)</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>(25-39)</td>
<td>.87</td>
<td>.87</td>
</tr>
<tr>
<td>(40-59)</td>
<td>.66</td>
<td>.66</td>
</tr>
<tr>
<td>(&gt; 60)</td>
<td>.70</td>
<td>.72</td>
</tr>
<tr>
<td>IMC</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Eutrophic</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Overweight</td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Obese</td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Abdomen Circumference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(M &lt; 94 cm e F &lt; 80 cm)</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>(M &lt; 94 cm e F &gt; 80 cm)</td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Presence of Disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>&lt;.001</td>
<td>1.6</td>
</tr>
<tr>
<td>Health Perception</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Quality of Life</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td></td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

287 Board #128 May 30 9:30 AM - 11:00 AM Experimental Investigation of Exercise-Related, Perceived Hedonic Responses to Preferred Versus Imposed Media Content Emily Frith, Paul D. Loprinzi, 38655. University of Mississippi, Oxford, MS. (No relevant relationships reported)

**PURPOSE:** We evaluated the differential influence of preferred versus imposed media selections on distinct hedonic responses to an acute bout of treadmill walking, which has yet to be investigated in the literature. **METHODS:** Twenty university students were recruited for this [160 person-visit] laboratory experiment, which employed a within-subject, counter-balanced design. Participants were exposed to eight experimental conditions, including 1) Exercise Only, 2) Texting Only, 3) Preferred Phone Call, 4) Imposed Phone Call, 5) Preferred Music Playlist 6) Imposed Music Playlist, 7) Preferred Video and 8) Imposed Video. During each visit (except Texting Only), participants completed a 10-minute bout of walking on the treadmill at an exercise intensity of ≥3 days per/week for ≥30 min/session for 6 months. 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-versus 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 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 screeners, 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 = 108) demonstrated the greatest decrease in PHQ-9 scores, average 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 participants achieved the same exercise levels below those recommended by contemporary Physical Activity Guidelines.

**Video:** P=0.002). For the FS all change scores statistically significantly increased from pre-to-mid and pre-to-post (p<.05).

**CONCLUSIONS:** This experiment provides strong evidence that entertaining media platforms substantively influence acute hedonic responses to exercise. Future work should explore social media strategies to promote long-term exercise adherence.
288 Board #129 May 30 9:30 AM - 11:00 AM
The Glutathione Redox Status And Total Antioxidant Responses To Supervised Physical Exercises In Metabolic Syndrome
Roberto C. Burini, FACSM, Fernando Moreto, Hugo T. Kano, Okeleys Teixeira, Camila R. Correa. Sao Paulo State University (UNESP) - Botucatu Medical School, Botucatu, Brazil.

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(LSM).

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. They all 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 yrs old (55±8 yrs), 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, HDLC, GSH and plasma TAP. However, only subjects without MetS increased HDLc, 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, HDLC 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 whereas, in the absence of MetS, the TAP responsiveness to LiSM was positively influenced by the increased HDLc 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.

289 Board #130 May 30 9:30 AM - 11:00 AM
The Wearable Technological Device as a Means of Physical Activity Monitoring
Alissia Underhill. Olivet Nazarene University, Bourbonnais, IL.

PURPOSE: To assess the use of a wearable technological device for the increase in attainment of physical activity (PA) with the goal of preventing Type II Diabetes Mellitus (T2DM) through weight loss. The Fitbit offers an advantage to other activity trackers when used for study purposes, in that it can provide continuous measurement of PA across the entire study period.

METHODS: Men and women over the age of 40, and at risk for prediabetes, were recruited. The study period was four months in length, with an initial four weeks of baseline PA testing, followed by 12 weeks of lifestyle intervention. Individualized PA goals were set. PA monitoring was very successful. Participants averaged 72 days of PA tracking with 46% of participants reaching the maximal number of days (77). The Fitbit Flex measures steps, minutes sedentary, minutes lightly active, minutes fairly active, minutes very active, and total active minutes.

RESULTS: Participants (N = 13) were aged 65.8 ± 8.3 years. At baseline, participants were performing 220.8 ± 249.0 minutes per week of moderate intensity PA. Participants increased moderate intensity PA to 243.3 ± 198.8 minutes per week. At baseline, participants were accumulating 7511.6 steps/day (SD = 3271.2) increasing to 8177.6 steps/day (SD = 3078.9) taken during the three month intervention. No statistical significance was found. A Pearson CC (0.598) showed there was a positive trend with minutes of moderate-to-vigorous activity and weight loss. 36% of the variables of weight loss was influenced by minutes of PA. Compliance to wearing the Fitbit was very good with 93.1% of the weeks having data tracked for at least ≥ 6 days/week. Wear time was corroborated by Fitbit data, which showed of the 1415 tracked days, only 9.3% days recorded were of less than 2000 steps. Barriers to technology were low and 100% of participants strongly agreed that continuous monitoring of weight and PA encouraged them to make healthy lifestyle changes.

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.

PSW05 papers from the Annual Meeting of the Physical Society of Waseda University — PHYSICAL SCIENCE IN SPORTS & EXERCISE®

290 Board #131 May 30 9:30 AM - 11:00 AM
The Physiological Assessment and Analysis of the Physical Demand of Riding a Snowmobile
Tania J. Pereira. University of Guelph, Guelph, ON, Canada. (Sponsor: Lawrence Spriet, FACSM)

No relevant relationships reported.

Physical activity (PA) is widely regarded as an essential component for maintaining health, yet there are subsets of the population that remain insufficiently active. This issue can be exacerbated in the winter due to decreased daylight hours, high precipitation and low temperature, thus some individuals are less likely to engage in PA. In cold climates, snowmobiling is a popular recreational activity, and could offer a potential solution for increasing PA time to the recommended ACSM standards; predicated on the fact that it is an activity that is sufficiently intense to stimulate health benefit.

PURPOSE: To measure the physical demands and activity patterns of a typical snowmobile ride in habitual snowmobile riders (n=44).

METHODS: The physical demand of an average ride, and requisite tasks, were quantified using ambulatory oxygen consumption and pre/post strength and power assessments. Aerobic demand was compared to a graded exercise test (GXT) on a cycle ergometer to determine exercise intensity.

RESULTS: A “representative” ride (30 ±17 min) involved a mean aerobic demand of 17.5 ± 6.6 ml/kg/min or 49 ± 20 % of VO2 max (5 METS), which compares to traditional forms of physical activity. During the ride, the VO2 values ranged from a mean minimum of 7.1 ± 3.0 ml/kg/min to a mean maximum of 32.5 ± 12.4 ml/kg/min. Maximal strength decreased 6% for maximal hand grip (p<0.001) and a similar magnitude for vertical jump, but the latter change was not significant. This immediate decrement in strength demonstrates snowmobiling to be an activity that requires significant upper body work. The mean VO2, while specifically freeing a stuck snowmobile was 27.9 ± 9.7 ml/kg/min (7-8 METS), indicating that riders were working at 77 ± 28% of their VO2 max.

CONCLUSIONS: Snowmobiling is an activity which falls into the moderate to vigorous intensity activity range that is typically associated with health benefits. A typical ride involves both aerobically based and muscular strength components as shown by a moderately demanding riding VO2 and muscular strength decrements Based on the observed values, snowmobiling is of a sufficient PA intensity to stimulate changes in health and fitness. Funding support from Mitacs and The Canadian Council of Snowmobile Organizations.

291 Board #132 May 30 9:30 AM - 11:00 AM
Randomized Trial Of Amino Acid Mixture Combined With Physical Activity Promotion In Overweight Adults
Keisuke Ueda1, Hiroiyuki Sasa2, Takehiro Tsujimoto1, Chiaki Sanbong1, Shuji Ikegami1, Yoshio Nakata3, Meiji Co., Ltd., Odawara, Japan. The University of Tokyo, Tokyo, 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 combined with a 4-week follow-up period was conducted at a single center in Minato-ku, Tokyo, Japan, between December 2016 and May 2017. The data were examined between June and August 2017. The study participants were 200 overweight adults within the age of 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 sessions of physical activity. The primary endpoints were the 12-week changes in the abdominal total, subcutaneous, and visceral fat areas, as assessed by computed tomography.

RESULTS: Of the 200 enrolled participants, 199 (99%) completed the 12-week intervention. Significant declines 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). No study-related unfavorable events occurred.

CONCLUSIONS: A-mix supplementation in combination with physical activity promotion facilitated abdominal fat reduction in overweight adults. This trial was based on a collaborative research agreement between the University of Tsukuba Faculty of Medicine and Meiji Co., Ltd. K.U., C.S., and S.I. are employees of Meiji Co., Ltd.
292 Board #133 May 30 9:30 AM - 11:00 AM

Validity Of Adhesive Worn Actigraph GT3X+ Accelerometer

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

(Purpose 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: Twelve participants (Age: 29 ± 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 < 0.001 for all).

CONCLUSIONS: When using ActiGraph GT3X+ accelerometer, adhesive worn devices may be a valid alternative to traditional belt-worn devices.

293 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

Breanne R. Carlson¹, Rachel Greco, 49855¹, Erich J. Petushek¹, Karin A. Pfeiffer, FACSM², Joseph J. Carlson³. ¹Michigan State University, East Lansing, MI, ²Northern Michigan University, Marquette, MI, ³Michigan State University, East Lansing, MI. (Sponsor: Karin Pfeiffer, FACSM)

(Purpose 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 1600 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 significant differences in perceived importance of both PA (Mean(SD): Sparta pre = 2.32(0.74) and post = 2.48(0.66) vs Active pre = 2.19(0.72) and post = 2.38(0.73)), and nutrition (Mean(SD): Sparta pre = 2.26(0.78) and post = 2.37(0.73) vs Active pre = 2.16(0.76) and post = 2.31(0.71)) in relation to health, however both groups increased over time in both measures (p < 0.001 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.

294 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. Linde¹, Nancy E. Sherwood², Julian Wolfsone², Matthew P. Buman, FACSM³, Mark A. Pereira¹. ¹Northwestern University, Chicago, IL, ²University of Minnesota, Minneapolis, MN, ³Arizona State University, Phoenix, AZ. (Sponsor: Matthew Buman, FACSM)

(Purpose 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></td>
<td>BMI &lt;25</td>
<td>13.63 (2.80)</td>
</tr>
<tr>
<td></td>
<td>BMI ≥25</td>
<td>7.77 (2.74)</td>
</tr>
</tbody>
</table>

*BMI Category

<table>
<thead>
<tr>
<th>Change in LPA from baseline to 3 months</th>
<th>BMI Category</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI &lt;25</td>
<td>3.05 (1.44)</td>
<td>0.04</td>
</tr>
<tr>
<td>BMI ≥25</td>
<td>2.39 (1.41)</td>
<td>0.09</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.
Does Squat Depth and Width Influence Hip and Knee Joint Moments?

W Matt Denning\textsuperscript{1}, Brad Gardiner\textsuperscript{1}, Tyler Standifird\textsuperscript{1}, Lauren Williams\textsuperscript{1,2}, Brigham Young University - Idaho, Rexburg, ID. \textsuperscript{1}Weber State University, Ogden, UT. \textsuperscript{2}Utah Valley University, Orem, UT.

(NO relevant relationships reported)

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 patterns. **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 squats 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.

**Results:** Generally, concentric and eccentric hip and knee moments increased with greater squat depth and decreased with greater squat width. At the deep depth, the eccentric moments for the wide and widest stance widths were 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 ± 0.17 Nm/kg, widest = 0.78 ± 0.17 Nm/kg; p < 0.01). 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 wide stance widths (1.14 ± 0.14 Nm/kg; p < 0.01). The knee concentric moment for the deep depth was significantly less at the widest stance width (1.07 ± 0.20 Nm/kg) when compared to the wide (1.19 ± 0.21 Nm/kg) and standard 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.

---

Clinical Trial To Assess The Effect Of High-intensity Interval Training, Progressive Resistance Or Concurrent Exercise Protocol On Hormonal Responses In Latin-american Overweight Adults

Gina Paola Velasco-Orjuela\textsuperscript{1}, Andrea del Pilar Quintero\textsuperscript{1}, María A. Domínguez-Sánchez\textsuperscript{2}, Jorge E. Correa-Bautista\textsuperscript{3}, Antonio García-Hermoso\textsuperscript{4}, Jhonatan C. Peña-Ibagón\textsuperscript{4}, Robinson Ramirez-Velázquez\textsuperscript{4}, Universidad del Rosario, Boyacá DC, Colombia. \textsuperscript{1}Universidad de la Sabana, Chía, Colombia. \textsuperscript{2}Universidad de Santiago de Chile, USA, Chile. (No relevant relationships reported)

**Purpose:** We hypothesized that the concurrent training (high-intensity interval training (4/4 min intervals at 85-95% maximum heart rate [HRmax]), interspersed with 4 min of recovery at 75-85% HRmax) + progressive resistance training (12-15 repetitions per set, at 50-70% of one repetition maximum with 60s of recovery) induces the highest metabolic perturbations and therefore the highest hormonal responses compared to the progressive resistance training and the high-intensity interval training protocol in a cohort of Latin-American overweight adults (age 18-30 years old). **Methods:** Randomized, parallel-group clinical trial among fifty-one men (23.6±3.5 yr; 83.5±7.8 kg; 28.0±1.9 kg/m2), physical inactivity (i.e. <150 min of moderate-intensity exercise per week for greater than 6 months), with abdominal obesity (waist circumference ≥ 90 cm) or body mass index ≥ 25 and ≤ 30 kg/m2 were randomized to the following 4 groups: high-intensity training (n=14), progressive resistance training (n=12), concurrent training (high-intensity and progressive resistance training (n=13)), or non-exercising control (n=12). Total- and free-testosterone and total-testosterone/cortisol-ratio assessments (all in serum) were determined before (pre) and 1-min post-exercise for each protocol session. **Results:** Decreases in cortisol and total-testosterone/cortisol-ratio levels were observed; −57.08% (95% CI, −77.88 to −38.26) and −0.021 (95% CI, −0.012 to −0.032, d=1.49), respectively in the high-intensity training group. In per-protocol analyses, the combined training group had greater changes in cortisol levels (−54.49, 95% CI, −15.28 to −93.69; d=1.33) and total-testosterone/cortisol-ratio (−0.017, 95% CI, −0.004 to −0.030; d=0.90) vs the high-intensity training group, but not the other interventions. Analyses of covariance revealed no significant change in the total- and free-testosterone between groups over time. **Conclusions:** The present data indicate a concurrent, or high-intensity training reduced cortisol and total-testosterone/cortisol-ratio levels significantly in physically inactive adults. Further study is required to determine the biological importance of these changes in hormonal responses in overweight men. **Trial Registration:** ClinicalTrials.gov NCT02915913.

---

Volume Of Exercise For Prevention Of Weight Regain (MET POWER)

Amanda N. Szabo-Reed, Joseph E. Donnelly, FACSM, Richard A. Washburn, FACSM, Debra K. Sullivan, Jeffery J. Honas, Matthew S. Mayo, Ron Krebill, Anna Gorzycya, Jeannie Goetz, Kansas University Medical Center, Kansas City, KS. (No relevant relationships reported)

**Purpose:** There is limited evidence regarding the volume of exercise required to minimize weight regain. The purpose of this trial was to examine the impact of 3 levels of exercise on weight regain subsequent to weight loss in adult men and women. **Methods:** Overweight/obese adults (n=175 (32 men, 143 women), age= 43 yrs., BMI=32 kg/m\(^2\)) who lost ≥ 5% of their initial body weight in response to a 3-mo. weight loss intervention which included energy restriction and increased exercise (100 min\(\times\)wk\(^{-1}\)) completed a 12 mo. maintenance intervention. Participants were prescribed a weight maintenance diet (RMR x 1.4), attended weekly behavioral sessions, and were randomized to one of 3 levels of exercise (150, 225, 300 min\(\times\)wk\(^{-1}\)), with a minimum of 3 sessions\(\times\)wk\(^{-1}\) under supervision. Exercise min across 12 mos. were obtained from direct observation or heart rate monitors for supervised and unsupervised sessions, respectively. **Results** (Table 1): There were no significant differences in the volume of exercise competed during weight loss (0-3 mos.) by randomized group (p = .32) or gender (p = .85). Average mins of completed exercise were significantly greater in those randomized to 300 min\(\times\)wk\(^{-1}\) (170 min\(\times\)wk\(^{-1}\) compared with both the 150 min\(\times\)wk\(^{-1}\) (147 min\(\times\)wk\(^{-1}\)) or 225 min\(\times\)wk\(^{-1}\) (120 min\(\times\)wk\(^{-1}\), p<.05) groups. Weight regain across all 3 groups was minimal (<3%), however, there were no significant differences in the magnitude of weight regain by randomized group (p=21) or gender (p=37). **Conclusion:** These findings suggest that exercise, irrespective of magnitude, is associated with weight loss maintenance.

Table 1.
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 could plausibly serve as a stealth physical activity intervention as it aims to strengthen the dog-owner bond, a construct strongly associated with dog walking behavior. PURPOSE: To examine changes in dog owners’ self-reported dog walking behavior and device-measured moderate-to-vigorous physical activity (MVPA) after completing basic obedience training. METHODS: Forty-one healthy but inactive individuals (85% female; mean age=40) who reported walking their dog ≤3 d/wk were randomized to a 6-week exercise intervention on physical and mental health in stroke patients. Method: Sixty-six stroke patients were randomly assigned to the following two groups. Thirty-three patients were in the experimental group (age: 58.30±11.04 yr), another thirty patients were in the control group (age: 60.23±9.59 yr). The experimental group had performed yoga exercise 3 times a week for twelve weeks with each session lasting 60 minutes per day, including warm-up (10 minutes), main exercise (35 minutes) and moderate stretching & meditation (15 minutes), additionally except rehabilitation courses held by the hospital. The control group had not carried out any exercise intervention except rehabilitation courses. The Borg balance scale, Beck depression inventory, quality of sleep, and quality of life were tested before and after yoga exercise intervention. Analysis of covariance (ANCOVA) was applied to examine the difference between experimental and control groups on balance, depression, quality of sleep and quality of life. RESULT: The score of Borg balance scale for stroke patients in the experimental group (19.62%) increased significantly compared to that in the control group (11.79%) (p<0.05). The depression level in the experimental group (29.01%) decreased significantly compared to that in the control group (35.3%) (p<0.05). The score of quality of sleep for stroke patients in the experimental group (29.37%) decreased significantly compared to that in the control group (46.7%) (p<0.05). In addition, the score of quality of life in the experimental group (19.59%) increased significantly compared to that in the control group (21.18%) (p<0.05). CONCLUSION: The result indicated that the yoga exercise intervention could improve the balance, depression levels, quality of sleep, and quality of life in stroke patients. As well as the yoga exercise intervention could be beneficial in physical and mental health for stroke patients.
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. **Result:** The result showed that there was no significant difference between two groups in all variables. CF significantly decreased in average rate of force development (6.0%), but significantly increased isokinetic strength and 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. **Keywords:** body composition, high intensity interval training, body fat.

Infant heart rate (HR) and heart rate variability (HRV) are used to estimate the nervous system development and overall well-being of the fetus. Exercise during pregnancy is associated with improved infant HR and HRV. Similarly, DHA supplementation during pregnancy has also been shown to improve infant HR and HRV. However, there has not been any observation of the potential relationship between exercise intervention and maternal DHA levels on Infant HR and HRV. **Purpose:** To determine the relationship between maternal exercise and plasma levels of DHA on infant nervous system development, estimated by measures of HR and HRV. **Methods:** Maternal plasma collected at 16 and 36 weeks of gestation were processed using solid phase extraction and analyzed using liquid chromatography/triple quadrupole mass spectrometry (LC/MS) to measure DHA levels. Samples were analyzed from 3 exercising (>50min aerobic exercise, 3x week) and 2 non-exercising pregnant women; average weekly METs were calculated based on standard MET values for each exercise activity. Infant HR and HRV were measured 1 month after birth. **Results:** There were no significant differences between groups in all variables. CF significantly decreased body fat at week 5. **Conclusion:** The result showed that there was no significant difference between two groups in all variables. CF significantly decreased body fat at week 5. **Keywords:** body composition, high intensity interval training, body fat.

Physical inactivity is associated with increased cardiometabolic disease risk and reductions in emotional health. Patients recovering from orthopedic surgery of the lower limb often experience pain and functional limitations, that lead to reduced physical activity levels, and weight gain. The inclusion of a post-operative wellness consultation with exercise and nutrition components, may motivate orthopedic patients to modify behaviors to mitigate the detrimental effects of inactivity following surgery and its associated adverse health outcomes. **Purpose:** The purpose of this study was to evaluate post-operative changes in physical activity, body composition, knee function, pain, and feeling scales as well as the efficacy of a nutrition and exercise consultation targeting the restoration of physical activity levels. **Methods:** Twelve patients undergoing partial meniscectomy were evaluated by an exercise physiologist 1 week (1W) and 6 weeks (6W) after surgery, and were randomly assigned to a control (CON) or post-surgical consultation (PS) group. The PS received personalized exercise and nutrition recommendations and wore a fitness tracking device to promote adherence. The Lysholm Knee Score (LKS) was administered to assess pain, and the Short Form Health Survey (SF-12) was divided into a mental component summary (MCS) and a physical component summary (PCS). Body mass (BM), percent body fat (PBF), and skeletal muscle mass (SMM) were assessed using a multi-frequency bioelectrical impedance. **Results:** There were no significant between-group differences in BM (p = 0.608), PBF (p = 0.804), SMM (p = 0.328), PCS (p = 0.458), or MCS (p = 0.543). **Conclusion:** Despite few significant differences between groups, there were significant individual level improvements in multiple health outcome measures. These findings suggest that there can be a positive impact on the health of military spouses from tailoring a program to their unique challenges. Future interventions with this population should continue to emphasize the importance of prioritizing self-care and show an interest in meeting the needs of spouses that are often overlooked.
POURPOSE: 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, the 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 ± 5.7 years, SD: 6.5 years, women: 66%) in 8 CBGE groups. The original 10-min exercise program (mean intensity: 2.7 METs, Osawa 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 average 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 = 0.118). Significant improvement was observed in time spent in the two-step test (1.33 to 1.39, p < 0.001) and chair standing test (22.9 to 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 and Development (AMED), MIEXT KAKENHI Grant Number JP14023054 and Keio Gijuku Academic Development Funds.

Body Composition Differences in Trained and Sedentary Individuals Matched for High BMI
Andrea Santi. University of Minnesota, Minneapolis, MN.

PURPOSE: This study determined whether aerobic training reduces body fat and insulin resistance. We compared body composition in obese insulin-resistant sedentary (OIR), obese insulin-sensitive sedentary (OS), and obese trained (OT) subjects matched for body mass index (BMI). We hypothesized that OT subjects would have less fat, especially visceral fat, and greater fat-free mass than the OIR or OS subjects.

METHODS: We measured body composition by Dual X-ray Absorptiometry (DXA) (n = 33; N = 11 in each group) in OIR, OS, and OT subjects matched for age, gender, and BMI. The OT participants were selected by self-report, with preferential recruitment from running groups and marathon mailing lists. RESULTS: Each group was matched for age [Mean ± SE, overall age 31.7 ± 0.9, overall sex distribution (64% male, 36% female) and overall BMI (31.6 ± 0.7)]. Insulin resistance (mean: SE), as measured by the homeostatic model assessment for insulin resistance (HOMA-IR), was higher in the OIR group (3.3 ± 2.0) than the OS (0.9 ± 0.2, p < 0.01) or OT (1.6 ± 0.2, p < 0.01) groups. Mean body fat percent was highest in the OIR group (43.5 ± 1.7) than the OS (37.0 ± 2.3, p < 0.04) or OT group (34.0 ± 3.1, p < 0.01). The OIR group also had higher mean fat mass in the body (39.1 ± 3.8 vs. 26.7 ± 3.8 kg, p < 0.005), android (4.3 ± 0.4 vs. 2.6 ± 1.3 kg, p < 0.05) and visceral region (1.3 ± 0.1 vs. 0.6 kg, p < 0.005) than the OT group. In contrast, the leaner mineral content, body fat percentage, and body mass index (BMI) were lower in the total body (2.8 ± 0.8 vs. 3.1 ± 0.7 kg, p < 0.05), arms (0.38 ± 0.03 vs. 0.44 ± 0.02, p < 0.05), gynoid region (0.27 ± 0.02 vs. 0.33 kg ± 0.02, p < 0.05), leg (1.0 ± 0.07 vs. 1.2 kg ± 0.06, p < 0.05) and pelvis (0.36 ± 0.02 vs. 0.43 kg ± 0.02, p < 0.05) was lower in the OIR group than the OT group. There was no significant difference in mean HOMA-IR or body composition between OS and OT groups.

CONCLUSION: While matching for age, gender, and BMI, obese trained subjects had higher lean mass, bone mineral content and lower fat mass than obese insulin resistant subjects. These findings support the limitations of using BMI to predict body composition, especially in trained subjects.

Physical activity, specifically jumping, is most effective in promoting bone health. Engaging adolescents in appropriate activity to achieve peak bone mass is critical. Although physical education (PE) programs offer content that would be deemed as bone-strengthening, no research has examined jumping opportunities in physical education.

PURPOSE: to examine jumping behavior in 4th and 5th grade female PE students.

METHODS: Thirty-eight 4th or 5th grade female students were randomly observed during PE lessons. The content of the lessons consisted of: tag games, mat ball/kickball, cardio activities and jump roping. Average lesson time was 24 minutes 30 seconds. Five researchers were trained to observe jumping behaviors of adolescents during PE. Jumping was defined as upward vertical movement during which both feet simultaneously and visibly left the ground. Prior to data collection inter-rater reliability was established at .80. Observers recorded all jumping behaviors that occurred during the warm-up, main lesson and cool down. Data were analyzed by lesson content (Jump Rope and Non Jump Roping).

RESULTS: Descriptive statistics were used to analyze all data. Across all non-jump roping lessons (N = 26) students averaged 15.8 jumps at a rate per minute (rpm) of .6. Students averaged 3.3 jumps during warm-ups, 12 jumps during the main lesson and 0 jumps during the cooldown. Across all jump roping lessons (N = 12) results indicated that students averaged 91.2 jumps at rpm of 3.9. Additionally students averaged 3.9 jumps during warm-ups, 87.3 jumps during the main lesson and 0 jumps during the cool down. CONCLUSIONS: Jump roping in PE can provide frequent jumping opportunities. However, non-jump roping lessons provided fewer jumping opportunities. Additionally, PE teachers are not providing jumping opportunities during a warm-up which may be an opportunity if the main lesson does not emphasize jumping. Further research needs to explore the frequency of jumps for health benefits.
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 survey 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=.001, 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<.001, personal health & wellness are important to me p<.001, my school provides opportunities for healthy eating and PA p<.001, it’s acceptable to be withheld from PE/ recess as punishment p=.048, my community provides opportunities for healthy eating and active living p=.0011, how often do brain breaks occur? p=.005, what time of day to brain breaks occur? p=.5133), but the only “healthy eating/active living are important” and “community opportunities for healthy eating/active living” were practically meaningful. CONCLUSIONS: The wellness program 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.

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

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 listserve across land grant institutions from all 50 states.

Results: Among respondents (N=806), 625 (77.5%) completed ≥75% 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 time spent with adult audiences, 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.

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. 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, Beta=-.202). 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, Beta=.498).

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 survey 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=.001, 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<.001, personal health & wellness are important to me p<.001, my school provides opportunities for healthy eating and PA p<.001, it’s acceptable to be withheld from PE/ recess as punishment p=.048, my community provides opportunities for healthy eating and active living p=.0011, how often do brain breaks occur? p=.005, what time of day to brain breaks occur? p=.5133), but the only “healthy eating/active living are important” and “community opportunities for healthy eating/active living” were practically meaningful. CONCLUSIONS: The wellness program 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.

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

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 listserve across land grant institutions from all 50 states.

Results: Among respondents (N=806), 625 (77.5%) completed ≥75% 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 time spent with adult audiences, 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.

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. 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, Beta=-.202). 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, Beta=.498).
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 project 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.

**Purpose:** 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 (EDU = 13%; CON = 12.3%), which were maintained at 12 and 24 months. EDU also showed an increased prevalence of “actives” and “very actives” 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 actives” 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 levels in patients with knee OA.

**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 (EDU = 13%; CON = 12.3%), which were maintained at 12 and 24 months. EDU also showed an increased prevalence of “actives” and “very actives” 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 actives” 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 levels in patients with knee OA.
**HealtheSteps** is a 6-month lifestyle program, whereby participants at risk for chronic disease meet bi-monthly with a trained HealtheSteps coach to set prescriptions in the areas of physical activity, exercise, and healthy eating.

**PURPOSE:** A prescription was designed to provide a pragmatic randomized controlled trial to explore the acceptability of delivering HealtheSteps to participants at risk for chronic disease by members of the community working at primary care and health services organizations in Southwestern Ontario.

**METHODS:** Data for the process evaluation included interviews with trained HealtheSteps coaches post-program (month 6) and interviews with participants, 6 months post-program (month 12). All coach interviews (n=12) and a purposeful sample of participant interviews (n=13) were analyzed separately. The sample of participant interviews were selected based on maximum variation in terms of site location, age, gender, ethnicity, marital status, education, occupation, body mass index, average daily step count, and self-rated health. Transcripts were read through by the research team, key themes and exemplar quotes to support these themes were then identified and summarized.

**RESULTS:** Coaches found HealtheSteps was easy to deliver as the focus was only on three key risk factors for chronic disease. Coaches noted group sessions, ensuring participants had the same coach at every session, and evaluating participant readiness prior to beginning the program, could improve the program for future delivery. Participants spoke positively of their coaches and found the program promoted accountability over their healthy lifestyle changes through tracking progress and step counts on the pedometer, and meeting with their coach. Participant suggestions to improve the program included providing pedometers for participants to continue to monitor their physical activity, and providing opportunities for the participants to be accountable to their lifestyle changes long-term, once the formal in-person coaching sessions are complete.

**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 (BHIF): a 12-week family-based pediatric obesity treatment program in a mid-western community of 30,000. METHODS: BHIF 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-12 week 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 BHIF 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 BHIF program is effective and increasing its reach is an important consideration to maximize its public health impact.
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, 600 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, G3:13.9±3.4 watt/kg wt) and females (G1: 9.1±2.6 watt/kg wt, G2: 9.0±2.6 watt/kg wt, G3:7.3±3.3 watt/kg wt). Knee extensor strength was significantly different between survivors and non-survivors (G1 vs. G3, G2 vs. G3) in males (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±13.0/10sec., 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.

REFERENCE:
Hye Lee, Miyoung Lee, Eunhyung Choi, Jaeyoun Jung, Jaemyung Kim, Muncheong Choi. (Sungmyung University, SEOUL, Korea. Republic of; Kookmin University, SEOUL, Korea, Republic of; Korea Institute of Sport Science, SEOUL, Korea, Republic of. (No relevant relationships reported)
CVD mortality risk 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-hip ratio (W:H), 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 woman-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 5 adiposity-combined risk categories, there was a significant positive trend in CVD mortality across decreasing categories of CRF within each category of W:H 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 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.

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

334 Board #175 May 30 9:30 AM - 11:00 AM The Prevalence of Hypertension in a Population of Former Professional Football Players
 Jaume Kaplan, Genevieve E. Smith, Gregory W. Stewart, FACSM. Tulane University School of Medicine, New Orleans, LA. (Sponsor: Gregory Stewart, MD, FACSM) (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 the most frequent hypertension stage (35.9%) with 20.5% of the sample having essential hypertension. Prevalence of hypertension was significantly higher in 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 these 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 (44.4% of screened 20-39 year-old former players reported 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

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) (No relevant relationships reported)

Chronic disease risk and poor health behaviors, including physical inactivity, are increasing among college students. African American (AA) college students are a vulnerable population given the disproportionate manifestation of chronic disease in AA adults. AA women are particularly high risk given the higher prevalence of chronic diseases among women compared with men. PURPOSE: To examine differences in chronic disease risk among AA college students by attainment of physical activity (PA) guidelines and gender.

METHODS: AA college students (N=63; 41 female, 20 male; aged 18.2 ± 1.3 yrs) were recruited for a study examining and intervening on cardiovascular disease risk. Physical assessments and blood marker investigation were collected. Participants also completed self-report surveys: International PA Questionnaire (IPAQ), Perceived Stress Scale (PSS), and Pittsburgh Sleep Quality Index (PSQI). Students were categorized based on PA guidelines (≥150 min/wk). Descriptive statistics, frequencies, and independent samples t-tests were used to describe overall and stratified chronic disease risk profiles.

RESULTS: Overall, students were overweight/obese (54%), had optimal blood pressure, did not attain the PA guidelines for health (54%), were moderately stressed (PSS: 15.1 ± 6.5), had poor sleep quality (PSQI: 5.7 ± 3.1), and failed to meet sleep recommendations (6.5 ± 1.2 hrs/night). Females reported higher perceived stress than males (PSS score 16.7 ± 5.6 vs. 11.5 ± 7.2, p<.01); no other gender-specific differences in physical or blood biomarkers were detected. More males (85%) than females (28%) met PA guidelines. Females who met PA guidelines had significantly lower waist circumference (WC) (74.5 cm vs. 79.5 cm, p<.001), lower HDL cholesterol (57.9 vs. 49.8 mg/dL), and higher sleep quality (4.8 vs. 6.0) compared with females not meeting PA guidelines (all p <.05). There were no significant differences between males by PA guideline attainment.

CONCLUSIONS: We identified linkages between PA guideline attainment and chronic disease risk in AA college students, which was more meaningful among females. Given the lower PA rates among females, additional work is needed to understand strategies for increasing PA among female AA college students. Supported by NIHMD 1R15MD010194-01.

332 Board #173 May 30 9:30 AM - 11:00 AM A Strategy To Reduce The Dropout Rate In A Volunteer-Led Community Weight-Loss Program
 Ryoko Mizushima, Yoshiho Nakata, Xinyu Zuo, Seiji Maeda, Kiyoji Tanaka, FACSM. Tsukuba University, Tsukuba, Japan. (Sponsor: Kiyoji Tanaka, FACSM) (No relevant relationships reported)

We implemented a volunteer-led community weight-loss program within the Tsukuba 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: The purpose of this study was to compare the degree of weight loss and the dropout rate across the 2 interventions (2015 vs. 2016).

METHODS: Participants were Tsukuba residents with a body mass index (BMI) >25 kg/m²: 27 in 2015 (4 men, age 60.7 ± 4.0 years, BMI 29.7 ± 4.0 kg/m²) and 39 in 2016 (9 men, age 57.3 ± 11.0 years, BMI 28.8 ± 3.8 kg/m²). The weight-loss program was led by community volunteers who attended 4 to 5 training sessions (3 hours per session). The program consisted of 8 sessions (2 hour per session) over 3 months. Participants were instructed to maintain a well-balanced low-calorie diet targeting 1680 and 1200 kcal/day for men and women, respectively. In 2015 (4 men, age 60.7 ± 4.0 years, BMI 29.7 ± 4.0 kg/m²) and 2016 (9 men, age 57.3 ± 11.0 years, BMI 28.8 ± 3.8 kg/m²). The dropout rate (44.4% vs. 25.8%, p <.05). A significant difference was found in the dropout rate (44.4% vs. 25.8%, p <.05).
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 yo) 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 accelerometry (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 (NW; 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 = .057) all p < .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; all p < .05). Only the association between MVPA and SBP was significantly different across WC strata, with a stronger association observed among the HWC group (p < .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.

PURPOSE: To examine 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 min/d (i.e., sedentary, light, moderate, vigorous, total metabolic equivalent task (MET)) using the Crotter 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 < .05 or < .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 = .51, 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

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 were assessed for MetS and DM status based on BMI, FBG, HbA1c, and questionnaire results, and stratified by race (Black, White, Other). Statistical analyses included 1-way ANOVA and Tukey post hoc pair comparisons. RESULTS: 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 for 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.

PURPOSE: To examine the association between physical activity level (PAL), body composition and muscular strength among healthy adults.

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 10000 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 values between physical activity level and the other variables are in the table below.

CONCLUSIONS: Unfortunately, health professionals from Sao Paulo state are not active enough. Objectively measured of physical activity level was significantly associated with BMI health professionals.
Recent studies have suggested a constrained energy expenditure model, wherein the capacity of physical activity to increase total daily energy expenditure is limited in part 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)^2 - 3.105(PAEE) + 635.6 (p = 0.011, r^2 = 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). After adjusting for RMR, PAEE was still correlated with EBAL (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 reductions in EBAL. These findings support a constrained model of energy expenditure.
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 30.9±13.3 pounds. Women reporting nausea had significantly greater GWG than those not reporting nausea (p=0.0015). There were no significant relationships between GWG and fatigue (p=0.97), back pain (p=0.19), pelvic pain (p=0.44), or swelling (p=0.98). CONCLUSION: Overall, the presence of nausea during early pregnancy was the only significant predictor of GWG. Specifically, women who reported nausea gained significantly more weight than those who did not. Future research should prospectively investigate the mechanisms by which nausea impacts health behaviors (thereby influencing GWG) within larger, more diverse samples. This information could prove to be valuable targets for behavioral interventions seeking to optimize GWG and maternal/child health outcomes.

**RESULTS**: Compared to those with desirable values, mean combined RGS was significantly lower in men (p<0.05) with elevated WC (3.61 vs. 2.79 kg/BMI), elevated BP (3.36 vs. 2.83 kg/BMI), elevated TG (3.44 vs. 2.97 kg/BMI), IGF (3.48 vs. 3.05 kg/BMI), reduced HDL-C (3.31 vs. 3.06 kg/BMI), and in those with MetS (3.47 vs. 2.79 kg/BMI), respectively. Similarly, compared to those with desirable values, mean combined RGS was significantly lower in women (p<0.05) with elevated WC (2.47 vs. 1.81 kg/BMI), elevated BP (2.14 vs. 1.72 kg/BMI), elevated TG (2.15 vs. 1.79 kg/BMI), IGF (2.18 vs. 1.80 kg/BMI), reduced HDL-C (2.11 vs. 1.84 kg/BMI), and in those with MetS (2.19 vs. 1.72 kg/BMI), respectively.

**CONCLUSIONS**: Mean combined RGS was lower in men and women with increased cardiometabolic risk and in those with MetS.

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

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>NORMAL n=97</th>
<th>OVERWEIGHT n=68</th>
<th>OBESITY CLASS 1 n=121</th>
<th>OBESITY CLASS 2 n=31</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>
<tr>
<td>VO2max (liters/min)</td>
<td>43.8 ± 6.5</td>
<td>39.6 ± 6.3**</td>
<td>34.3 ± 5.1**</td>
<td>30.1 ± 4.2**</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>82.7 ± 6.7**</td>
<td>93.8 ± 7.3</td>
<td>104.7 ± 7.8**</td>
<td>114.7 ± 7.4**</td>
</tr>
<tr>
<td>Body fat mass (kg)</td>
<td>13.5 ± 5.6</td>
<td>20.6 ± 4.2**</td>
<td>29.4 ± 4.6**</td>
<td>42.1 ± 5.8**</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< 0.05 vs all groups. ** p< 0.001 vs all groups are different.
346 Board #187 May 30 9:30 AM - 11:00 AM Trajectories of Stair Climbing Performance for Black and White Midlife Women Brittny S. Lange-Maia, 1 Imke Janssen, 1 Carrie Karvenon-Gutierrez, 2 Stephanie L. Fitzpatrick, 1 Elsa S. Strotmeyer, 1 Bradley M. Appelhans, 1 Elizabeth F. Avery, 1 Sheila A. Dugan, 1 FACSM, 3 Howard M. Kravitz, 2 Rush University Medical Center, Chicago, IL. 1University of Michigan, Ann Arbor, MI. 2Kaiser Permanente, Portland, OR. 3University of Pittsburgh, Pittsburgh, PA. (Sponsor: Sheila Dugan, FACSM)

(No relevant relationships reported)

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, 89.8% were in the stable group (median baseline 17.0 sec). The group who slowed (10.2%) was slower compared to the stable group, though they 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.

347 Board #188 May 30 9:30 AM - 11:00 AM Relationship between Body Composition and Health Behaviors in High and Low Fit College Women Chaise A. Murphy, Shinya Takahashi, Jim Bovard, Jean Ann Fischer, Marusa Cernjul, Desmond Cooney, Karsten Koehler. University of Nebraska-Lincoln, Lincoln, NE.

(No relevant relationships reported)

College-age women exhibit particular susceptibility to establishing health behaviors resulting in unwanted weight gain or chronic dieting. 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 freshman-level university nutrition class. Percentage body fat (PBF) was assessed by bioimpedance following an overnight fast. VO2max was estimated from a 1.5-mile time trial performance. Dietary energy intake (EI) was determined using 24-hour dietary recalls. Physical activity (PA) was assessed by accelerometry. The eating behavior traits drive for thinness (DT), body dissatisfaction (BD) and cognitive dietary restraint (CRD) were assessed using online surveys. Participants were divided into high fitness (HF) and low fitness (LF) groups by median split and path analyses were conducted. RESULTS: HF and LF women differed significantly (p<0.05) in EI [36.0±11.7 vs 40.2±9.7 kcal/kg FFM], VO2max [39.2±5.9 vs 35.7±7.2 ml/kg/min], BF [%41.9±6.4 vs %38.3±6.0], and PA [28.1±11.3 vs 10.3±5.1 min/day]. The group who belonged to the HF group after adjusting for age, sex, BMI, and VO2max had higher EI (Cohen’s d = 0.23), VO2max (Cohen’s d = 0.32), and PA (Cohen’s d = 0.22) compared to LF participants.

CONCLUSIONS: In college-age women, aerobic fitness appears to be the strongest predictor of body composition, even after adjusting for low and high fitness. HF individuals demonstrated expected relationships between DT, EI and BF which were not seen in LF individuals. Although PA differed between HF and LF, it was not associated with other variables, particularly PBF. These results emphasize the importance of fitness and physical activity in producing favorable body composition among college-age women.

348 Board #189 May 30 9:30 AM - 11:00 AM Association of Breakfast Frequency with Lean Body Mass in Healthy Young Subjects: A Cross-Sectional Study Jun Yasuda, 1 Mai Asako, 2 Takuma Arimitsu, 3 Satoshi Fujita, 4
g
1Graduate School of Sport and Health Science, Ritsumeikan University, Shiga, Japan. 2College of Sport and Health Science, Ritsumeikan University, Shiga, Japan.

(No relevant relationships reported)

Skipping breakfast has been reported to decrease daily energy and nutrient intake. Therefore, skipping breakfast and subsequent negative energy balance can be one of risk factors associated with reduced muscle mass.

PURPOSE: To investigate whether breakfast frequency is associated with lean body mass (LBM) in Japanese collegiate students.

METHODS: A total of 270 healthy young subjects (152 men, 118 women) participated in this study. We collected information on lifestyle (living condition, breakfast frequency, smoking and drinking habits), eating behavior with the Dutch Eating Behavior Questionnaire (DEBQ), sleep quality with the Pittsburgh Sleep Quality Index (PSQI), circadian rhythm type with the Morningness-Eveningness Questionnaire (MEQ), mental state with the Center for Epidemiologic Studies for Depression Scale (CES-D), and physical activity with the International Physical Activity Questionnaire (IPAQ). According to Dietary Reference Intakes for Japanese, the subjects were asked the breakfast frequency in the past one month (excluding consumption of tablets, energy drinks, confectionary, fruits, dairy products, or sweetened beverage alone). LBM in each part of body was assessed using dual-energy X-ray absorptiometry, and then calculated for appendicular LBM (ALBM). We classified the breakfast frequency into 2 categories (1: 0-6 times, 2: everyday) to clarify the importance of daily breakfast consumption for LBM.

RESULTS: Multiple regression analysis showed that having breakfast everyday was positively related to total LBM (β = 0.065, P = 0.028, R2 = 0.361) and ALBM (β = 0.093, P = 0.002, R2 = 0.522) after adjusting for age, living condition, BMI, DEBQ, PSQI, MEQ, CES-D, and IPAQ scores as variables.

CONCLUSIONS: We demonstrated that breakfast frequency was associated with total LBM and ALBM regardless of possible confounders, such as sex, BMI, and physical activity. This result suggests that skipping breakfast is one of risk factors for lower muscle mass in healthy young population.

This work was supported by the Japanese Council for Science, Technology and Innovation (SIP, Project ID 14533567), and the grant “Technologies for creating next-generation agriculture, forestry and fisheries” (funding agency: Bio-oriented Technology Research Advancement Institution, NARO).

349 Board #190 May 30 9:30 AM - 11:00 AM High Intensity Interval Training and Dietary Supplement Use in the Army Jessica L. Kegel, Josh B. Kazman, Patricia A. Deuster, FACSM. Uniformed Services University, Bethesda, MD.

(No relevant relationships reported)

PURPOSE: To establish health and psychosocial profiles of US Army soldiers who engage in high intensity interval training (HIIT) and/or use risky dietary supplements (RDS).

METHODS: Data were from 2014 US Army Global Assessment Tool (n=252K) survey respondents to characterize Soldiers who engaged in HIIT and/or used RDS (i.e., performance-enhancing/weight-loss products) along with demographics, 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 (y/n) and RDS-use (y/n). 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.

Data from the National Health and Nutrition Examination Survey (NHANES) have been used to estimate the proportion of US adults who have high, moderate, and low fitness levels by body mass index (BMI) category. These data have also been used to construct categories for fitness. However, these categories are often weighted unevenly to be more inclusive in the moderate and high-fitness categories. **PURPOSE:** To cross-classify adults in the US population by fitness level and BMI, as well as fitness level and body composition, and to calculate the percentage of the population that can be classified as “fit but fat” using tertiles.

**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. The body composition matrix (based on percent body fat) showed that 18.1 ± 1.0% were categorized in the middle third, 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 “fat.” 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 CVD/CVRF diagnosis, whereas no changes were found for moderately active patients and a significant decrease in PA dose is observed in highly active patients. These findings demonstrate that personalized exercise prescription may be needed to optimize PA behavior in CVD/CVRF patients.

**RESULTS:** Changes in PA behavior appears to be dependent on initial PA dose. Inactive patients may be more motivated to increase their PA dose after CVD/CVRF diagnosis, whereas no changes were found for moderately active patients and a significant decrease in PA dose is observed in highly active patients. These findings demonstrate that personalized exercise prescription may be needed to optimize PA behavior in CVD/CVRF patients.
354 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, FACSVM, Dianne Neumark-Sztainer. University of Minnesota, Minneapolis, MN. (Sponsor: Daheia Barr-Anderson, FACSVM) (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 25 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 -0.41), moving in with parentstile parents or leaving their parents’ home (-1.07 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.

355 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 Vandenberg, 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 cardio-respiratory 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 (2D:4R) correlates with sport participation throughout adolescence and young adulthood in women. METHODS: A cross-sectional analysis of indirect prenatal androgen concentrations (i.e. 2D:4R) was obtained from 92 females (aged 18-30y). Participant demographic, anthropometric, behavioral, and retrospective sport participation information were collected at one occasion. RESULTS: 2D:4R 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 2D:4R 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.

356 Board #197 May 30 9:30 AM - 11:00 AM Demographic, Health Behavior, And Cardiometabolic Risk Factor Profiles In Yoga And Non-yoga Participants: Nhanes 1999-2006
Bethany M. Forseth1, William R. Boyer2, Eugene C. Fitzhugh2, Amy Miller2. 1University of Wisconsin - Milwaukee, Milwaukee, WI. 2California Baptist University, Riverside, CA. (University of Tennessee, Knoxville, TN. (No relevant relationships reported)

BACKGROUND: Previous studies have described the demographic and limited disease status characteristics of yoga participants using nationally representative data. However, there is a paucity of population-based data describing the cardiometabolic risk factors of yoga participants in the U.S. PURPOSE: To examine the demographic, health behavior, and cardiometabolic risk factor characteristics of participants who report participating in yoga versus not participating yoga using a nationally representative sample of U.S. adults. METHODS: Study participants were from the 1999-2006 National Health and Nutrition Examination Survey (NHANES) who self-reported participation in yoga (n=171) or no-yoga (n=8,817). Demographic variables included: age, gender, race/ethnicity, and education. Health behaviors included: smoking status, alcohol consumption, and the healthy eating index. Cardiometabolic risk factors included: HbA1c, blood pressures (BP), BMI, waist circumferences, cholesterol, homeostatic model assessment of insulin resistance (HOMA), glucose, and insulin. SAS survey procedures were used for all analyses. RESULTS: Yoga participants were primarily female (82.6%), were college educated (57.6%), were mostly non-smokers (61.7%), and reported moderate alcohol consumption (75.1%). Yoga participants, compared to their non-yoga counterparts, had a healthier cardiometabolic risk profile: HbA1c (5.2 vs 5.4%), BP (114/69 vs 121/72mmHg), BMI (24.7 vs 27.7 kg/m²), waist circumferences (85.9 vs 95.3 cm), HOMA (1.2 vs 2.0mIU/L), glucose (91.8 vs 100.0 mg/dl), and insulin (7.8 vs 10.8 U/ml), respectively. CONCLUSION: These results are the first to examine the cardiometabolic risk factor profiles of yoga users using a nationally representative sample of U.S. adults. Given the emergence of yoga as a common form of physical activity, it is imperative to understand the characteristics of those who participate in yoga to further understand its relationship with cardiovascular risk.

357 Board #198 May 30 9:30 AM - 11:00 AM Determination of Health Status Using Self-rated health and Physiological Markers of Fishersfolk in Ghana Central Region
Olufumilola L. Dominici1, Yvaya, Kluiboto1, Nathaniel Aitkun1, Edward W. Ansah2. 1University of Ilorin, Ilorin, Nigeria. 2University of cape Coast, Cape Coast, Ghana. (No relevant relationships reported)

PURPOSE: Occupational lifestyle is ascertained to influence one’s health. Studies have shown that 10 bpm increases in resting heart rate especially when compared with 45bpm is a significant risk cause for all mortality with increasing heart rate (HR) in linear relation. Self-rated health has been accepted as a predictor of health and mortality as well as HR and blood pressure. There is the need to ascertain the self-rated health through objective measures using physiological markers (systolic blood pressure (SBP), diastolic blood pressure (DBP), HR, Body mass index) in determining health status of fishersfolk in Central Region of Ghana. METHODS: The research design was cross-sectional and quasi experimental. Purpose and quasi experimental methods were used to select the two urban fishing communities and 361 participants (64.3% male and 35.7% female) with ages ranging from 15-100 (M = 37.5, SD = 1.399) for the study. Institutional approval and informed consent were obtained. Deluoe auto Digital Blood Pressure Monitor (Model MS-752), stadiometer and body fat/hydration scale (Model 70322F97) were used to collect the physiological data and a standardized self-rated health questionnaire. Descriptive statistics and multiple regression analyses were the statistical tools used.RESULTS: SRH of fair or poor was reported by 49% (n = 177) of the participants. However, 7.8% (n = 28) had low HR while 30% (n = 108) had high or very high HR, 36.5% (n = 131) had SBP stage one and two (n = 170) were hypertensive while 44.6% (n = 161) had stage one or two DBP hypertension, with 23% (n = 83) being pre-diastolic hypertensive. Multiple regression analysis indicated that the general model was statistically significant in predicting the health status of the fishersfolk, F(8,532) = 3.582, p = 0.001, adj.R² = 0.005. However, gender (p = 0.021) and age (p = 0.002) were the only significant independent predictors of the health status of the fishersfolk. CONCLUSIONS: The fair and poor health of 49% SRH correlated with the objective measures of 30% high HR as well as 36.3% and 44.4% high SBP and DBP.
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.

**PURPOSE:** To determine whether all-cause mortality risk differs between individuals who achieve high CRF through the adoption of PA compared to those who have intrinsically high CRF.

**METHODS:** A prospective study with at least two clinical visits (mean follow-up time: 14.0 (8.6) years) between 1974 and 2002 to assess CRF mortality risk in 3,597 men and 2,693 women. CRF was determined using a submaximal exercise test, with a cycle ergometer. The outcome measure was all-cause mortality. Multivariate-adjusted models, adjusted for age, sex, gender, household income, and education assessed the odds of each outcome comparing BMI classification and PA groupings. 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, gender, household income, and education assessed the odds of each outcome comparing BMI classification and PA groupings. Results: Compared to overweight adolescents who engaged in 0-2 d/wk of PA, those who engaged in 5-7 d/wk were 41% more likely to finish tasks, 37% more likely to stay calm, 73% more likely to show interest in learning new things, 27% less likely to argue excessively, and 42% less likely to be unhappy (p<0.01). Compared to obese adolescents who engaged in 0-2 d/wk of PA, those who engaged in 5-7 d/wk were 41% more likely to finish tasks, 37% more likely to stay calm, 73% more likely to show interest in learning new things, 27% less likely to argue excessively, 42% less likely to be unhappy, and 47% less likely to bully others (p<0.001). Furthermore, for adolescents who engaged in 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.
47% lower in No-Low (HR 0.53 [95% CI, 0.46-0.61]), and 24% lower in Yes-High (HR 0.76 [95% CI, 0.67-0.86]). FH and CRF did not show a significant interaction (p for interaction = 0.18). 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.

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.

Over the past three decades numerous studies have illustrated the inverse relationship between cardiorespiratory fitness (CRF) and mortality. However, this relationship has almost exclusively been studied using estimated CRF (CRF est.), with known error of ± 3 to 7 ml/kg/min, with no studies assessing this association using directly measured CRF in both men and women that were apparently healthy at baseline testing. PURPOSE: To assess the association of CRF, obtained using cardiopulmonary exercise testing (CPX) on all-cause mortality in a large cohort of apparently healthy men and women at baseline. METHODS: Participants included 4,137 participants (2,326 M, 1,811 W; mean age: 42.8 ± 12.2 y) free from cardiovascular disease and cancer at baseline, who underwent a maximal CPX to determine CRF. Participants were followed for 242 ± 11.7 years (1.1 to 49.3 y) for mortality outcomes using data from the National Death Index. Participants were categorized into CRF tertiles (low, moderate, and high) based on age and sex-specific percentiles, from the Fitness Registry and the Importance of Exercise National Database (FRIEND). Cox-proportional hazard models adjusted for age were performed to determine the relationship of CRF with all-cause mortality. RESULTS: After a mean follow-up of 242.4 years, 727 participants were deceased. CRF was inversely related to all-cause mortality, where low CRF was associated with a 31% increased risk for all-cause mortality compared to high CRF (Hazard ratio (HR) 1.31; p<0.01). The inverse relationship between CRF and all-cause mortality was also present for men and women when examined independently. Specifically, Low fit men and women had a 54% and 28% higher risk of dying from all-causes compared to high fit men and women (Men HR 1.54, p<0.01; Women HR 1.28, p<0.01), respectively. CONCLUSIONS: These data demonstrate that CPX measured CRF is a strong predictor of all-cause mortality. This coupled with the known diagnostic and prognostic value of CPX measures in clinical populations and the recent support for CRF as a vital sign suggest it should be considered in clinical practice, as it may help to improve the efficacy of the risk assessment and guide clinical decisions.

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 EUBOEHEALTH-Congress 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 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 (EHIS), 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 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% (Norway: 18.0%, Hungary: 20.6%, Estonia: 19.9%, Germany: 16.4%). On average, 48.8% of the population of the Euro-15 has access to 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 associated disease in several (European) countries. No comparable data from the fifth member state (Serbia) were available. The EUBOEHEALTH-Project is funded by the German Federal Ministry of Education and Research.
368 Board #207 May 30 9:30 AM - 11:00 AM

**The Association of Physical Activity and Body Mass Index with Myocardial Infarction: The Tromso Study**

Marius Renninger1, Maja-Lisa Lachen1, Ulf Ekelund, FACSFM2, Laila A. Hopsotch1, Lone Jørgensen1, Ellissiv B. Mathiesen1, Inger Njølstad2, Henrik Schirmer2, Tom Wilsangard2, Bente Morseth2, Ulf Ekelund, FACSFM1. 1-UIT - The Arctic University of Norway, Tromso, Norway. 2-Norwegian School of Sport Sciences, Oslo, Norway. 3University Hospital of North Norway, Tromso, Norway. 4None

**RESULTS:** After exclusions, the final sample used in the analysis included 16104 individuals. During a median follow up of 34 years, 1613 incident cases of MI were documented. Physical activity and BMI were both independently associated with MI. Hazard ratio (HR) (95% confidence interval) for moderately active compared to inactive individuals was 0.87 (0.77-0.98), for overactive compared to normal weight individuals HR was 1.54 (1.39-1.72), and for obese compared to normal weight individuals was 2.70 (2.24-3.26). In joint analysis, normal weight inactive individuals had a 20% higher risk of MI compared to their active counterparts (HR 1.20 (1.02-1.41)). The highest risk of MI was observed in inactive individuals with a 3-fold increased risk compared to active normal weight individuals (HR 3.20 (2.30-4.44)). The risk of MI increased with increasing BMI regardless of the activity level. Nevertheless, HRs were lower for active compared to inactive individuals within the same weight category. **CONCLUSION:** The findings suggest that physical activity and BMI are independently associated with risk of MI in young and middle-aged men and women. Physical activity seems to attenuate but not eliminate the risk of being overweight or obese with MI.

**Acknowledgements:** None

**Sources of Funding:** This work is funded by the Northern Norway Regional Health Authority.

**Disclosures:** None

---

367 Board #208 May 30 9:30 AM - 11:00 AM

**Cardiorespiratory Fitness, Alcohol Consumption And The Incidence Of Hyper Non-hdl Cholesterolemia: A Cohort Study**

Natsumi Watanabe1, Kazunori Shimada1, Susumu S. Sawada, FACSM1, I-Min Lee, FACSM2, Yuko Gando3, Haruki Momma4, Ryoko Kawakami1, Motohiko Miyachi5, Yumiko Hagi5, Chihiro Kinugawa5, Takashi Okamoto5, Koji Tsukamoto5, Steven N. Blair, FACSM5, Juntendo University, Chiba, Japan. 2Juntendo University Graduate School of Medicine, Tokyo, Japan. 3National Institutes of Biomedical Innovation, Health and Nutrition, Tokyo, Japan. 4Harvard Medical School, Boson, MA. 5Tokohu University, Sendai, Japan. 6Waseda University, Saitama, Japan. 7Tokai University, Kanagawa, Japan. 8Tokyo Gas Co., Ltd., Tokyo, Japan. 9University of South Carolina, Columbia, SC. 10None

**Results:** Physical inactivity is a risk factor of non-high-density lipoprotein (HDL) cholesterolemia, and also high alcohol consumption increases HDL cholesterol. However, the interaction between cardiorespiratory fitness (CRF), an objective marker of physical activity, and alcohol consumption on the incidence of hyper non-HDL cholesterolemia is not clear. **PURPOSE:** To investigate the joint effect of CRF and alcohol consumption on the incidence of hyper non-HDL cholesterolemia among Japanese men. **METHODS:** We evaluated CRF and the incidence of hyper non-HDL cholesterolemia in 4,067 Japanese men [median [IQR] age 36 [30-44] years] who were free from hyper non-HDL cholesterolemia. Participants underwent a submaximal exercise test, a medical examination, and questionnaires on their health habits including alcohol consumption (less than 1g/day, 1-2g/day, ≥2 g/day) in 1986. CRF was measured using a cycle ergometer and maximal oxygen uptake was estimated. The incidence of high levels of non-HDL cholesterolemia (≥ 170 mg/dL) from 1986 to 2006 was ascertainment based on fasting blood levels. Hazard ratios and 95% confidence intervals for the incidence of hyper non-HDL cholesterolemia were calculated using Cox proportional hazards models after adjustment for age, body mass index, systolic blood pressure, smoking, and family history of dyslipidemia. **RESULTS:** Hyper non-HDL cholesterolemia was observed in 1,482 participants during the follow-up period. Using the Low CRF & less than 1g/day alcohol consumption group as reference, the hazard ratios and 95% confidence intervals were 0.88 (0.73-1.06) for Low CRF & less than 1g/day alcohol consumption group, 0.77 (0.64-0.93) for the High CRF & less than 1g/day alcohol consumption group, and 0.70 (0.57-0.87) for the High CRF & ≥23 g/day alcohol consumption group, respectively. **CONCLUSIONS:** Japanese men with a high CRF and a high alcohol consumption have a lower the incidence of hyper non-HDL cholesterolemia.

---

368 Board #209 May 30 9:30 AM - 11:00 AM

**Overturning the Hypothesis that Cigarettes Can Enhance Hematocrit and Improve Aerobic Capacity**

Grace L. Naylor1, Jennica Harrison1, J. Mark VanNess2, Michelle M. Amaral1, Jonathan M. Saxe3, Lewis E. Jacobson4, Courtney D. Jensen5. 1University of the Pacific, Stockton, CA. 2St. Vincent Hospital, Indianapolis, IN. 3None

**RESULTS:** 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 4.6% 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.

---

369 Board #210 May 30 9:30 AM - 11:00 AM

**The Association Between Physical Activity, Sleep, and Cardiovascular Risk Factors in College Students**

Heather H. Betz, Julie M. Cousins. Albion College, Albion, MI. 1Sponsor: Jonathan Myers, FACSM

**RESULTS:** Physical activity can help improve traditional cardiovascular risk factors, including blood pressure and body composition (Acher and Blair, 2011). In addition to the traditional cardiovascular risk factors, sleep has started to emerge as an important component to overall and cardiovascular health (Grandner et al., 2014). Low levels of sleep have been shown to negatively impact a host of cardiovascular risk factors, including blood pressure, blood lipids, markers of inflammation, and body fatness. (Grandner et al., 2016) **PURPOSE:** To examine the associations between physical activity and sleep with blood pressure and waist circumference in college-age adults. **METHODS:** A total of 57 Albion College students (23 males, 34 females) participated. Height, weight, waist circumference, and blood pressure were measured. Physical activity was self-reported and sleep was assessed with The Pittsburgh Sleep Quality Index. Multiple regression was used to assess the purpose. **RESULTS:** 47.4% of participants were physically active five or more days per week, while 38.5% of participants averaged eight or more hours of sleep per night. 8.8% had a waist circumference categorized as high and 5.2% of participants were pre-hypertensive. 52.6% of the total participants were athletes, with 48% of those currently in-season. There was a significant interaction between physical activity and sleep on total hours of sleep on systolic blood pressure (R2=0.029, R=0.13) and waist circumference (p=0.023, R=0.13). Total hours of sleep had a significant unique advantage via elevations in hemoglobin and oximetry. This, left alone, could suggest insufficient 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
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 healthy young
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 and CMD risk factors in apparently
healthy young adult females. METHODS: Twenty-five non-obese [body mass
index (BMI) < 30 kg/m²] 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
(RR), 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
(WHR) and resting HR (Spearman’s ρ = 0.436, P < 0.03), cholesterol (ρ = 0.404, P =
0.04), low-density lipoprotein cholesterol (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,
ρ = 0.03), and LDL-C (ρ = 0.477, P = 0.02); total body fat percentage and resting HR
(ρ = 0.363, P = 0.001); 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 WHR 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.

A-49  Free Communication/Poster - Nutrition Interventions
Wednesday, May 30, 2018, 7:30 AM - 12:30 PM
Room: CC-Hall B

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 Hann, C. Brooks Mobley, Yufeng Zhang, Michael D. Roberts, Andreas N. Kavazis, FACSM. Auburn University, Auburn, AL. (Sponsor: Andreas N. Kavazis, FACSM)
[No relevant relationships reported]

Purpose: Ketogenic Diets (KD) consist of high fat, moderate protein and low
carbohydrate. KD have been used as a weight loss tool and as a therapeutic tool for
neurological disorders. It has been suggested that KD increase longevity, but to date
only two studies in mice have been performed with equivocal results. Therefore, we
determined the effects of KD on longevity and multi-organ oxidative stress markers
in rats. Methods: Ten-month-old male Sprague-Dawley rats (n=8 per group)
were provided with one of two isocaloric diets: standard chow (SC; 24% (% kcal) protein, 58% CHO, 18% fat; 20 g/day) or KD (23% protein, 10% carbohydrate, 67% fat; 16 g/day). Rats were euthanized if: a) vitality scores (range = 4 (good health) to 20
(poor health)) exceeded a score of 16 per the recommendations of Phillips et al. (J Am Assoc Lab Anim Sci, 2010, 49(6): 792-799), b) rapid weight loss accompanied by changes in food and water consumption, or c) the rat suffered from a condition to
which a university veterinarian deemed euthanasia necessary for humane purposes.
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 survival-log rank test indicates that KD increased the lifespan of rats (p=0.009) when compared to SC. No significant difference in body mass was observed
at the beginning (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.

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 Wook Lee1, Elieff Galvan2, Teak V. Lee3, Vincent CW Chen1, Steven Bui1, Stephen F. Crouse, FACSM4, James D. Fluckey2, Stephen B. Smith3, Steven E. Richman, FACSM3, University of Texas Medical Branch, Galveston, TX, 1Pierce College, Woodland Hills, CA, 2Georgiaian Court University, Lakewood, NJ, 3Dixie State University, St. George, UT, 4Texas A&M University, College Station, TX. (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=37; age=59.8 ± 6.9; height=168.4 ± 8 cm; weight=79.5 ± 16 kg; body fat=39.3 ±
10 kg; male/female=15/22) undertook 12 weeks of RET (3x/week, 3 sets, 12 reps
70% of maximum strength [1RM]) and submitted >1,776 diet logs (>4x/week for
12 weeks, 37 subjects). Participants’ diets (mean choline intake: 5.9 mg/kg lean d) were
supplemented with 0.7 mg/kg lean d (Low, n=13), 2.8 mg/kg lean d (Med, n=11), or
7.5 mg/kg lean d (High, n=13) of choline in the form of egg yolk. Body composition,
1RM, 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 ± 9.8%, 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 ± 7.9%, p=0.010) after controlling for lean mass, protein,
betaine, and vitamin B6. 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.
Dietary protein consumed as a liquid supplement pre-sleep has been shown to increase resting metabolism without changing thermal conductance. 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/isonitrogenous 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 REE (C1725;327; CP, 17184; PL, 16911;265) kcal/d, p=0.95) or acute RER (p=0.56) or morning REE (C1396;293; CP, 1361;175; PL, 1432;216) kcal/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 compared to the acute exercise dose. METHODS: To investigate the difference of executive function on exercise 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, 26°C mean, 30°C maximum; relative humidity, 75% mean, 93% maximum). Sixty recreational cyclists (52±9 y) were informed of the experimental protocol. All cyclists were screened for mild cognitive impairment via Mini-Cog assessment (4:1:1). 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 (14:5 % 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 ≥ 98, 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, 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 6.15 ± 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.

378 Board #219 May 30 11:00 AM - 12:30 PM
Experimental Effects of Acute Exercise on Episodic Memory Acquisition: Decomposition of Multi-Trial Gains and Losses
Evelyen Sng, Emily Frith, Paul Loprinzi. University of Mississippi, Oxford, MS.
(No relevant relationships reported)

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 (RWLT). 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=0.09) and after the 20-min delay (10.9 vs. 9.4; P=0.01). The exercise group (vs. control) had a smaller proportion of losses from Trial 3-4 (10.4% vs. 20.3%; P=0.04) and had a greater proportion of gains from Trial 5-6 (38.5% vs. 14.8%; P=0.01). CONCLUSIONS: The exercise-induced multi-trial memory effect may be influenced by greater item gains and fewer item losses from exercise.

379 Board #220 May 30 11:00 AM - 12:30 PM
EMF Stimulation As Passive Exercise Improves Cognitive Function And Psychomotor Activity In Senescent Rats
Timea Teglas1, Gabriella Dörnyei1, Karoly Brez1, Csaba Nyakas1, University of Physical Education, Budapest, Hungary. 2Ssemelweis University, Budapest, Hungary.
(No relevant relationships reported)

PURPOSE: During advancing age 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 and after the 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=0.09) and after the 20-min delay (10.9 vs. 9.4; P=0.01). The exercise group (vs. control) had a smaller proportion of losses from Trial 3-4 (10.4% vs. 20.3%; P=0.04) and had a greater proportion of gains from Trial 5-6 (38.5% vs. 14.8%; P=0.01). CONCLUSIONS: The exercise-induced multi-trial memory effect may be influenced by greater item gains and fewer item losses from exercise.

380 Board #221 May 30 11:00 AM - 12:30 PM
Effects of Acute Exercise on Stress-Induced Memory Function
Pamela Ponce, Dylan Delaney, Emily Frith, Paul D. Loprinzi. University of Mississippi, University, MS.
(No relevant relationships reported)

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-induction 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 no group x gender interaction effect (F=1.52; P=0.22), but there was evidence of a group x gender interaction effect (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 logic-based memory performance, as men experienced a larger decline in memory function following a social stressor, irrespective of an acute exercise response.

381 Board #222 May 30 11:00 AM - 12:30 PM
The Effects of Acute Exercise on Working Memory and Delay Discounting
Julie A. Cantelon1, Grace E. Giles2, Robin B. Kanarek3, Caroline R. Mahoney2, Holly A. Taylor1. 1Tufts University, Medford, MA. 2U.S. Army NSRDEC, Natick, MA. 3University of Physical Education, Budapest, Hungary.
(No relevant relationships reported)

Given the choice, people tend to prefer immediate rewards over delayed rewards. This tendency to devalue rewards with increasing delays to their receipt is referred to as delay discounting. Previous research has demonstrated an inverse relationship between working memory capacity and delay discounting. Furthermore, an acute bout of moderate intensity exercise has been shown to improve working memory and the ability to delay processing, which could potentially alter discounting. Increased delay discounting has been associated with a variety of unhealthy behaviors, such as smoking, drug abuse and obesity. Therefore, intervention strategies aimed at reducing such impulsive decision-making would be advantageous across a variety of domains. To date, research has focused on the effects of prolonged exercise interventions on reducing discounting, but the effects of acute bouts of exercise remain unexplored.

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) participated in a repeated measures design which was used to recruit 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 discussed.

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) except Trail-Making Test B significantly improving from pre- to post-Pilates classes (61.5 ± 22.0 to 52.2 ± 9.6 sec; P = 0.02). There were no changes in Trail-Making Test A. Working memory significantly increased in both groups (Pilates: 154.6 ± 124.6 to 216.7 ± 95.6 msec; P < 0.01; control: 166.0 ± 133.0 to 258.0 ± 88.3 msec; P < 0.01) because only the neutral task significantly improved (Pilates: 1016.5 ± 159.2 to 918.0 ± 143.0 sec; P < 0.01; control: 1014.8 ± 163.2 to 884.3 ± 168.1 sec; 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.

An enriched environment consists of complex housing with increased space and a variety of toys, which results in enhanced exercise activity and social interactions. Housing rodents in the enriched environment are known to improve both anxiety-like behavior and cognition. However, the contribution of increased exercise activity to such a functional plasticity are less clear. **[Aim]** The aim of the present study was to examine effects of increased exercise activity in the enrich environment on anxiety-like behavior and cognition. **[Methods]** Wistar rats were housed in the two different housing groups [standard environment (SE) group (N = 22); enriched environment (EE) group (N = 22)]. EE contained a slope, a small hut, three tunnels, and a running wheel that such exercise activity was increased. Exercise activity was continuously recorded using three-axis accelerometers for 6 weeks. The accelerometers were embedded in the back. The animals were submitted to the elevated plus maze (EPM) and Morris Water Maze (MWM) tests to assess anxiety-like behavior and spatial learning and memory. The muscle hypertrophy was evaluated from immunostained (MHC Ila) cross-section area (CSA). All experimental data were expressed as mean ± standard deviation. Comparisons were performed using a t-test. The level of significance was set at p < 0.05. **[Results]** Exercise activity was higher in the EE group compared with the SE group in light period. All hindlimb muscle wet weights per BW were greater in the EE group compared with the SE group. Moreover, the CSA of MHC Ila in the soleus muscle increased in the EE group (EE: 1729 ± 224 μm², SE: 1589 ± 144 μm², p < 0.05). In the EPM test, time spent in open/closed arms was significantly increased in the EE group (39.4 ± 15.8%, p < 0.05) than the SE group (24.0 ± 15.1%). This result suggests that anxiety-like behavior was reduced in the EE groups. On the third day of the MWM test, escape latency was reduced in the EE group (11.50 ± 1.87 sec) than the SE group (17.93 ± 3.40 sec, p < 0.05), which indicates that spatial learning and memory was improved in the EE group. **[Conclusions]** Increased exercise activity in the enriched environment improves anxiety-like behavior and spatial learning and memory.
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) has been 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=0.08; LF was a 24-hr recall for the control group (n=15) vs. 607, p=0.006, but not for the exercising groups (p=0.05). Post-hoc tests revealed benefits to 24-hr recall only for the groups that exercised before (M=10.295, SE=0.57) or both before and after (M=10.10, SE=0.57) memory tasks compared to control (M=7.72, SE=0.60, p=0.004, 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.

We have previously reported that exercise training (ET) in older adults diagnosed with mild cognitive impairment (MCI) is associated with increased functional connectivity of the default mode network (Chirles et al., 2017), increased cortical thickness (Reiter et al., 2015), decreased cortical activation during semantic memory retrieval and increased episodic memory performance, but no change in verbal fluency (Smith et al., 2013). Verbal fluency, which refers to producing words from a specific category (e.g., starts with F), involves selecting words by inhibiting competing alternatives (e.g., phone). It is not known if the ET influences the total score or the complexity of the words produced. PURPOSE: The purpose of this study was to examine the effects of a 12-week walking ET intervention on the frequency and complexity of words produced during a phonemic fluency task. METHODS: Seventeen MCI participants and 18 cognitively intact controls completed a 12-week ET intervention consisting of supervised treadmill walking at a moderate intensity. Before and after ET, 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 = .120). 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 frequently appearing words and being more efficient in the face of demands to quickly produce words under a time constraint. It is plausible ET is related to enhanced cognitive control by inhibiting competing words and facilitating a search for easier words to speak.

PURPOSE: To explore the effect of one bout of moderate intensity aerobic exercise on attention and affect in 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 session on the control cycle ergometer at 0 Watts. Before and after both 30-minute sessions, participants completed two computerized tests of attention: The Digit Span Test and the Flanker Task. Performance on the Digit Span 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 congruent and incongruent 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 accuracy for the congruent trials of the Flanker Task (p = .058), as well as a significant decrease in mean reaction time pre- to post-session (mean difference: -.23 ± 0.8 ms, p = .028) that was more pronounced for the congruent vs. the incongruent trials (p = .08). Participants also reported feeling more energetic 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.

PURPOSE: To explore the effect of one bout of moderate intensity aerobic exercise on attention and affect in 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 session on the control cycle ergometer at 0 Watts. Before and after both 30-minute sessions, participants completed two computerized tests of attention: The Digit Span Test and the Flanker Task. Performance on the Digit Span 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 congruent and incongruent 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 accuracy for the congruent trials of the Flanker Task (p = .058), as well as a significant decrease in mean reaction time pre- to post-session (mean difference: -.23 ± 0.8 ms, p = .028) that was more pronounced for the congruent vs. the incongruent trials (p = .08). Participants also reported feeling more energetic 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.

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 females & 9 males (Age = 21.7±1.8 yrs) volunteered. Day 1: body composition (Bodpod) and VO2 max were assessed (IRmax = 189 ± 5.5% b/min, VO2 max = 45.7 ± 7.3 ml/kg/min, BF% = 18.1 ± 6.3%). 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 AE routine order was counter-balanced. Days 2, 3&4 were separated by 1wk. Prior to (PreR) & PreEx & following R & RE routine order was performed. Ss performed the imPACT assessment for CP (Conditions 1) X (Sex) 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±560ms - 510±580ms) was significantly reduced (p<0.02), whereas PreR-PostR RT (525±535ms - 532±67ms) & PreR-PreEx RT (525±535ms - 526±60ms) 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 high-intensity RE routine, RT was significantly reduced for M & F. However, WM & IC did not differ significantly following RE for M or F. M exhibited greater VO2 & CVC, 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.

**PURPOSE:** To determine the effects of music and other attentional focus conditions on muscular activation and psychological response to single-joint isometric exercise.

**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 (Tr) 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), affective 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, Tr, 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, n2 = .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, n2 = .25), with a greater RPE in INT (13.87) compared to EXT (12.39) and MUS (12.61).

**CONCLUSIONS:** The primary finding from the current study was that external focus, either through 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.

An affective forecast is the prediction of how positive or negative one will feel in response to a future event. Researchers have identified a positive relation between affective forecasts and exercise behavior. **PURPOSE:** 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 = 250, 51% men, 48% women, 15% 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 = .46 vs. r = .22, Z = 1.99, p = .02). **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 session) 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. 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 (P3b) and involuntary attention (P3a) were evoked by novel auditory oddball task before and after the Flanker task. **Results:** The accuracy of behavioral data was significantly different in 4 periods (F=35.83, p<0.001). The RPE score was higher in EG than CG (F=47.62, p<0.001). The time domain (mMSSD) and frequency domain (LF, HF and LF/HF) in HRV data showed significant difference between the EG and the CG in all periods. Such, the mental fatigue was induced after the Flanker task. In the auditory oddball task, the reaction time was prolonged after the fatigue was induced (371.13±100.21ms vs. 388.07±93.66ms, t=4.878, p<0.01). ERPs data showed that, after the fatigue-inducing task, P3a (19.290μV vs. 14.836μV, F=6.749, p<0.05) significantly decreased, indicating the impaired involuntary attention. Meanwhile, the P3b amplitude decreased and the latencies (15.373μV vs.12.036μV, F=10.451, p<0.05) at Fz, Cz and Pz sites increased significantly, indicating that the selective attention was impaired. **Conclusion** One hour of continuous cognitive task could induce psychological fatigue. Athletes’ involuntary attention and selective attention were damaged after mental fatigue.
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 (SHCS-M), SCI-QOL). Cognitive function was assessed using NIH Toolbox (Dimensional Change Card Sort Task, Flanker Inhibition Control & Attention, List Sorting Test (memory, Picture Sequence)). **RESULTS:** Subjects with SCI rated physical function QOL dimensions (EQ-5D, PROMIS physical health, SHCS-M) lower than non-SCI subjects (all p < 0.0002). QOL dimensions relating to mental/functional (PROMIS mental health, SCI-QOL Positive Affect & Well-Being (PAWB), Anxiety, Depression) did not differ between groups (all p > 0.05). 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 QOL domains (Resilience R² = 0.46 to 0.72; PAWB R² = 0.29 to 0.51). No correlations between QOL and cognition 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 contributes 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:** To compare the effects of two different exercise program (combined vs. aerobic) on cognitive function of hypertensive elderly. **METHODS:** Hypertensive medicated elderly (age 65±5 yrs, 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 resistance exercises to the main muscle groups (15 rep) twice/week and the aerobic exercises at 50min walking on a treadmill at 60% VO2 reserve, three times/ week, or to Aerobic Training (AT, n=13) composed by the same aerobic protocol, or to the control group (CG, n=19) which received no treatment. Cognitive function of the three groups were performed before and after 16 weeks of interventions or control period. Groton Maze Learning Test (GML) was used to assess spatial memory executive function (Working memory, attention and inhibitory control), along with Shopping list (ISL) for auditory learning and latter memory recall. 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 CT (1.5 ± 2) when compared 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 (0.16±1). **CONCLUSIONS:** The rule-break errors suggest CT and AT improve attention, inhibitory control and working memory and only CT improve short term auditive 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.

**CONCLUSIONS:** 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-ups and, and timed stairs test. These variables were collected in three experimental groups; 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 did 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 vs. p=0.002) and LB group (93±9, p=0.02) when compared to the HB group (71±19). 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 measurement. 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:99±2, LB:101±2, HB:101±1.5, p=0.26), timed up-and-go (CON:13±3, LB:13±2, HB:14±2.5, p=0.51), and timed stairs test (CON:11±2, LB:11±1, HB:11±2.1, 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 GM068865.

**CONCLUSIONS:** 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 volunteer DS 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, A Quick Test for Cognitive Speed, AQ7) were measured before and 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 AQ7. **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). AQ7 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.

402 Board #243 May 30 11:00 AM - 12:30 PM The Effects of Cardiovascular Health on Cognitive Function in Older Adults
Justin Mason,1 Salvador Jaime,2 Arun Maharaaj,3 Roque Nelson,1 Gershon Tenenbaum,1 Arturo Figueroa, FACSM1. 1Florida State University, Tallahassee, FL. 2University of Wisconsin - La Crosse, La Crosse, WI. 3Texas Tech University, Lubbock, TX. (Sponsor: Arturo Figueroa, FACSM)

No relevant relationships reported.

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 VO2max, carotid IMT, and cfPWV. Fitness comparisons were made using an independent sample t-test. Cognitive function and driving performance scores were transformed to Z-scores.

RESULTS: VO2max was higher among ET than S (41±9 vs 25±3 ml/kg/min, p<.01). BMI was higher among S than ET (26±4 vs 24±4, p<.01). There were no differences in brachial systolic blood pressure (131±13 vs 122±19 mmHg), cfPWV (122±2 vs 122±5 m/s), carotid-IMT (.74±.15 vs .76±.13 mm), and cognitive function scores (-.01±.57 vs -.09±.97) between the groups. However, ET performed better on the driving simulator (.18±.58 vs -.28±.92, p<.05). Carotid IMT and cfPWV were moderately associated (r=.38, p<.01). VO2max was not associated with age, carotid IMT, or cfPWV.

CONCLUSION: Enhanced cardiorespiratory fitness may mitigate age-related decrements in driving performance independently of central structure and function.

404 Board #245 May 30 11:00 AM - 12:30 PM Investigation Between Daily PE, Fluid Intelligence, Fitness and BMI among Middle School Youth Over Time
Caroline E. Stanton, Julian A. Reed, Brooke E. Huhn. Furman University, Greenville, SC. (Sponsor: Anthony Caterisano, FACSM)

No relevant relationships reported.

Developmental research has demonstrated that higher cognitive abilities are often linked to physical activity participation. PURPOSE: The purpose of the study was to examine the impact of 45 minutes of daily physical education on Fluid Intelligence, fitness levels and BMI among middle school youth. METHODS: An analysis of variance (ANOVA) mixed effect linear model was used to evaluate the effectiveness of 45 minutes of daily physical education on Fluid Intelligence, Progressive Aerobic Cardiovascular Endurance Run (PACER), push-ups, curl-ups and BMI among youth in grades 6th-8th attending Legacy Early College, a Title I school in the southeastern US. Gain scores (final post-test assessment in May 2017 - original pre-test assessment in September 2014) were calculated and analyzed for significance. The interaction between school and time was estimated for each outcome. Each analysis was stratified by gender and adjusted by age to control for baseline differences by school. A Title I control school that provided physical education for only one semester was identified and utilized as a comparison. Summary of RESULTS: Legacy Early College students observed gain increases on Fluid Intelligence sections, significantly the Total Section, (Gain Score=10.31; F=5.920; df=140; p=016) over time. Legacy students observed gain increases in PACER laps, push-ups and curl-ups, over time compared to controls. Legacy students also observed decreases in BMI over time, compared to gain increases in controls. CONCLUSIONS: 45 minutes of daily physical education led to increases in Fluid Intelligence, PACER laps, push-ups and curl-ups, as well as decreases in BMI among Legacy middle school students from 2014 to 2017.

405 Board #246 May 30 11:00 AM - 12:30 PM Lasting Effects of Acute Exercise on Working Memory Performance in Older Adults with Long and Short Sleep
Junyeon Won1, Alfonso Alfñi2, Lauren Weiss1, Corey Michelson1, J. Carson Smith, FACSM. 1University of Maryland at College Park, College Park, MD. 2John’s Hopkins University, Baltimore, MD. (Sponsor: J. Carson Smith, FACSM)

No relevant relationships reported.

BACKGROUND: A growing body of research indicates that acute exercise in older adults is associated with enhanced executive function, including inhibitory control and working memory. However, most studies have measured cognition shortly after the exercise session, and whether or not acute exercise has longer lasting cognitive benefits in older adults has not been established.

PURPOSE: To investigate executive function performance 1.5 hours after a single session of exercise, compared to rest, in healthy older adults; and to secondarily determine if sleep moderates these effects.

METHODS: 24 healthy older adults (65.8±8.1 years) completed two experimental sessions on different days that entailed 30-min of seated rest or moderate intensity exercise on a Monark cycle ergometer. Ninety minutes after exercise and rest, participants performed the Stroop Color and Word Task (Stroop) to measure inhibitory control and the Symbol Digit Modalities Task (SDMT) to working memory. To examine sleep, participants wore an actigraphy watch for at least three days prior to the first experimental session.

RESULTS: SDMT performance following acute exercise (60.0±9.6) was significantly better compared to rest (57.7±8.9) [p = .049, η² = 0.146]. Moreover, oral SDMT performance was significantly better after exercise compared to rest in short sleepers (< 7.5 hr/night) [p< .001, η² = .085], but did not differ between exercise and rest in long sleepers (> 7.5 hr/night) [Condition*Sleep interaction, p = .047, η² = .174]. Short sleepers also significantly performed better in written SDMT after exercise relative to rest [p = .004, η² = .583]. Stroop interference score (incongruent minus congruent) was not significantly different between exercise and rest conditions.

CONCLUSION: These findings suggest that working memory performance is enhanced up to 1.5 hours after acute exercise in older adults who sleep less. Future studies should explore whether these effects of acute exercise confer a long-term protection against cognitive decline in older adults with poor sleep.
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 elderly overweight 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 GT3X-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 programmed using E-Prime 2 professional (Psychology Software Tools, Inc., Pensacola, FL, USA). Global switch costs and local switch costs were derived and used as the outcomes of the task. Anthropometrics were measured using standardized procedures. 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 smaller 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. Z-scores were used for the analysis and negative numbers represented scores below expected normal values. 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. 0.711 ± 1.7, p=0.013). 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 (-1.50±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.

**Impact of Physical Activity on Cognition in Older Mexican Americans**

Kamiah Moss, Stephanie Large, Sid E. O’Bryant, Leigh A. Johnson. The University of North Texas Health Science Center, Fort Worth, TX.

Alzheimer’s disease (AD) is a devastating public health problem that affects over 5.4 million Americans. Exercise is considered a modifiable risk factor for Alzheimer’s disease and cognitive decline. Physical activity has been found to improve cognitive function in older adults. However, few studies have examined the relationship between self-reported PA and cognitive functioning in Mexican American elders.

**Purpose:** To examine to impact of PA levels (inactive vs. highly active) on cognitive performance in Mexican American elders.

**Methods:** Data was analyzed from HABLE (Health and Aging Brain among Latino Elders), which is an epidemiological study of aging among Mexican Americans. The IPAQ-long form was administered to 361 cognitively normal participants (59+7yrs). IPAQ scores were stratified into two groups inactive and high PA. Cognition was assessed via neuropsychological test scores in five domains: Memory (Logical Memory 1 & 2), Executive (CLOX 1, Trails A), Visual Spatial (CLOX 2, Trails B), Attention (Digit Span), Language (Animal Naming), and global cognition (MMSE). An independent samples t-test was used to compare inactive and high PA groups on cognitive performance.

**RESULTS:** The inactive group scored significantly lower on WMS III Logical Memory 1 (32±9 vs. 35±9, p<0.01), WMS III Logical Memory II (19±7 vs. 22±7, p<0.01), CLOX 1 & 2 (24±3 vs. 25±3, p<0.05), and MMSE (26±3 vs. 27±2, p=0.01). There were no significant differences found among the groups on Trails A (59±31 secs vs. 54±23 secs), Trails B (141±68 secs vs. 145±69 secs), Digit Span (11+3 vs 11+3), and Animal Naming (16+4 vs.17+4).

**CONCLUSION:** High levels of physical activity was associated with better performance in memory, executive functioning, and global cognition among Mexican American elders with normal cognition. Inactivity was associated with poorer cognitive performance.

Supported by NIH ROI AG054073 and The Alzheimer’s Association AARG-16-442652.
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 (aged 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 bilaterally for 1 min via insonation 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). Peak systolic, mean and diastolic and CBFv were not different across conditions at either post-session assessment (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 > 0.05) or EX30 and EX10 (P > 0.27). Peak systolic, mean and diastolic CBFv were not different across conditions at either post-session assessment (P > 0.05) or EX30 and EX10 (P > 0.27). Peak systolic, mean and diastolic CBFv were not different across conditions at either post-session assessment (P > 0.05) or EX30 and EX10 (P > 0.27). Peak systolic, mean and diastolic CBFv were not different across conditions at either post-session assessment (P > 0.05) or EX30 and EX10 (P > 0.27). Peak systolic, mean and diastolic CBFv were not different across conditions at either post-session assessment (P > 0.05) or EX30 and EX10 (P > 0.27). Peak systolic, mean and diastolic CBFv were not different across conditions at either post-session assessment (P > 0.05) or EX30 and EX10 (P > 0.27).
response 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-one 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-Ojuel2, Andrea del Pilar Quintero3, Jorge Enrique Correa-Bautista1,2, Antonio García-Hermoso1, Rosa Helena Bustos-Cruz1, Carlos Andrés Peña-Guzmán1, Luis Andrés Téllez-Téllez2, Robinson Ramirez-Vélez2,1, Universidad de La Sabana, Chía, Colombia. 1Universidad del Rosario, Bogotá D.C, Colombia. 1Universidad de Santiago de Chile, USACH, Santiago de Chile, Chile. 2Universidad Santo Tomás, Bogotá D.C, Colombia. (No relevant relationships reported)

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 = 1.01], NT-3 (89.9, 95% CI, 2.2 to 172.1; d = 0.79), and NT-4/5 (7.5, 95% CI, 1.7 to 13.3; d = 0.77) compared to the control group.

CONCLUSIONS: The findings indicate that acute resistance training and combined exercise increase 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, Zhen Xu1, Zhe Wang1, Yong Zhang1, Li Li Ji, FACSM2,1. Tianjin Key Laboratory of Exercise Physiologyand Sports Medicine, Tianjin University of Sport, TJAN-JIN, China. 2School of Kinesiology, University of Minnesota, MN, MN. (No relevant relationships reported)

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 mitochondria state 3 respiration (-42%, p<0.01), ATP synthesis activity (-40%, p<0.01); and elevated Beclin1 (+35%, p<0.05), LC3-II (+26%,p<0.05), BAX (+30%,+48%, p<0.01) protein levels, both ME and MR significantly elevated mitochondria state 3 (+72%,+101%, p<0.01), RCR (+47%,+98%, p<0.01), and ATP synthesis activity (+27%,+45%, p<0.01), and elevated Beclin1 (+28%, p<0.05; +57%, p<0.01), LC3-II (+30%,+39%; p<0.05, BC12 (+23%,+38%; p<0.01), and BAX (+30%+48%, p<0.01) protein levels. MR increased mitochondria state 3 respiration (+16%, p<0.05, RCR (+34%, p<0.01), ATP synthesis (+14%, p<0.05), Beclin1 (+23%, p<0.01), LC3-II (+7%, p<0.05), BC12 (+2%+0.5%, p<0.05, BAX (+13%,+19%, 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 NSFC 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)

(No relevant relationships reported)

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 of 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 (Stop and Non-Stop) 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 tDCS and sham groups (p>0.05). Balance continued to show improvements during the simple cognitive tasks in the tDCS 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. (No relevant relationships reported)

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

MINNEAPOLIS, MINNESOTA
ACSM May 29 – June 2, 2018
Minneapolis, Minnesota
rats (n=12-13/group), 6 weeks of age, were exercise trained (ET) or were sedentary controls (SD). The exercised rats ran on a treadmill using a ramped protocol for 5-7 weeks at an intensity equal to ~75% \( VO_{2\text{max}} \). Five hours after the final exercise session rats were euthanized and the cortex, hippocampus, and cerebellum brain regions were collected and stored at -80°C until further analysis. Nrf2 protein concentration was measured via western blot analysis. Total glutathione (TGSH) and reduced glutathione (GSH) concentration were measured via HPLC. Manganese superoxide dismutase (Mn-SOD) activity was assayed using a spectrophotometric assay. All samples were analyzed in duplicate. The significant level was set a-priori at p<0.05 and the results are displayed as the mean ± SEM. RESULTS: Hippocampal Nrf2 was significantly elevated with exercise (ET=3.62±0.20 vs. SD=2.28±0.10 arbitrary units), but was significantly reduced in the cortex (ET=3.20±0.24 vs. SD=6.39±0.26 arbitrary units) and cerebellum (ET=2.02±0.11 vs. SD=3.12±0.16 arbitrary units). TGSH and GSH and significantly increased in the hippocampus (ET=182.76±4.64 vs. SD=135.54±8.99 umol/mg protein) (ET=178.94±5.49 vs. SD=131.16±3.83 umol/mg protein), respectively, but were unchanged in cortex and cerebellum regions. No significant differences were detected in Mn-SOD with aerobic exercise in any brain region. CONCLUSIONS: Nrf2 and antioxidative factors are up-regulated in the hippocampus only with chronic aerobic exercise training compared to sedentary controls. However, other brain regions respond differently to aerobic exercise. This merits notation as the hippocampus is a primary brain region susceptible to neurodegenerative diseases.

Age-related motor deficits are associated with a decreased ability to modulate primary motor cortex (M1) excitatory and inhibitory circuits. In young healthy adults, an acute bout of lower-limb aerobic exercise modulates upper-limb corticospinal excitability and intracortical circuitry. Importantly, these changes are associated with improved performance on skilled upper-limb motor tasks. However whether these effects extend to healthy older adults is not known. PURPOSE: To determine whether an acute bout of lower-limb aerobic exercise alters corticospinal and intracortical excitability using single and paired pulse transcranial magnetic stimulation (TMS) of the extensor carpi radialis muscles in healthy older adults. METHODS: Corticospinal excitability, short-interval intracortical inhibition (SICI), and intracortical facilitation (ICF) were assessed in 16 healthy older adults (10 female, aged 65.3 ± 6.4 years) at two time-points prior to (30 minutes pre-exercise) and two time-points following an exercise bout (immediately and 30 minutes post-exercise) to evaluate the time course of cortical excitability modulation. The exercise bout consisted of 20 minutes of continuous cycling at moderate-intensity (50% peak power output (watts) from 135±43 to 185±64 Watts) performed in a pre-experimental session. RESULTS: Due to no significant difference between baseline time-points, the two pre-exercise time-points were averaged to provide a baseline value for all measures. To control for baseline fitness levels (\( VO_{2\text{max}} \), a one-way repeated measures ANCOVA revealed an increase in SICI by 12 ± 7% immediately after and by 11 ± 9% 30 minutes post-exercise compared to baseline levels (F_2,14 = 3.82, p<0.05). There was no effect of exercise on any of the other measures. CONCLUSION: This study is the first to show that primary motor cortical inhibitory circuits may be modulated by a single bout of aerobic exercise in healthy older individuals. These findings imply that short bouts of moderate intensity exercise promote motor cortical plasticity in healthy older people.

Psychosocial factors were assessed with these scales: Beck Depression Inventory (BDI), Dysfunctional Attitudes Scale (DAS), Daily Stress Inventory (DSI), Perceived Stress (PSS), Brief Resilience Coping 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.

To assess psychosocial and energetic factors associated with FHA in exercising women. METHODS: 35 years-old females (n=24) were divided into two groups depending on the population studied. We performed a cross-sectional comparison of exercising women (≥2 years of activity) and non-exercising women (0 years of activity). Results: Excercising women had significantly lower FRDQ (p=0.008, 0.010), FRMFI (p=0.003), and FRMFI (p=0.007), 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.

Age-related motor deficits are associated with a decreased ability to modulate primary motor cortex (M1) excitatory and inhibitory circuits. In young healthy adults, an acute bout of lower-limb aerobic exercise modulates upper-limb corticospinal excitability and intracortical circuitry. Importantly, these changes are associated with improved performance on skilled upper-limb motor tasks. However whether these effects extend to healthy older adults is not known. PURPOSE: To determine whether an acute bout of lower-limb aerobic exercise alters corticospinal and intracortical excitability using single and paired pulse transcranial magnetic stimulation (TMS) of the extensor carpi radialis muscles in healthy older adults. METHODS: Corticospinal excitability, short-interval intracortical inhibition (SICI), and intracortical facilitation (ICF) were assessed in 16 healthy older adults (10 female, aged 65.3 ± 6.4 years) at two time-points prior to (30 minutes pre-exercise) and two time-points following an exercise bout (immediately and 30 minutes post-exercise) to evaluate the time course of cortical excitability modulation. The exercise bout consisted of 20 minutes of continuous cycling at moderate-intensity (50% peak power output (watts) from 135±43 to 185±64 Watts) performed in a pre-experimental session. RESULTS: Due to no significant difference between baseline time-points, the two pre-exercise time-points were collapsed to provide an average baseline value for all measures. To control for baseline fitness levels (\( VO_{2\text{max}} \), a one-way repeated measures ANCOVA revealed an increase in SICI by 12 ± 7% immediately after and by 11 ± 9% 30 minutes post-exercise compared to baseline levels (F_2,14 = 3.82, p<0.05). There was no effect of exercise on any of the other measures. CONCLUSION: This study is the first to show that primary motor cortical inhibitory circuits may be modulated by a single bout of aerobic exercise in healthy older individuals. These findings imply that short bouts of moderate intensity exercise promote motor cortical plasticity in healthy older people.

Purpose: Sleep is considered one of the most important recuperation techniques for elite athletes, with its specific features implicating different aspects of learning skills and physical recuperation. The aims of this study were (1) to assess objectively the sleep characteristics of elite gymnasts and (2) to correlate these findings with their age. METHODS: Twelve elite female gymnasts (15.1 ± 1.5 years old, \( VO_{2\text{max}} = 52.18 ± 5.1 \text{ml min}^{-1} \text{kg}^{-1} ; 36.7 ± 1.7 \text{training hours/week} \) underwent a nocturnal polysomnography (PSG) after a regular training day (6 - 6.5 h of training). The PSG was scored according to the guidelines of the American Academy of Sleep Medicine (AASM). Time in bed (min), Total Sleep Time (TST, min), Sleep Efficiency (SE, %), Non Rapid Eye Movement 1 (NREM1, %), NREM2 (%, Slow Wave Sleep (SWS, %), REM (%), Wake After Sleep Onset (WASO, min), Sleep Onset Latency (SOL, min), Awakening Index (h) and Apnea-Hypopnea-Index (h) were measured and analyzed. Furthermore, the gymnasts completed the Epworth Sleepiness Scale (ESS) and Pittsburgh Sleep Quality Index (PSQI). Sleep parameters were correlated with age using a Pearson Correlation. RESULTS: The following objective values were attained: time in bed 487 ± 13 min, TST 437 ± 27 min, SE 89.5 ± 4.1 %, NREM 4.9 ± 3.6 %, NREM2 38.7 ± 10.2 %, SWS 36.9 ± 11.4 %, REM 19.3 ± 3.8 %, WASO 32.4 ± 9.2 min, SOL 18.3 ± 16.5 min, Awakening Index 16.1 ± 6.3 /h, Apnea-Hypopnea-Index 0.9 ± 0.8 /h, ESS 5.3 ± 2.5 (24), PSQI 2.6 ± 1.9 (21). Age-matched correlations for %SWS (R=0.693, P<0.013) and arousals from SWS (R=0.622, P<0.031) were found. The younger the gymnasts, the higher the SWS, was found, with higher amounts of arousals from SWS in the younger gymnasts. CONCLUSIONS: Objective sleep assessments through PSG in elite female athletes suggest a higher amount of SWS compared to non-elite athletic peer students (Suppiah et al., Ped. Ex. Sc. 2016; 28(8):588-595) as a salient feature in their sleep architecture. This may represent an advantage towards higher performance, as sleep deficits are related with lower performance. Hence, it needs to be explored whether a thorough analysis of elite athletes’ sleep should be incorporated in health screenings.
in the mouth for 20 sec and MR treatments were applied using a Latin square design. RESULTS: No differences were found in the change of MEP from pre to immediately after the MR across the conditions C0–C0 (5.54±4.4%; GLU–GLU:6.12±11.2%; MAL–3.95±3.4%; MDX–8.91±7.9%). In contrast, the increase in MEP was greater at the post peak time in CHO conditions (GLU–11.14±7.7%; p<0.01; MAL–12.9±7.8%; p<0.07; MDX–28.0±14.4%; p=0.02) as compared to PLAC (PLAC–14.3±7.8%). MVC was similar at pre (PLAC=260±25; NM; GLU=241±19; NM; MAL=245±21; NM; MDX=248±25; NM), after (PLAC=269±26; NM; GLU=249±18; NM; MAL=257±19; NM; MDX=250±23; NM), and 10 min after (PLAC=262±28; NM; GLU=256±17; NM MAL=269±25; NM; MDX=253±21; NM) the MW. CONCLUSIONS: CHO MR increased corticospinal motor excitability 10 min after application; however, the form of CHO used did not influence this response. The increase in corticospinal motor excitability did not translate into an improvement in motor performance.

II college completed questionnaires that assessed female athlete triad cumulative risk using 5 factors (low energy availability, low body mass index, delayed menarche, disordered eating, and amenorrhea, and stress fractures). Women were grouped according to how many risk factors they had for the female athlete triad. At the end of each sport season, injury data was compiled using SportsWare (an electronic medical record database used by the athletic trainers to manage injury data). RESULTS: Forty-one women were considered low risk for the female athlete triad (Low Risk Triad group) and 16 women were considered moderate risk for the female athlete triad (Moderate Risk Triad group). No women in our study were at high risk for the female athlete triad. Forty-seven of the 57 women (82%) incurred 90 musculoskeletal injuries. The most prevalent injuries included: low back pain/spasm/strain (n=12), followed by shin splints/medial tibial stress syndrome (n=9), general knee pain (n=7), quadriceps strain (n=6), and knee sprain (anterior cruciate ligament, posterior cruciate ligament, medial collateral ligament and lateral collateral ligament sprain; n=5). The most prevalent injuries differed between gymnasts with and without back pain in the previous 12 months using t-tests. The Micheli Functional Scale and Oswestry Low Back Pain Scale. Demographic information, clinical characteristics, and flexibility measurements were compared between gymnasts with and without back pain in the previous 12 months using t-tests.

The endocannabinoid (eCB) system has emerged as a promising target for enhancing fear extinction learning, which has therapeutic applications for the treatment of stress and anxiety disorders that rely primarily on exposure-based therapies. 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: ICV/CM (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 (d = 0.39), 3 (d = 0.50), 4 (d = 1.16), and 5 (d = 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 UW Virginia Home Henry Fund and the Advancing a Healthier Wisconsin Endowment at the Medical College of Wisconsin.

A-53 Free Communication/Poster - Age and Gender Issues Wednesday, May 30, 2018, 7:30 AM - 12:30 PM Room: CC-Hall B

424 Board #263 May 30 11:00 AM - 12:30 PM Perception Regarding Injury and Training in Elite, Adolescent Rock Climbers Rachel N. Meyers1, Morgan N. Potter2, Steven L. Hobbs1, Aaron J. Provance31, University of Colorado Boulder, Boulder, CO. 2Children’s Hospital Colorado, University of Colorado School of Medicine, Aurora, CO. (No relevant relationships reported)

PURPOSE: Our objective was to examine the awareness and knowledge of youth-specific climbing injuries and risk factors amongst elite, adolescent rock climbers. METHODS: We surveyed elite adolescent rock climbers, ages 8-18 competing in the 2017 USA Climbing Sport and Speed National Championships. Subjects answered questions on their knowledge and awareness of the most common youth climbing injury and safe training practices. One-way ANOVAs and Bonferroni post hoc tests identified misperceptions about youth climbing injuries and the safe age to start double dyno campusng, a climbing-specific training exercise. Risk ratios were used to compare the proportion of athletes who self-reported as “informed” and “uninformed” when asked about common finger injuries in adults and youth. RESULTS: 267 climbers completed the survey (age =13.99±2.66, 51.9% male, 48.1% female). The adult-specific A2 pulley injury, was erroneously reported by the subjects to be the most common youth climbing injury, with an average ranking of 3.09±2.20 on a scale of 1 (most common) to 8 (least common). The youth-specific and most common injury in adolescent climbers, growth plate finger injuries, ranked second most common, with an average of 4.6±0.22. These rankings were significantly different (p<0.001). Only 5.7% of climbers correctly identified the safe age to begin double dyno campusng, a risk factor for growth plate injuries. 48.9% of climbers reported they were aware of growth plate injuries to the finger; yet only 54% of these climbers correctly identified the injuries as stress fractures. 73.5% overall reported growth plate finger injuries to either be a type of A2 pulley injury or did not know. CONCLUSION: Adolescent climbers demonstrated the misconception that skeletally immature climbing-specific injuries and training techniques do not need to be treated differently from skeletally mature climbers. As climbing enters the 2020 Olympics, it is imperative that adolescent climbers, coaches, and parents be better educated on pediatric-specific climbing injuries and when to seek medical attention. Improved knowledge can help reduce the risk of these injuries and the potential for permanent finger deformity and/or loss of function.

425 Board #266 May 30 11:00 AM - 12:30 PM The Relationship Between Flexibility and Low Back Pain in Female Adolescent Gymnasts Morgan N. Potter, David R. Howell, Emily A. Stuart. Children’s Hospital Colorado, Aurora, CO. (No relevant relationships reported)

PURPOSE: Our objective was to elucidate the association between lower back pain, flexibility, and individual characteristics in adolescent female gymnasts. METHODS: Female gymnasts ages 6-18 years competing in the USA Women’s Artistic Junior Olympic Program levels 3-10 were enrolled in the study. Subjects underwent active and passive flexibility measurements at the shoulder, hip, quadriceps, and hamstrings. They were then asked if they experienced back, shoulder, and/or hip pain in the last 12 months. Those with a history of back pain then completed the Micheli Functional Scale and Oswestry Low Back Pain Scale. Demographic information, clinical characteristics, and flexibility measurements were compared between gymnasts with and without back pain in the previous 12 months using t-tests.
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 in men (n=243) and women (n=243) participated in this study. The average age, BMI and %BF of participants were 20.5±2.3 years, 22.6±4.3 and 8%±2%, respectively. Sex differences existed in back pain, flexibility, and pubertal development.

RESULTS: Fifty-one gymnasts participated: 19 who reported back pain in the past 12 months (age= 13.3±3.3 years; BMI= 18.6±6.2) and 32 who did not (age= 11.1±2.4 years; BMI= 17.5±1.9). Those with back pain reported more hours per week of gymnastics participation (22.7±6.9 vs. 18.5±5.9 hours/week; p= 0.026), and a higher proportion reported experiencing menarche (24% vs. 6%; p<0.009) than those who did not. Passive Hookeal shoulder flexion (178.6±6.1 vs. 180.0±0.0 degrees; p= 0.008) and active right prone knee flexion (131.1±9.2 vs. 122.0±5.1 degrees; p= 0.07) were lower among those who reported back pain. When considered together, having experienced menarche at the time of assessment was independently associated with the presence of self-reported back pain in the past 12 months (adjusted odds ratio= 3.179, 95% CI= 1.22-43.87; p= 0.029).

CONCLUSION: Risk factors for back pain in adolescent female gymnasts may be more complex and multifaceted than the simple flexibility measurements we used. While the history of low back pain and flexibility were not significantly associated, low back pain was common in gymnasts with a history of menarche. As back pain etiology is likely related to many factors, clinicians should be aware of intrinsic patient factors, such as pubertal maturation, when considering risk of future back injury.

426 Board #267 May 30 11:00 AM - 12:30 PM Sex Differences in Objective and Subjective Sleep in Collegiate Athletes

Janelle L. Adomet1, Brett M. Gervais1, Stephanie L. Dietrich2, Babak Mohklses1, Jason R. Carter1. 1Michigan Technological University, Houghton, MI. 2University of Chicago, Chicago, IL. (No relevant relationships reported)

Despite the importance of sleep in athletic performance, objective assessments of sleep are not well characterized in collegiate athletes, and the impact of sex (i.e., male vs. female) on subjective and objective sleep in collegiate athletes remains equivocal. PURPOSE: To establish normative estimates of subjective and objective sleep in male and female collegiate athletes, and determine if sex differences exist. METHODS: Subjective and objective sleep were assessed during the off-season in 108 collegiate athletes (56 males, 21 ± 1 years; 52 females, 20 ± 1 years) recruited from the Michigan Tech University varsity football, basketball, volleyball, soccer, hockey, track, and nordic ski teams. Subjective assessments included Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), Epworth Sleepiness Scale (ESS), and 3-5 consecutive weeknights of sleep diary to determine subjective total sleep time (TST). Objective assessments of TST, sleep efficiency (SE), and wake after sleep onset (WASO) were determined using wrist actigraphy in parallel with sleep diaries. The apnea-hypopnea index (AHI) was determined using an at-home apnea screening test during one of the actigraphy nights. RESULTS: Actigraphy revealed that 94% of all athletes received <8 hrs of objective TST, with 63% receiving <7 hrs. Male athletes reported significantly higher subjective TST (i.e., sleep diary) compared to female athletes (7.6±1.0 vs. 6.9±1.0 hrs, p<0.001). However, objective TST (i.e., actigraphy) was not different between males and females (6.9±0.1 vs 6.8±0.1 hrs, p=0.56). Moreover, females demonstrated significantly higher SE (87.1± vs. 82.1±% males, p=0.001) and lower WASO (31.2± vs. 38± min, p=0.032) compared to males. PSQI, ISI, and ESS were not significantly different between sexes. AHI was significantly higher in male athletes (1.2±0.2 vs. 0.5±0.1 episodes/hr, p=0.001), but both groups were well below the threshold for clinical sleep apnea. CONCLUSION: Subjective and objective assessments of sleep differed in male and female subjects, yet both groups were well below recommended levels of sleep for collegiate athletes. These findings suggest that different sleep education strategies and interventions may be necessary in male and female collegiate athletes to improve sleep duration and/or quality.

427 Board #268 May 30 11:00 AM - 12:30 PM Can Ultrasound Subcutaneous Fat Thickness be used to Estimate Percent Body Fat in Older Adults?

Robert Thiebud1, Takashi Abe1, Jeremy Loenneke1, Eiji Fujita1, Takuya Akamine1, Janelle L. Adomet1, Takashi Abe1, Jeremy Loenneke1, Eiji Fujita1, Takuya Akamine1, Janelle L. Adomet1. 1Texas Wesleyan University, Fort Worth, TX. 2University of Mississippi, Oxford, MS. 3National Institute of Fitness and Sports in Kanoya, Kagoshima, Japan. (No relevant relationships reported)

Ultrasound imaging has been used to develop body composition, which includes percent body fat (%BF), in young and middle-aged adults. However, it is unknown whether ultrasound imaging can predict %BF in older adults when using dual-energy x-ray absorptiometry (DXA) as the criterion method. PURPOSE: To develop prediction equations to estimate %BF in older men and women using ultrasound subcutaneous fat thickness. METHODS: Four-hundred and nineteen men (n=176) and women (n=243) participated in this study. The average age, BMI, and %BF of participants were 70.6 ± 6.4 yrs, 23.5 ± 3.0 kg/m² and 28.2 ± 7.4%. Participants were randomly separated into a model development group (n=260) and cross-validation group (n=159). B-mode ultrasound using a 5-MHz scanning head imaged subcutaneous fat thickness on the right side of the body at the anterior forearm, anterior and posterior upper arm, anterior trunk, posterior trunk, anterior and posterior thigh, and anterior and posterior lower leg. A whole body scan using DXA was used to determine %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. RESULTS: Bland-Altman plots revealed a mean bias of 0.2266 ± 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.

428 Board #269 May 30 11:00 AM - 12:30 PM Menstrual Cycle Influence on Iron-Status Markers in Female Athletes. IronFEMME Pilot Study

Ana B. Peinado1, Laura Barba1, Ángel E. Díaz2, Javier Butragueno1, Nuria Romero-Parra1, Francisco J. Calderón3, Pedro J. Benito3, Rocío Cupeiro3. 1LFE Research Group, Universidad Politécnica de Madrid, Madrid, Spain. 2Ministry of Education, Culture and Sport, Highest Spanish Sports Council, Madrid, Spain. 3Ministry of Education, Culture and Sport, Madrid, Spain. (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-trained women (34.9 ± 4.2 years; 163.9 ± 6.1 cm; 58.4 ± 5.5 kg; peak oxygen consumption (VO2peak) 49.7 ± 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±3.6; MFP: 80.2±3.9; LP: 83.6±5.8; p=0.101), although we observed lower values at EFP. Time was not significant on serum iron (Baseline: 69.9±4.5; Post0h: 76.6±4.9; Post3h: 70.0±4.6; p=0.247). Ferritin (ng/ml) values were similar across menstrual cycle phases (EFP: 27.9±2.1; MFP: 31.8±2.5; LP: 32.0±2.4; p=0.451); however, there was a significant effect for time (p=0.017) with higher values at Post0h (33.1±2.7) compared to baseline (28.8±2.5). We observed similar values of transferrin (mg/dl) across menstrual cycle phases (EFP: 300.8±40.4; 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 x 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)

429 Board #270 May 30 11:00 AM - 12:30 PM Menstrual Cycle Influence on Hepcidin Secretion and Inflammatory Responses in Female Athletes. IronFEMME Pilot Study

Laura Barba1, Rocío Cupeiro1, Ángel E. Díaz2, Elena Santiago1, Víctor Alfaro1, Beatriz Rael2, Cristina Maestre-Cascáles1, Juan Orellana1, Ana B. Peinado1. 1LFE Research Group, Universidad Politécnica de Madrid, Madrid, Spain. 2Ministry of Education, Culture and Sport, Highest Spanish Sports Council, Sports Medical Center, Madrid, Spain. 3Tambre Clinic, Madrid, Spain. 4ETSIAE, Universidad Politécnica de Madrid, Madrid, Spain. (No relevant relationships reported)

Deficient iron absorption may be conditioned by an increase in inflammatory markers and hepcidin levels after exercise. The interaction between inflammatory markers Abstracts were prepared by the authors and printed as submitted.
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 (VO2peak) 49.7±3.1 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 VO2peak. 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±3.23; MF: 78.4±1.95; LP: 78.0±2.23; p=0.762). Time was significant (p<0.001) on Hepcidin with higher values at Post0h (81.9±21.5) compared to Baseline (76.8±21.9). IL-6 (pg/ml) levels were not different across menstrual cycle (EF: 3.5±1.0; MF: 3.0±1.1; LP: 5.4±1.6; p=0.079); however time (p=0.001) at Post3h (54.6±6.3) showed significant higher values compared to Baseline (2.6±2.1) and Post0h (5.9±3.2). We found an interaction between menstrual cycle phase and time with lower values at Post3h during LP (8.7±9.9) compared to EF (7.1±7.9) and MF (5.7±1.9). Increased CRP (mg/dl) levels were reported (p=0.033) during EF (2.0±0.33) related to MF (1.0±1.1) and LP (0.8±1.4). Time had no significant effect on CRP (Baseline: 1.3±2.4; Post0h: 1.3±2.3; Post3h: 1.2±2.0; p=0.707). CONCLUSION: According to 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 (VO2peak) compared to age-matched peers, and therefore have the potential for increased relative gains in VO2peak in response to chronic exercise training. Individualized exercise prescriptions and monitoring improvement both rely on accurate assessment of VO2peak; however, expired gas analysis is not always available. Therefore, prediction equations have been established to estimate VO2peak for both treadmill (TM) and cycle ergometry (CE) tests in able-bodied adults. Whether or not these equations are appropriate for MS patients has yet to be investigated. PURPOSE: To compare VO2max obtained via TM and CE maximal exercise tests to previously established cardiometabolic prediction equations. METHODS: MS patients (44 ± 11 yrs, 28.1 ± 8 kg/m^2, 11 ± 10 yrs since dx) performed a maximal graded exercise test on both a TM and CE. Twenty-five minute stages with a constant, self-selected pace, with a 2% increase in grade per stage. CE tests increased by 15 Watts/min. VO2peak was compared to previously established mode-specific cardiometabolic prediction equations using paired samples t-tests and further examined with Bland-Altman plots. RESULTS: Predicted VO2peak 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^{-1}, respectively. The CE had a mean bias, upper LOA, and lower LOA of -2.20, 3.31, and -7.72 ml·kg·min^{-1}, respectively. CONCLUSION: Cardiometabolic prediction equations resulted in higher VO2peak estimates for both TM and CE in MS patients. The wide limits of agreement (Bland-Altman plots) suggest the accuracy in predicting individual VO2peak 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. Neurological deficits are often the result of demyelination, which disrupts the ability of the axons to efficiently conduct nerve impulses. The cause of MS is not well understood, but it is believed to be an autoimmune process that targets the myelin sheath, the protective layer around neurons. This study was supported with product by Dymatize Nutrition.
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 (MVIC) and isokinetic (MVICv) 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 (25TW), 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 ± 1.8 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 relationship between MVC SA and two FWP variables in the MS group (r = 0.76, p = 0.02). A significant relationship was also found between MVC SA and four FWP variables in the Non-MS group (r = 0.81, p < 0.01). No difference was observed in MVIC SA between groups (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.

**Purpose:** To evaluate the association between physical activity, walking ability and functional capacity in persons with MS. METHODS: Sixteen participants with relapsing-remitting MS (EDSS 2.8±0.9; 47±8 y; 77.6±14.0 kg; 1.70±0.1 m) and 14 age- and mass-matched healthy controls (43±11 y; 78.6±17.0 kg; 1.70±0.09 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; 82.3±18.2 kg; 1.7±0.1 m) and 8 healthy controls (44±12 y; 81.2±21.1 kg; 1.7±0.1 m) also completed the same exercise bout in a 35°C, 30%RH environment. In both trials, rectal temperature (Tr), mean skin temperature (Ts) and local sweat rate (LSR) and cutaneous vascular conductance (CVC) on the upper-back was measured throughout.

**RESULTS:** At 30°C, end-exercise Tr_M=37.2±0.3°C, CON=37.3±0.4°C; P=0.31), Ts (MS:34.5±0.5, CON:34.6±0.5°C, P=0.43), LSR (MS:0.04±0.02, CON:0.04±0.02 mg.cm⁻².min⁻¹; P=0.71), and CVC (MS:344±256, CON:268±157% of baseline; P=0.35) were similar between groups. Likewise, at 35°C, end-exercise Tr_M (MS:37.2±0.4°C, CON:37.3±0.3°C; P=0.70), Ts (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.
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 walk test, timed up and go, sitting 1 min of briskly walking/jogging/running at 15-17 RPE level with walking at 9-11 RPE level, 30 min of CME (4 min walking warm-up at 9-11 RPE level, followed by 21 min alternating 1 min of briskly walking/jogging/running at 15-17 RPE level with walking at 9-11 RPE level). The findings suggest that results in a varied of symptoms and is often disable. Studies conducted in large populations of cannabis users and non-users currently using cannabis perform similarly on physical function are unknown. **Purpose:** To examine the impact of body fatness on 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.
Exercise is Medicine®/Poster - EIM: Cognitive and Mental Function

**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 so, 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 < .005.

**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 various features can lead to an increased number of steps/day.

A-55 Exercise is Medicine®/Poster - EIM: Cognitive and Mental Function

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

**Purpose:** To examine effects of cortisol and an acute bout of moderate intensity, aerobic exercise on Cognitive Functioning. **METHODS:** A counterbalanced, random selection repeated measures design was implemented for this study. 19 subjects (M=6, F=13; 20.3 ± 1.6yrs) completed two testing sessions separated by one week. During the first session, participants filled out a PAR-Q, medical health history, and informed consent paper. Saliva samples were taken to measure cortisol levels. The CogState Brief Battery Assessment was administered. Body composition was assessed using DEXA. Subjects rested quietly for 30 minutes while listening to soothing music. During the exercise testing, subjects cycled on a Monark cycle ergometer for 30 minutes at a submaximal exercise intensity against 1 k and self-selected rpm’s to elicit at 70% HRR (or RPE of 15). Subjects then performed a cool-down for 5 minutes where

**A-55 Exercise is Medicine®/Poster - EIM: Cognitive and Mental Function**

**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 so, or all, of the 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 < .005.

**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 various features can lead to an increased number of steps/day.
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 disorders. Mental health benefits have been supported for 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 offer a viable tool for every individual, regardless of age, gender, capacity, or ability to utilize exercise. The purpose of this pilot study was to examine the effects of major depressive disorder (MDD) and exercise. 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.

**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 adherence to 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.

**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 co-located mental health resources. The purpose of this study was to assess factors influencing firefighters' perceptions about implementation of worksite exercise.

**RESULTS:** Significant departmental differences were noted for perceptions in leadership support for exercise (p = 0.03), fitness personnel availability (p < 0.001), 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.

**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 +/- 8.6 yr) from 3 fire departments in the Tampa Bay region of Florida. The participants completed a 45-item implementation questionnaire after a one-time worksite exercise intervention program. The questionnaire inquired 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), 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 = 0.04). Younger respondents were more likely to have gym memberships (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).

**CONCLUSIONS:** Factors influencing perceptions about the implementation of worksite exercise. Stakeholder engagement (leadership support) and available resources vary across departments and

**POSSIBLE EXPLANATIONS:**

1. **Exercise Engagement:** It is possible that firefighters who are more engaged in worksite exercise programs are more likely to report positive perceptions. This could be due to increased awareness and familiarity with the program.

2. **Leadership Support:** Firefighters who perceive strong support from leadership are more likely to engage in worksite exercise, which may explain the significant relationship between leadership support and perceptions. Leadership support may facilitate access to resources and encourage participation.

3. **Fitness Personnel Availability:** Availability of qualified fitness personnel is crucial for firefighters' willingness to participate in worksite exercise. A lack of fitness personnel may lead to feelings of inadequacy and a lack of confidence in the program's effectiveness.

4. **BMI:** BMI is a significant predictor of exercise engagement. Firefighters with lower BMI are more likely to perceive worksite exercise as important, possibly due to a higher baseline level of physical activity and perceived benefits of exercise.

5. **Low Back Pain History:** Firefighters without low back pain history are more likely to engage in off-duty exercise. This could indicate a higher level of perceived need for exercise to manage stress or maintain overall health.

Further research is needed to confirm these relationships and explore additional factors that may influence perceptions about worksite exercise implementation.
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.