Changes In Vitamin D Status Before And After Nordic Summer In Overweight Middle-aged Participants

Prenatal sun exposure can influence Vitamin D status in adulthood. Pregnancies in latitudes with low sun exposure are often associated with low Vitamin D status. The purpose of this study was to evaluate Vitamin D status before and after a 2-week Nordic summer season with a second year follow-up.

METHODS: 90 women (40-50 years of age, BMI 25±4 kg/m²) were randomized to consume placebo (PLAC), a standardized beverage (800 kcal/day) that met current Vitamin D requirements, or a fish oil supplement (ω3 1.6 g/day) that provided 2.4 g of EPA and DHA. Blood samples were collected before and after the second summer season with a second year follow-up. Serum Vitamin D levels (25(OH)D) were determined and compared with those recommended by the Institute of Medicine. A 2-year follow-up was planned to determine if Vitamin D status improved after the second summer season.

RESULTS: Serum 25(OH)D levels were not different after the second summer season compared with baseline values (PLAC: 37.4±11.7 ng/mL, ω3: 41.6±13.1 ng/mL, p>0.05). After the second summer season, Vitamin D status was lower in the ω3 group compared with the placebo group (ω3: 36.1±11.3 ng/mL, PLAC: 40.2±11.5 ng/mL, p<0.05). The second year follow-up showed that vitamin D status did not improve in the ω3 group compared with the placebo group (ω3: 35.9±11.0 ng/mL, PLAC: 40.2±11.5 ng/mL, p<0.01). These data suggest that moderate doses of EPA and DHA may not be sufficient to improve Vitamin D status in overweight or obese middle-aged women.

CONCLUSIONS: The results of this study suggest that moderate doses of EPA and DHA may not be sufficient to improve Vitamin D status in overweight or obese middle-aged women. Future studies should evaluate if higher doses of EPA and DHA are necessary to improve Vitamin D status in this population.
Resistance exercise enhances the anabolic sensitivity of myofibrillar protein synthesis rates (MPS) to the ingestion of a moderate amount of protein in young and older men. However, the effectiveness of higher-intensity resistance exercise to potentiate postprandial MPS after the ingestion of minimal dose of protein in aging women has not been well characterized. PURPOSE: We compared changes in MPS to ingestion of ~14 g whey protein or water at rest and after resistance exercise in middle-aged and older women. METHODS: 10 women (59±2 y; BMI: 25.1±1 kg/m²; LBM: 46±2 kg) performed a bout of unilateral leg extension exercise (3 sets x 12 repetitions) at 60% estimated 1RM prior to ingesting whey protein (0.3 g/kg LBM; WHEY, n=5) or water (WATER n=5). Primed continuous infusions of L-[ring-13C]phenylalanine, blood, and skeletal muscle biopsies were used to measure MPS over a 4-h postprandial period in both exercise (EX) and non-exercised (CON) legs. RESULTS: Plasma essential amino acid concentrations were increased in basal (2.5-fold) in WHEY group (P<0.05), but not in WATER group (P>0.05). EX significantly increased MPS above basal in both WHEY (5-fold) and WATER (2.5-fold) groups over the 4-h postprandial period (P<0.05). MPS were not significantly increased above basal rates in the CON leg throughout the postprandial period in either condition (P>0.10). No group differences in MPS were observed between the WHEY or WATER groups in either the EX or CON legs (P>0.05). CONCLUSION: A moderate volume of resistance exercise significantly increased MPS in aging women. However, the ingestion of a low dose of whey protein immediately after resistance exercise did not potentiate the MPS response when compared to ingesting water. Therefore, more targeted anabolic strategies are warranted to maximize the MPS response to feeding and exercise in older individuals.
Ischemic preconditioning (IPC) of the legs prior to exercise has been shown as a novel approach to improve performance in a number of different exercise modes in normoxia. Very little has been done examining the influence of these mechanisms during exercise in hypoxia. PURPOSE: To determine if IPC is an effective intervention for improving 5km cycle time trial (TT) performance both in normoxia and hypoxia. METHODS: Thirteen men (age=24 ± 4 years, VO2 max=63.1 ± 5.1 ml·kg⁻¹·min⁻¹) completed four randomized trials of each combination of normoxia (F02 = 0.16) or normoxia with a resting pre-exercise IPC protocol (4 x 5min at 220mmHg) or SHAM (4 x 5min at 20mmHg) procedure. Following the IPC/SHAM protocol subjects completed two constant load bouts and a 5km time trial on a cycling ergometer. Breakthrough (VT1), oxy-hemoglobin (Hb), deoxy-Hb, total-Hb, skeletal muscle oxygenation/extraction (measured via near-infrared spectroscopy) were continuously monitored throughout the trials. RESULTS: IPC significantly improved 5km TT time in normoxia by 9.9 ± 1.7% compared to SHAM (IPC: 491.2 ± 33.7 s vs. SHAM: 495.9 ± 34.5 s, P < 0.05). IPC did not alter 5km TT performance times in hypoxia. Muscle oxygenation, extraction, and tissue saturation did not differ between treatments or inspirates (P > 0.05). CONCLUSION: IPC improves 5km cycling TT performance in normoxia only. Muscle oxygenation was unchanged suggesting that highly trained subjects choose power output based on a set level of muscular oxygenation regardless of the fraction of inspired oxygen or treatment with IPC.
We previously demonstrated that 7 days of intermittent hypoxic training improved blood perfusion (241.7 ± 46.9 % in HYP vs. 175.8 ± 27.2 % in NOR) and hemoglobin (deoxy-Hb) (241.7 ± 46.9 % in HYP vs. 175.8 ± 27.2 % in NOR) in working muscles. In addition, power output during exercise was significantly improved (M: 8.3-13.0% (p = 0.009). The M group improved PO at VT2 by 13.8% (p = 0.01, 1st set: 16.5 ± 2.5 vs. 13.3 ± 2.1, 2nd set: 19.9 ± 2.5 vs. 16.7 ± 2.0, 3rd set: 21.7 ± 2.5 vs. 17.5 ± 1.9, 4th set: 21.1 ± 2.4 vs. 17.6 ± 1.9, 9th set: 21.2 ± 2.2 vs. 17.9 ± 1.7 mmol/L). CONCLUSIONS: The power produced during high-intensity interval training is not affected by hypoxic condition. However, energy production through anaerobic glycolytic system seems to accelerate in hypoxic condition.
the entire body to conduct higher load lifts at higher velocities and lower training volumes. Little research has been done in looking at the Olympic style weightlifting and the impact it can impose on the body. Whether this mode of training results in similar BMD adaptations is unknown, particularly in middle and older age adults.

**PURPOSE:** To determine the influence of age and sex on BMD in Masters Olympic Weightlifters when body mass index, weightlifting experience and strength were controlled. **METHODS:** Men (n = 27) and women (n= 24) competitors from the 2017 National Masters Championships were included. **RESULTS:** INT-CYC gained significantly (p<0.05) higher total body mass head BMD (5.0 %), lumbar spine BMD (4.6 %), femoral neck BMC (9.8 %) and bone stiffness (12.3 %) than CON-CYC. INT-CYC gained significantly higher CSA (11.0 %), CSMI (10.1 %) and TBS (4.4 %) outcomes than CON-CYC. INT-SWI gained significantly (p<0.05) higher femoral neck BMC (6.0 %), legs BMC (4.2 %) and bone stiffness (12.7 %) than CON-SWI. INT-SWI gained significantly higher CSMI outcomes (10.9 %) than CON-SWI. There were no significant differences (<0.05) differences between INT-SOC and CON-SOC for any bone outcomes (0.9-3.9 %). **CONCLUSIONS:** The present 9-month jumping intervention improved bone outcomes in non-weight bearing sports, such as swimming and cycling, but not in a weight-bearing sport, such as soccer.

**3080 Board #5 June 2 9:00 AM - 11:00 AM Calcium, PTH, And CTX Responses to Treadmill Walking During Different Thermal Environments in Older Adults**

Sarah J. Wherry, Christine M. Swanson, Pamela Wolfe, Rebecca S. Boxer, Rpbert S. Schwartz, Wendy M. Kohrt, FACSM. University of Colorado Anschutz Medical Campus, Aurora, CO. (Sponsor: Wendy Kohrt, FACSM)  

Serum ionized calcium (iCa) decreases and parathyroid hormone (PTH) and c-terminal telopeptides of type I collagen (CTX, marker of bone resorption) increase during endurance exercise in younger and older adults. Evidence from equine models suggests this may be due to dermal calcium loss. **PURPOSE:** To determine if exercise in a warm environment exaggerates the decrease in iCa and increases in PTH and CTX compared to a cool environment. **METHODS:** Women (n=5) and men (n=7) aged 61-78 years performed two identical 1-hour treadmill walking bouts under warm (~28°C) and cool (~21°C) conditions at ~75% of maximal heart rate iCa, PTH, and CTX were measured every 15 minutes starting 15 minutes before and continuing for 60 minutes after exercise. Sweat calcium loss was estimated from sweat volume and sweat calcium concentration. Changes in iCa, PTH, and CTX were adjusted for plasma volume shifts. Between and within group differences were analyzed using linear mixed model regression analysis. **RESULTS:** There was no difference in sweat calcium loss between thermal conditions. iCa decreased similarly during exercise in both conditions (W: -0.16, 95% CI: -0.28, -0.04 mg/dL; C: -0.16, 95% CI: -0.24, -0.04 mg/dL). After adjusting for plasma volume shifts, change in iCa was significantly higher for the warm condition (W: 0.24, 95% CI: 0.04, 0.44 mg/dL) indicating a larger calcium loss during warm compared to cool conditions. PTH increased similarly during exercise in both conditions (W: 16.4, 95% CI: 6.2, 26.5 pg/mL; C: 17.3, 95% CI: 8.1, 26.4 pg/mL). Adjusting for plasma volume shifts did not change the results. CTX increased similarly in both conditions (W: 0.08, 95% CI: 0.05, 0.11 ng/mL; C: 0.08, 95% CI: 0.01, 0.16 ng/mL), and adjusting for plasma volume shifts did not change the results. There were no differences between conditions for any outcome, even after adjusting for plasma volume shifts. **CONCLUSION:** Differing thermal conditions do not appear to be a major factor in the decrease in iCa and the increases in PTH and CTX observed during exercise in older adults. This may be due to the low sweat calcium loss during both conditions or small temperature difference. Future studies should determine if there are sex- or age-related differences that modify the relationship between sweat calcium loss and the activation of bone resorption during exercise.

**3081 Board #6 June 2 9:00 AM - 11:00 AM Bone Density Measurements in an Elite Population of Older Weightlifters**

Kevin R. Moyle,1, Bryan L. Riemann2, Robert LeFavi3, Kiayle Goins2, Kayleigh Erickson2, Mara Mercado3, Jody Stone4, Jeremy Ford5, David R. Hooper5, Jacksonville University, Jacksonville, FL. “Armstrong State University, Savannah, GA. (No relevant relationships reported)  

In the aging population, low bone mineral density (BMD) is a prevalent health concern, ranging from the milder condition of osteopenia, to the more severe osteoporosis. Resistance training, particularly with heavy resistance that loads the axial skeleton is often prescribed as an intervention to increase BMD. Training for the sport of Olympic Weightlifting requires consistently exposing the axial skeleton to high loads and thus should lead to elevated BMD. **PURPOSE:** The purpose of this study was to measure total body and lumbar spine BMD in Olympic Weightlifters competing in the Masters National Championships. **METHODS:** 26 men (age: 49.8 ± 11.6 years; height: 172.9 ± 7.3 cm; weight: 85.0 ± 13.1 kg) and 21 women (age: 47.1 ± 9.3 years;
BMD values (lumbar, thoracic, pelvis, leg and whole body BMD) were compared with age, sex, and baseline measures for VO_{2peak}, isotropic strength, and T2DM duration. Changes over 9-months were analyzed for group effects after adjusting for baseline. Changes in BMD were compared with age, sex, and changes in VO_{2peak} and muscle strength. RESULTS: Baseline associations showed that age was inversely related to pelvis BMD (p=0.006, r=−0.20) and females had significantly lower thoracic, lumbar, and whole body BMD (p<0.001). VO_{2peak} was correlated to leg (p<0.001, r=0.31) and whole body (p=0.02, r=0.17) BMD, and isokinetic leg strength was correlated to thoracic (p=0.001, r=0.26), pelvic (p=0.001, r=0.28), leg (p=0.001, r=0.46), and whole body (p=0.01, r=0.34) BMD. All groups increased whole body BMD with exercise training (P<0.05); however, no group effects were found for BMD changes after 9-months (p>0.10). Changes in pelvic BMD were found to be higher in females (p<0.04) than males and changes in VO_{2peak} were inversely correlated with changes in thoracic BMD (p<0.04; r=−0.15). No significant effects were observed. CONCLUSION: Sex, aerobic fitness, and muscle strength had similar relationships with BMD in individuals with T2DM as typically found in the normal adult population. However, group changes after 9-months of exercise training, while increased, were not different from the changes in CON. Funding provided by the National Institutes of Health, R01-DK086298

MicroRNAs (miRNAs, miRs) are short, non-coding RNA molecules that regulate gene expression at posttranscriptional level. Recent research has indicated that some miRNAs, such as miR-21 and miR-23a, target on genes of osteogenesis (Lian et al. 2012) and/or muscle atrophy (Wada et al. 2011). In the process of aging, there are progressive declines in bone mineral density (BMD) and muscle function, which potentially may be regulated by these miRNAs. PURPOSE: To examine the relationships between specific circulating miRNAs and bone density and muscle function in older postmenopausal women. METHODS: Seventy-five postmenopausal women aged 60 to 85 years old participated in this study. Body composition and areal BMD (aBMD) were measured by DXA. Volumetric BMD (vBMD) and bone strength were measured by pQCT. Grip strength was assessed by the digital grip strength dynamometer, whereas gait speed was assessed using the 4-meter path. Muscle power was assessed through countermovement jumps on the jump mat. Serum levels of miRNAs (miR-21, -23a, -23b, -125, -15b) were measured by real-time PCR. RESULTS: MiR-21 was significantly negatively correlated with left trochanter BMC (r = −0.252, p = 0.048), right trochanter BMC (r = −0.294, p = 0.020), and cortical vBMD at tibia 38% site (r = −0.253, p = 0.047). There was also a trend for a significant correlation between miR-21 and lumbar spine aBMD (r = −0.249, p = 0.051). MiR-125b was significantly positively correlated with jump velocity (r = 0.263, p = 0.03) and relative jump power (r = 0.294, p = 0.028). CONCLUSION: Our results suggest that a higher expression level of MiR-21 could be an effective intervention at developing bone density in populations with osteopenia or osteoporosis.

Excessive internet-connected, cellular telephone (smartphone) use is associated with greater anxiety and lower quality of life in college students. However, the acute effect of a bout of smartphone use on positive and negative affect and how this may differ from other, common activities (i.e., low-intensity exercise, school work) in college students, has not been studied. PURPOSE: To compare the effects of separate bouts of smartphone use, treadmill walking, and school work on positive and negative affect in college students. METHODS: Forty one college students (n = 25 female, 21.7 ± 2.0 years old) completed four, 30-minute conditions (control, treadmill walking, smartphone, school work), on separate days, in a controlled, laboratory environment: 1) Control, participants were seated on a chair in a quiet room. 2) Walking, participants walked at 3.1 mph on a treadmill. 3) Smartphone, participants utilized their smartphones to interact with their personal social-media accounts (e.g., Facebook, Twitter). 4) School work, participants completed self-selected school work (e.g., studying). Participants completed the positive and negative affect scale pre- and post-condition. RESULTS: Analyses of variance revealed a significant (F = 22.3, p < 0.001) by time interaction for positive affect which significantly increased (r = 4.2, p = 0.001) from pre- to post-condition during walking (21.8 ± 8.4 pre, 27.4 ± 9.9 post), did not change (r = 1.2, p = 0.24) during school work (21.8 ± 7.7 pre, 23.0 ± 8.2 post) and significantly (r = 3.7, p ≤ 0.001) decreased during both the smartphone (21.5 ± 8.1 pre, 17.2 ± 6.7 post) and control (19.8 ± 7.8 pre, 14.9 ± 5.8 post) conditions. There was also a significant (F = 15.6, p = 0.051) condition by time interaction for negative affect which significantly decreased (r = 2.3, p = 0.03) from pre- to post-condition during school work (13.4 ± 4.4 pre, 12.4 ± 4.1 post) and did not significantly change (r ≤ 1.6, p ≥ 0.11) for the remaining conditions (control: 12.5 ± 3.5 pre, 13.7 ± 4.1 post; walking: 12.3 ± 3.7 pre, 11.8 ± 2.7 post; smartphone: 12.5 ± 3.3 pre, 12.6 ± 2.6 post). CONCLUSION: Walking on a treadmill increased positive affect and school work decreased negative affect in college students. Conversely, a bout of smartphone use significantly decreased positive affect and did not reduce negative affect.
Low-income children are at disproportionate risk of low physical activity (PA) and school achievement. Exercise has been shown to positively affect executive function (EF) in children, and may act to prime the brain for learning. Likewise, tablet-based learning applications are an engaging educational modality that can be employed in diverse settings. However, little research exists in real world settings, particularly regarding the robustness of EF improvements after engagement with electronic learning technologies. PURPOSE: To investigate changes in children’s EF’s pre-/post- PA, versus pre-/post-PA incorporating a tablet-based STEM learning platform in a real-world low-income childcare setting. METHODS: Children (n=19, ages 7-10) attending a YMCA summer childcare program serving low-income families participated in a control condition (40 minutes of quiet reading), and two, 40 minute PA sessions, one immediately followed by 5-10 minutes of a tablet-based science, technology, engineering, and math (STEM) lesson (PA+tablet). PA sessions utilized acrobatically-oriented games led by trained staff. Pedometers were used to measure children’s total steps during PA. EF was measured pre- and post- all three conditions. Children were randomly assigned to condition group. Relationships between condition and Stroop score changes were assessed using multi-level mixed effects linear regression, controlling for condition, test administrator, child age and gender. RESULTS: Children averaged 954.5 steps per PA session (SD=751.8). Relative to the control condition, participation in PA was associated with a .72 point improvement in Stroop score; that improvement was not significant (p=.61). However, participation in PA+tablet resulted in a 3.5 point deterioration in Stroop score relative to the control condition (p=.08). CONCLUSION: In a real world setting serving children at risk of low-physical activity and scholastic achievement, PA may prime children for learning by improving EF, but improvements do not appear to be sustained after engagement in tablet-based STEM learning.

Physical activity is typically negatively associated with sedentary behavior. However, individuals who exercise regularly but allocate large amounts of time to sedentary behavior are an exception to this relationship and known as ‘active couch potatoes’ (ACP). The ACP is of concern as the negative health effects of sedentary behavior appear to be independent of the benefits of physical activity. Previously published research found a positive relationship between smartphone use and sedentary behavior but no relationship between smartphone use and physical activity. Therefore, being a high smartphone user may predict being an ACP (i.e., being highly sedentary yet sufficiently physically active). This idea was previously explored with a correlational study using a sample of college students. In that study, smartphone use was associated with being an ACP. However, this relationship has not been tested in adults beyond college age. Furthermore, previous research did not include the most commonly studied predictor of sedentary behavior - TV viewing. PURPOSE: To test whether adults’ smartphone use, TV viewing, sex and age predicts being an ACP. METHODS: A sample of 423 adults (n = 277 female, 40 ± 16 years old) completed surveys assessing physical activity, sedentary behavior, and demographic information. Daily smartphone use and TV viewing were also assessed. Participants were coded as an ACP (or not) based off scores from the physical activity and sedentary behavior surveys. A binary logistic regression was used to test whether smartphone use, TV viewing, sex and age were predictors of being an ACP. RESULTS: The binary logistic regression model was statistically significant, χ² = 50.96, p = 0.001 (df = 4). Sex and TV watching were not significant predictors of being an ACP (Wald ≤ 1.148, p ≥ 0.284). Age and smartphone use were significant predictors of being an ACP (Wald ≥ 6.545, p ≤ 0.011). Results revealed an inverse relationship between age and the likelihood of being an ACP, and a positive relationship between smartphone use and the likelihood of being an ACP. CONCLUSIONS: Similar to college students, increased smartphone use predicted being an ACP in adults beyond college age. Because TV viewing was not a predictor, greater attention should be given to understanding the relationship between smartphone use and the health compromising ACP lifestyle.

Meeting U.S. Physical Activity (PA) Guidelines has health benefits. Yet, little is known about factors related to changes in PA over time, particularly among minority populations. PURPOSE: To examine sociodemographic, PA preferences (for walk and bike), and health factors related to accelerometer-derived patterns of 1-year PA change in the Houston Travel Related Activity in Neighborhoods (TRAIN) Study, a majority-minority cohort. METHODS: Participants were an Actigraph wGT3X-BT monitor and completed self-report surveys at baseline and follow-up. Valid wear time was defined as ≥ 4 days, ≥ 10 hrs/day. PA was stratified by meeting Guidelines using total MVPA defined by Freedson. Four PA patterns were defined: (i) maintain high activity above Guidelines, (ii) meet Guidelines, (iii) maintained low activity, (iv) maintained low activity. Multinomial logistic regression was used to examine associations between studied factors and each PA pattern, with the ‘maintain high’ group as referent. RESULTS: Complete data were available for 153 adults (19% maintained high activity, 8.5% increased, 13% decreased, 59.5% maintained low activity). Controlling for all variables, males (OR = 0.3, 95% CI = 0.1, 0.9) had lower odds of being in the ‘maintain low’ group. Blacks (vs. whites, OR = 18.9, 95% CI = 2.6, 275.0), those liking biking (vs. strongly liking, OR = 2.4, 95% CI = 1.3, 15.0), and older participants (vs. younger, on continuous scale, OR = 1.1, 95% CI = 1.0, 1.1) had higher odds of being in the ‘maintain low’ group. Factors directly associated with being in the ‘increased’ group were being black (vs. white, OR = 17.9, 95% CI = 1.3, 209.0), strong dislike for biking (vs. strongly liking OR = 25.2, 95% CI = 1.6, 401.3), and having...
more chronic diseases (vs. less, on continuous scale, 95% CI = 1.5, 11.7). Having low educational attainment (vs. high, OR = 0.04, 95% CI = 0.0, 0.9) was inversely associated with being in the ‘increased’ group. No studied factors were significantly associated with being in the ‘decreased’ group.

CONCLUSION: PA patterns are dynamic and suggest that sociodemographic, PA preferences, and health factors relate to change patterns over time. Future studies should examine the role of these factors over longer follow-up periods, and consider these factors when designing interventions.

Alarming trends in obesity precipitate the examination of current weight-management strategies used by exercise professionals (EPs). Unaddressed energy balances negatively affect the efficacy of weight-management interventions. However, the scope of practice of EPs limits their ability to address energy imbalances through observation of trends in dietary intake. Common methods, such as the 24-h dietary recall, tend to underestimate energy intake (EI) especially in overweight and obese populations, and are associated with poor adherence. Furthermore, traditional dietary recall methods assess past EI without considering how future EI will change over time. Therefore, the development of new technologies to accurately facilitate EPs in addressing EI imbalances, and improve the effectiveness of weight-management interventions is warranted.

PURPOSE: To investigate perceptions of a new technology designed to track EI via computerized forecast modeling. METHODS: Evaluating perspectives towards technology can be difficult using traditional Likert scale surveys. Q Methodology provides an avenue to systematically study subjectivity by using factor analysis and correlation to assess agreement and variances of views. Participants (N = 21, 2 males, 9 females; 47 ± 17 yrs.; BMI 26.1 ± 5 kg/m²) were given 50 statements “from most like my view” to “most unlike my view.” The Q sort consisted of statements associated with the Transtheoretical Model of behavior change, barriers, and the adoption of a new technology to track EI. RESULTS: Factor analysis revealed two factors of participants’ views: compliant dieters and dedicated exercisers. CONCLUSION: Two converging views emerged surrounding the adoption of a new technology designed to track nutritional intake. Correlations between factors provide tangible evidence of technology apprehension. Overall, the analysis identifies how facets of a diverse population will perceive a novel technology designed to track EI, and provides insight into how distinct barriers can be overcome to enhance adoption. Conducting preliminary research regarding perceptions of technology adoption can enhance the development and marketability of an EI forecasting system.

A majority of Americans do not meet physical activity or nutrition guidelines for health. Convenient interventions to support healthy behaviors may be beneficial. Smartphone use has become ubiquitous, with apps that are an integral part of life for many. The health and fitness category of apps is robust and growing, but the potential for these apps to affect health behavior change is poorly understood.

PURPOSE: To evaluate top-ranked fitness, nutrition, and weight-loss smartphone apps for incorporation of evidence-based behavior change strategies. METHODS: Two investigators coded descriptions of the 150 top-ranked “free” apps in the health and fitness category of the US iOS app store for evidence of health behavior change strategies using the Behavior Change Technique (BCT) Taxonomy (v1). Prevalence of taxonomy items were calculated and Pearson correlations were estimated for the relationship between BCTs per app and customer ranking, as well as for the relationship between BCTs per app and app store ranking. Significance was set at p < 0.05. RESULTS: 71 app descriptions were identified as fitness, nutrition, and/or weight-loss focused. Of these, 45.1% incorporated goals and planning; 57.7% incorporated feedback and monitoring; 56.8% incorporated social support; 29.6% incorporated comparison of behavior; 29.6% incorporated shaping knowledge; 22.5% incorporated associations; 11.6% incorporated reward and threat; 9.9% incorporated antecedents; and 5.6% incorporated natural consequence. Only 17 of the 93 techniques in the BCT taxonomy were utilized across all coded apps. There was a trend towards a weak negative correlation between number of BCTs per app and app store ranking (r = -0.22, p = 0.06) and no significant correlation between number of BCTs and customer rating (r = -0.02, p = 0.87). 41.5% of the “free” apps offered a premium version, in addition, and 11.3% required a paid subscription after download. CONCLUSIONS: Goal planning, monitoring, feedback, and social support were the most common strategies found in the popular fitness, weight-loss, and nutrition apps, though more must be learned about their effectiveness. Furthermore, there is potential to incorporate a greater variety of health behavior change techniques.
RESULTS: ROM was significantly correlated with the changes in VJ (ΔVJ, r = -.65) and the changes in ISO (ΔISO, r = -.75) at 24-hours after baseline, and ROM was also significantly correlated with the change in VJ (ΔVJ, r = -.66) and the change in ISO (ΔISO, r = -.79) at 48-hours follow-up, but not at 72. LESS scores were significantly correlated with ΔISO (r = -.67), as well as ΔISO (r = -.62), respectively, but not at 72.

CONCLUSIONS: These findings indicate that higher levels of flexibility resulted in better mitigation of the decreases to VJ and ISO following the exhaustive bout of exercise at both 24- and 48-hours post-exhaustive exercise, but not at 72. A possible explanation for the association between higher LESS scores (poorer mechanics) and faster return of ISO towards baseline may be that those with poorer LESS scores exerted less effort during the exhaustive exercise bout and therefore did not manifest a high level of muscle damage. However, this was not supported by the non-significant relationships between LESS and the number of repetitions participants completed (r = .27); or LESS and RPE following exercise (r = .27). The reason for this finding remains unclear. Clinicians can use ROM prior to training to predict the recovery of lower extremity power and strength following intense physical activity.

Pearson partial correlation coefficients

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Landing kinetic are associated with injury risk and altered after injury, but are difficult to assess clinically. Relationships between soundwave characteristics and kinetics have only been reported during bilateral tasks. Preliminary evidence may support the use of sound as a clinically feasible technique of landing kinetic evaluation. Purpose: To assess the relationship between kinetic/peak vertical ground reaction force (vGRF), linear loading rate (LR), instantaneous LR and soundwave characteristics (peak audio amplitude, audio frequency) during a single leg landing task. Methods: Physically active participants (15 males/11 females, age=24.8±3.6 years, height=176±9.05 cm, mass=74.86±14.4 kg) with no injuries in the past 3 months completed 5 single leg landings per limb onto a force plate while soundwave characteristics were recorded with a microphone. Means and standard deviations were calculated for all landings of each limb and considered independent outcomes for a total of 52 landings. Loading time was defined from initial contact to peak vGRF. Linear and instantaneous LR were defined as the slope during loading time and peak slope during the middle 60% of loading time respectively. Audio frequency was calculated from the onset of sound to peak audio amplitude defined as the largest peak to peak amplitude of sound. Outliers were detected through the Grubbs’s Outlier Test and 1 data point was removed from each of the peak amplitude and audio frequency datasets for a final sample of 51 limbs. Spearman’s rho correlations were used to assess relationships between soundwave and kinetics due to non-normally distributed data. Results: Peak audio amplitude was moderately correlated with non-normalized vGRF (rho=-0.356, p=0.010), normalized vGRF (rho=-0.486, p=0.001), linear LR (rho=-0.500, p=0.001), and instantaneous LR (rho=-0.368, p=0.009). Audio frequency was moderately correlated with instantaneous LR (rho=-0.394, p=0.005). Conclusion: Peak audio amplitude may be more useful for assessing normalized vGRF and linear LR, but audio frequency may be more useful for instantaneous LR assessment. Evidence of soundwave and kinetic relationships support continued refinement of soundwave measurement techniques especially in feedback based interventions and for use in previously injured populations.

Abstracts were prepared by the authors and printed as submitted.
While there have been several school-based physical activity (PA) interventions targeting improvement in cardiovascular disease (CVD) risk factors, including cardiorespiratory fitness (CRF), few have assessed the long-term effect on a cardiometabolic health composite score. PURPOSE: To determine the effect of a two-year school-based PA intervention on CVD risk five years after cessation. METHODS: We recruited two elementary schools, assigned to intervention (n=125 children) or control (n=134 children). The intervention school offered 210 min/week more PA than the control school over two consecutive years (4th and 5th grades) during 2004-2007. A follow-up assessment was conducted 5-y post intervention (10th grade) through linear mixed models, including random intercepts for children. RESULTS: Analyses revealed significant effects of the intervention five years after cessation of the intervention. As cardiometabolic health can be maintained long-term, school-based PA intervention remained in effect for CVD risk factors five years after intervention (ES=.44). Conclusion: These data reveal that the significant effects of a two-year school-based PA intervention (ES=.27), this decrease was not maintained at 5-y follow-up (ES=.09), whereas WC was initially unchanged post intervention (ES=.02), but decreased at 5-y follow-up (ES=.24). Conclusions: These data reveal that the significant effects of a two-year school-based PA intervention remained in effect for CVD risk factors five years after cessation of the intervention. As cardiometabolic health can be maintained long-term, school-based PA intervention remained in effect for CVD risk factors five years after intervention (ES=.44).

G-24 Free Communication/Slide - New Strategies to Increase Physical Activity in Youth

Saturday, June 2, 2018, 9:00 AM - 11:00 AM
Room: CC-Mezzanine M100D

3101 June 2 9:00 AM - 9:15 AM Effects of a School-Based Physical Activity Intervention on Cardiometabolic Health Five Years After Cessation

Geir K. Rorland1, John Bartholomew, FACSM3, Lars Bo Andersen1, Sigmund A. Andersen2, Eivind Aadland1, 1Western Norway University of Applied Sciences, Sogndal, Norway, 2The University of Texas at Austin, Austin, TX, 3Norwegian School of Sport Sciences, Oslo, Norway. (Sponsor: John Bartholomew, FACSM)

Preschool centers are ideally situated to intervene on preschoolers’ health behaviors such as physical activity (PA), diet, and sleep (PADS). In order for health behavior interventions to be sustainable within the preschool center, the intervention needs to be implemented by classroom teachers. Unfortunately, teachers are constrained by demands such as meeting early childhood education learning standards (state mandated policies). It is possible that integrating health behavior lessons and activities into learning standard could improve teachers’ compliance with health behavior interventions. PURPOSE: To examine the impact of integrating health behavior interventions into learning standards on preschoolers’ PA, diet and sleep behavior. METHODS: This was a parallel group pilot randomized control study. Data were collected in Spring 2016 and analyzed in Fall 2016. Two preschool centers were randomized to either the PADS (children, n = 60) or the control (CON; children, n = 54) group. The PADS intervention consisted of a PA, diet, and sleep curriculum and activities embedded into Massachusetts early education learning standards and was implemented for four days/week for 12 weeks. PADS also had a parent component, which was delivered online. CON preschool participated in their usual activity. PA was assessed using accelerometers for seven days per week. Diet and sleep variables were assessed using a parent report surveys. Outcome variables were assessed at baseline, 6-weeks, and 12-weeks. RESULTS: After adjusting for baseline differences, significant group by visit interaction were observed for during preschool-day percent of time spent in moderate-to-vigorous PA (PADS; baseline = 77.7% ± 3.6, 12-week = 11.7 ± 3.8; CON, baseline = 10.7% ± 3.7, 12-week = 10.9% ± 3.5, p = 0.03) and sedentary time (PADS; baseline = 83.6% ± 5.8, 12-week = 77.2% ± 6.4; CON; baseline = 79.1% ± 5.4, 12-week = 78.4% ± 5.5, p = 0.05). At 6-week, significant improvement (p = 0.02) was observed in percent of time spent in total daily vigorous activity for the PADS compared to the CON group. CONCLUSION: This pilot study provides preliminary evidence that integrating health behaviors into learning standards are feasible and potentially an effective way for increasing preschoolers PA level but not effective in changing either diet or sleep behaviors.

3102 June 2 9:00 AM - 9:15 AM Effects of a School-Based Physical Activity Intervention on Cardiometabolic Health Five Years After Cessation

Geir K. Rorland,1 John Bartholomew, FACSM, Lars Bo Andersen, Sigmund A. Andersen, Eivind Aadland.1 Western Norway University of Applied Sciences, Sogndal, Norway. 2The University of Texas at Austin, Austin, TX. 3Norwegian School of Sport Sciences, Oslo, Norway. (Sponsor: John Bartholomew, FACSM)


Jennifer M. Sacheck, FACSM1, Virginia Anzman-Frasca2, Jennifer M. Sacheck, FACSM1, Stephanie Anzman-Frasca2, Virginia Chomitz2, Kenneth Chui3, Paula Duquesnay1, Miriam Nelson, FACSM, Catherine Wright1, Christina Economos1, 1Tufts University, Boston, MA. 2University of Buffalo, Buffalo, NY. 1University of New Hampshire, Durham, NH.

Purpose: Schoolchildren do not meet current recommendations for school-time and daily moderate-to-vigorous physical activity (MVPA), which is further exacerbated by a steady decline in MVPA over the elementary school years. Our objective was to evaluate the impact of two innovative school-based PA programs, 100 Mile Club® and Just Move/NYPTM, on school-time (sMVPA) and total daily MVPA among lower-income schoolchildren.

Methods: Elementary schools (n=18) were randomized to 100 Mile Club® (walk/run program), Just Move (active classroom breaks), or control. Teachers/champions were trained to implement programming for 3rd and 4th grade students. Consented children were measured at baseline (pre-intervention), mid-point (6 months), and end-point (18 months). MVPA was measured via 7-day accelerometer (Actigraph GTX3®). Height/weight were measured to assess weight status. Demographics were collected by parent report. Mixed effects linear regression models were used to examine the impact of program on sMVPA and total daily MVPA adjusting for school-level clustering, sex, grade, BMI status, free/reduced-price lunch eligibility (FRPL), wear-time, and average daily temperature.

Results: 982 children (8.7 ± 0.7 years; 44% male; 64% non-white; 40% overweight/obese; 55% FRPL; 38% 100 Mile Club, 32% Just Move, 31% control) had valid accelerometer wear-time (≥3 days, ≥10 hr/day) over the three time points. At baseline, 8.4% (18.3 ± 8.6 min/day) and 19.8% (44.9 ± 20.1 min/day) fulfilled the 30-min sMVPA and 60-min total daily MVPA recommendations, respectively. There was a significant program effect on sMVPA (p = 0.002), but not for daily MVPA (p = 0.47).

Pair-wise comparisons suggest that this difference was driven by a decrease in sMVPA in control schools from mid- to end-point (Bonferroni p = 0.004, -2.3 min, 95%CI -4.3,
Young children spend a significant amount of time in structured preschool settings; however, the majority of this time is spent in sedentary behaviors. Given that obesity, physical activity (PA), and sedentary behaviors track throughout development, interventions aimed at increasing PA opportunities for young children in the preschool setting may be critical in establishing healthy trajectories for young children. **PURPOSE:** To examine PA in preschool-aged children during school days when a PA curriculum was administered as compared to non-intervention days. **METHODS:** A pilot PA curriculum, Kiddie CATs on the Move, was implemented in local preschools over 23-weeks, 2-3 times per week by classroom teachers and college students enrolled in a service-learning course. Physical activity was objectively measured by accelerometer during the preschool day at 3 intervention timepoints. A total of 32 children (M(age) = 3.91±0.6, 12 males, 20 females) who had at least 2 days of valid data on both intervention days and non-intervention days were included in the analyses. Minutes per hour (min/hr) of moderate-to-vigorous (MVPA), total PA (light + MVPA), and sedentary as well as percentage of time spent in each were calculated. Paired-samples t-test was used to compare intervention vs. non-intervention days. **RESULTS:** Children engaged in significantly more total PA (min/hr) on days when the PA curriculum was administered vs. non-intervention days (17.2±3.5 vs. 16.0±3.5, p<0.001) and significantly more min/hr in MVPA (9.5±2.7 vs. 8.5±2.9, p<0.001). On intervention days, children spent significantly less time in sedentary behavior compared to days without the intervention (71.3% vs. 73.4%, p<0.01). **CONCLUSIONS:** The current findings suggest the Kiddie CATs on the Move curriculum significantly increased the amount of time preschoolers engaged in PA (total and MVPA) throughout their school day. This teacher- and student-led intervention in the preschool setting may represent a viable approach to increase PA and aid in the establishment of healthy behaviors in young children.

**Conclusion**

Programs that increase children’s physical literacy (PL), defined as the ability, confidence, and motivation to be physically active for life, hold promise for helping children achieve physical activity recommendations. Few studies have evaluated PL interventions. **PURPOSE:** To fill this gap, we conducted a pilot evaluation of a PL-based intervention in the school setting. **METHODS:** Three New York City elementary schools were recruited. The intervention included twice-weekly lessons during regularly scheduled 3rd/4th grade PE classes over 10 weeks between Feb-Jun 2017. Twenty lessons were selected from a bank of 400 activities designed to build running, locomotion, and balance skills through age-appropriate play and games. Lessons were linked to SHAPE America PE standards and involved a warm up (active classroom breaks). Demographic data were collected by parent report. Third and fourth grade children were recruited and measured for height/weight and 7-day accelerometry (Actigraph GT3X+). SS for PA was self-reported and a S-S score (6 items) was median split into low and high categories. For each program group, the association between low vs. high S-SS and changes in MVPA from baseline (pre-intervention) to 6 months were examined using mixed effects models adjusting for sex, grade, race, BMI category, free/reduced price lunch eligibility (FRPL), mean temperature, and school-level clustering. **RESULTS:** 747 children (87.0±7.7 years, 43% male, 64% non-white, 56% FRPL, 40% overweight/obese) had valid accelerometer wear-time (3 days, 10 hrs/day) and 20% (45/193.9 min/day) were measured; body-mass index z-scores computed. Paired sample t-tests tested change in each were calculated. **RESULTS:** **CONCLUSIONS:** Children participating in active classroom breaks who reported high S-SS had increased MVPA compared to those reporting lower support. Future work should consider how to effectively support and sustain S-SS to encourage school-wide improvements in behaviors.
Low physical activity (PA) and increased screen time (ST) is problematic for preschool-age children (2.9-5 years), and is attributed to childhood overweight/obesity. Due to this, several organizations have provided recommendations surrounding these behaviors. However, few studies have examined the compliance rates of preschoolers based on the recently released PA and ST recommendations (≥15 minutes of PA/hour and ≤60 min/day).

**PURPOSE:** To assess preschool-age children’s compliance with PA and ST recommendations and identify variables contributing to compliance.

**METHODS:** Baseline data from preschoolers (n=50, 50% male, age = 3.7±0.8 years, BMI % = 50.2±26.5) in two preschool centers. An Actigraph GT3X accelerometer worn on the lower back of children for seven consecutive days. PA data were reduced using Pate et al. cut points, and compliance was assessed for school-day (≥15 min/hour) and total day (≥180 min) recommendations. ST and parent variables were assessed with self-report validated questionnaires. Appropriate descriptive statistics were calculated for all variables. Logistic regression was used to determine differences in compliance based on gender, ST, school-day PA, parent PA, and parent PA knowledge.

**RESULTS:** Children engaged in 11.3±3.6 min/hour of PA and 102.6±79.6 min/day of ST. The percentage of preschoolers meeting school-day recommendations and total day recommendations were 17.1% and 26.5%, respectively. Approximately 35.9% of preschoolers met ST recommendations. There were no gender differences in PA (p=0.052) or ST (p=0.91) compliance. Additionally, only school-day PA significantly contributed to the likelihood of meeting total day recommendations (OR=1.05, 95% CI=1.002, 1.104).

**CONCLUSION:** Preschoolers’ compliance with PA and ST recommendations was low in this sample. Additionally, only school-day PA was a significant predictor of daily PA recommendations. ST and parent variables were assessed with self-report validated questionnaires. Appropriate descriptive statistics were calculated for all variables.

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3114 June 2 9:20 AM - 9:40 AM  
**Left Arm Pain and Numbness-Recreational Athlete**  
Paul A. Krebs, Clinton Hartz.  
*The Ohio State University, Columbus, OH.*  
(Sponsor: James Borchers, MD, MPH, FACSM)  
(No relevant relationships reported)

**History:** A 41 year old right hand dominant female presented with left arm pain and numbness of 6 months duration with progressive worsening. Symptoms started in the distal posterior medial aspect of her arm and radiated to the 4th and 5th fingers of the hand. The pain was worse with lifting, swimming, biking, and tennis, forcing her to stop her normal athletic activities. She also noticed swelling in the distal aspect of the arm where the pain originated and a palpable bump. She denied history of trauma, clicking, locking, or instability.  

**Physical Exam:** Neck exam showed full painless range of motion, no tenderness, and a negative Spurling test. Shoulder exam showed full strength and range of motion. Her left elbow had full range of motion with pain, no instability or crepitus. She had soft tissue tenderness and swelling in the distal arm medially with palpable nodules just proximal to the medial epicondyle. Cozen’s, Speed’s, and Yergason’s tests were negative. She had 5/5 strength and full range of motion of her left hand. Her neurologic exam showed decreased sensation in the ulnar nerve distribution. Capillary refill and radial pulses were intact.  

**Differential Diagnosis:**  
1. Cubital Tunnel Syndrome  
2. Ulnar Neuropathy Secondary to Mass Effect  
3. Fracture/Stress Fracture  
4. Cervical Radiculopathy  
5. Thoracic Outlet Syndrome  

**Tests and Results:**  
XR Humerus: No soft tissue swelling or acute osseous abnormality  
Limited Diagnostic Ultrasound: 4 hypervascular nodules adjacent to ulnar nerve, likely lymph nodes  

**Final Working Diagnosis:**  
Ulnar neuropathy secondary to mass effect, lymphadenopathy, need to rule out malignancy.  

**Treatment and Outcomes:**  
1. MRI Left Humerus: abnormal enlarged lymph nodes. Mass effect evident along the ulnar nerve.  
2. Referred to Hematology Oncology.  
4. PET scan: hypermetabolic lymphadenopathy above and below the diaphragm, uptake in the spleen and liver, consistent with a Stage III lymphoma.  
5. Bendamustine/Rituximab (BR) was started because of its response rate and lower side effect profile compared to other chemotherapies.  
6. Patient has undergone 2 cycles of BR with good response, including near resolution of her humeral disease.  
7. She is restarting activities as tolerated. The expectation is that her ulnar neuropathy will improve with remission of her lymphoma.

3115 June 2 9:40 AM - 10:00 AM  
**Bilateral Wings**  
Nina Yaftali. Rush, Chicago, IL.  
(No relevant relationships reported)

**History:** A 17-year-old high school football player sustained a left shoulder injury while tackling an opposing player to the ground. He had pain in the left shoulder that increased the following day with radiation into the neck. He was evaluated by orthopedics 5 days post-injury. Initial X-rays of the cervical spine and left shoulder were unremarkable and subsequent left shoulder MRI 12 days post-injury was also unremarkable. Over the next few weeks the pain resolved but weakness in the shoulder persisted. He was then referred to our clinic for further evaluation approximately 3 months post-injury with ongoing shoulder weakness. He denied paresthesias.  

**Physical Examination:**  
Weakness was isolated to left shoulder external rotation and abduction. Shoulder flexion, extension and internal rotation were intact. Inspection showed atrophy of left supraspinatus and infraspinatus. Full pain free ROM of neck. Sensation and reflexes were intact in upper extremities.  

**Differential Diagnosis:**  
1. Supraspinalus nerve injury  
2. Rotator cuff tear  
3. Cervical radiculopathy  
4. Brachial plexus injury

**Test and Results:**  
Diagnostic US of left shoulder: Increased echogenicity of left supraspinatus and infraspinatus. Full pain free ROM of neck. Sensation and reflexes were intact in upper extremities.

**Treatment and Outcomes:**  
1. Referral to surgery resulted in nerve transfer surgery from spinal accessory nerve to supraspinalus nerve  
2. One month post-op little to no return of external rotation with mild weakness in left shoulder shrug as expected course post-operatively  
3. Returned to football one month after surgery with recommendation to avoid positions requiring tackling  

**Final Working Diagnosis:**  
Left supraspinalus nerve injury  

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

The Polar heart rate monitor was used to record HR and participant forehand topspin three position rally table tennis trials at frequency of 60 using a mechanical table tennis ball thrower to control the exercise intensity. Each by graded exercise test (GXT), sub-maximal exercise test (SBT), and table tennis exercise group (n = 12, TG) and control group (n = 12, CG). All subjects were assessed.

**PHYSICAL EXAM:**
The examination of the athlete was done in the athletic training room by a physical therapist. Subjectively, questions about female athlete triad indicated inconsistent

**DIFFERENTIAL DIAGNOSIS:**
1. Ulnar Stress Reaction
2. Periostitis
3. Bone Contusion

**TESTS AND RESULTS:** Plain Radiographs demonstrated bowing of the ulna

**WORKING DIAGNOSIS:**
The final diagnosis was bowing of the ulna with a stress reaction.

**TREATMENT AND OUTCOMES:**
1. Increase core strength in pike position in create a “tighter” pike throughout the pike position during dive.
2. Scapulothoracic strengthening to offload the forearm during the dive.
3. Bone Contusion

**DIFFERENTIAL DIAGNOSIS:**
Suggesting an osseous pathology so imaging was suggested by the physical therapist and ordered by the orthopedic surgical fellow.

**APPLICATION OF TREATMENT MEASURES:**
1. Applied mechanical splinting and immobilization
2. Applied activity modification
3. Bone Contusion

**RESULTS:**
After HIIT, TG significantly improve VO\(_2\)max (55.01 ± 4.76 vs. 58.05 ± 4.88 ml/kg/min, p < .05) and LACpost (pre 11.72 ± 1.89 vs. post 12.50 ± 1.51 mmol/L, p < .05) of SBT, and better than CG (p < .05). However, there were no significant difference in MIE test between TG and CG (p > .05). TG (pre 371.36 ± 112.97 vs. post 475.71 ± 165.62 sec, p < .05) showed significantly improvement in TSSTF compare to CG (pre 361.20 ± 79.18 vs. post 334.80 ± 128.00 sec, p < .05).

**CONCLUSIONS:**
Eight weeks HIIT could effectively improve aerobic capacity, specific fitness and exercise performance of table tennis players. Incorporation of a suitable training program into the training routine might be important to improve the exercise performance.

**RESULTS**

Sprint interval training (SIT) is associated with health benefits, but ‘classic’ SIT (6x30-s ‘all-out’ cycle sprints) requires high motivation and is associated with negative affective responses and high levels of perceived exertion. In order to make SIT more suitable for sedentary individuals, the number of sprints and sprint duration have previously been reduced to develop a reduced-exertion high-intensity interval training (REHIT) protocol consisting of 2x20-s ‘all-out’ cycle sprints within a 10-min session. This genuinely time-efficient protocol remains effective at improving aerobic capacity (VO\(_2\)max). It is unknown if further reducing the sprint duration in the REHIT protocol affects improvements in VO\(_2\)max or changes in mood. The purpose of this study was to examine the effects of HIT on biomarkers of inflammation and angiogenesis, over time, in HIT bouts of varying duration (short bout, 5 min, and long bout, 15 min). Methods: Ten males, 18-45 years old, who had participated in CrossFit for at least 6 months, were recruited from local affiliates. The participants completed a total of 3 lab visits [Visit 1: collection of descriptive data; the next 2 visits were randomized between the short bout and long bout]. All subjects completed the same exercises. Blood was drawn pre and post-exercise, and 1 hour, 3 hours, and 6 hours post-exercise, centrifuged, and plasma frozen for analysis. A multiplex assay (Millipore MagPix) was used to determine concentrations of the biomarkers of interest [interleukin 6 (IL-6), interleukin 10 (IL-10), tumor necrosis factor alpha (TNF-alpha), and vascular endothelial growth factor (VEGF)]. Results: The short bout produced results similar to those of the long bout. Repeated measures ANOVA revealed no trial-dependent differences (p > 0.05) in any of the biomarkers. Both temporal responses and concentrations were similar in the short and long bout. Conclusions: The biomarkers IL-6, IL-10, TNF-alpha, and VEGF all follow a similar pattern of peaking post-exercise, and returning to baseline within 6 hours, regardless of the duration of the HIT. A practical implication is that a 5 min bout of HIT may be as effective as a 15 min bout in terms of eliciting certain specific physiologic responses. Supported by WSSU Office of Student Research, Honors Student Research Grant (K.N.C.).
High intensity intermittent training (HIIT) enhances anaerobic and aerobic capacities. Our recent study have demonstrated in animal study that the 6-week combination of chlorella intake and HIIT further elevated glycolytic and oxidative phosphorylation as ATP supply in skeletal muscle as compared with chlorella alone and HIIT alone, resulting in enhancement of anaerobic and aerobic exercise capacities. However, the combined effects of chlorella intake and HIIT on anaerobic and aerobic capacities in human remain unclear. PURPOSE: The aim of this study was to investigate whether the combination of chlorella intake and HIIT further enhanced anaerobic and aerobic capacities as compared with HIIT alone in human.

METHODS: Twelve healthy young male subjects (21 ± 1 years) were participated in this study. Subjects completed 3-week of exhaustive HIIT consisting of 6-7 bouts of 20-second cycling at an intensity of 170% maximal oxygen uptake (VO2max) with a 10-second rest between each bout, 3 days/week. They orally took chlorella or placebo (10 tablets) after the breakfast and dinner between the 3-week in a double-blind, randomized, crossover design with 4 weeks between each intervention.

RESULTS: After each HIIT intervention, VO2max was significantly increased in both chlorella and placebo groups (P<0.05). However, the amount of change in VO2max after the intervention was significantly higher in chlorella intake than placebo intake (P<0.05). After each HIIT intervention, MOD was significantly increased in both chlorella and placebo groups (P<0.05). However, the amount of change in MOD after the intervention was significantly higher in chlorella intake than placebo intake (P<0.05).

CONCLUSIONS: These results suggest that the combination of chlorella intake and HIIT may further enhance anaerobic and aerobic capacities in human. Supported by Grants-in-Aid for Scientific Research (#17H02183, #10K13059, M. Iemitsu)
Abstract
High Intensity Interval Training (HIIT) has become an increasingly popular mode of exercise, especially with those with the perception of a lack of time. These intervals have been shown to decrease the time spent being active while simultaneously providing similar results to steady-state training to elicit the cardiovascular adaptations.

Purpose: To investigate the changes between steady-state training and HIIT training on respiratory exchange ratio (RER), peak oxygen consumption (VO\textsubscript{2\peak}), heart rate (HR) and rate of perceived exertion (RPE) in recreationally trained, college-aged participants.

Methods: Thirty men 21 to 27 years old (23.31 ± 2.17 yr, 78.7 ± 6.3 ng/ml and 78.7 ± 8.2 ng/ml, at 0.5, 24 and 48 hrs after exercise, respectively) were recruited for the study. Subjects participated two sessions and were randomly assigned to two groups: Steady-State (SS) or High Intensity Interval Training (HIIT) training on a treadmill. SS training consisted of a 3-minute warm-up at 2.0 mph with a 0% grade followed by the Balke Protocol. HIIT protocol consisting of a 5-minute warm-up at 3 mph at 0% grade, followed by maximum effort sprints for 30 seconds followed by a 30 second active recovery with sprints intervals beginning at 4.5mph increasing by .5mph after recovery interval. 

Results: There was a significant difference in RER between groups (t (12) = -2.30, p < 0.05, d = 0.55). However, no significant differences in VO\textsubscript{2} (t (12) = -1.06, p = 0.31, d = -0.36) and HR (t (12) = -0.82, p = 0.43, d = 0.26) were identified using a paired t-test, between treadmill conditions (SS, HIIT). Furthermore, there were no significant differences (z = -1.51, p = 0.13, d = 0.54) in RPE after conducting a Wilcoxon matched pairs signed-rank test. The results suggest that training at higher intensities for a shorter period of time yielded similar results to training at lower intensities for a longer duration. Conclusion: HIIT training allows for increased cardiovascular health in a time efficient manner, which can accommodate various schedules.

High intensity interval training (HIIT) has recently gained popularity as an effective stimulus for eliciting adaptations in various aspects of physical fitness. Those adaptations may also involve complex hormonal changes, however less is known about the hormonal responses to this type of exercise training.

Purpose: To determine if increasing BR weight during 6 wks of HIIT increases upper body MVO\textsubscript{2} and upper body skeletal muscle strength, endurance and power.

Methods: 18 recreationally active men and 15 women (23±2y) performed 10 BR HIIT sets, 30 min: 60 rest, 3x/week, for 6 wks. For the first 3 weeks, women used 40, 1.5", 20lb BR and men used 50 lb, 1.5", 25lb BR, after which BR weight was increased by 10lb using a heavier rope for another 3 wks in both groups. Upper body MVO\textsubscript{2}, (arm ergometer) and skeletal muscle performance (isometric shoulder [shld] flexion/extension, dynamic shoulder power, maximum sit-ups and push-ups) was assessed at baseline, and after 3 and 6 wks.

Results: During BR HIIT male and female heart rates were >85% of predicted maximums, and peak HIIT blood lactates (BLA) reached 10.79 and 8.33 mmol/L, respectively. See table below for MVO\textsubscript{2} and skeletal muscle performance adaptations after 3 and 6 wks of BR HIIT.

Conclusion: This study investigated the changes in serum levels of thyrotropin (TSH), free thyroxine (T\textsubscript{3}), and thyroid stimulating hormone (TSH) in response to HIIT in healthy humans.

Abstract

Purpose: To investigate the changes between steady-state training and HIIT training on respiratory exchange ratio (RER), peak oxygen consumption (VO\textsubscript{2\peak}), heart rate (HR) and rate of perceived exertion (RPE) in recreationally trained, college-aged participants.

Methods: Thirty men 21 to 27 years old (23.31 ± 2.17 yr, 78.7 ± 6.3 ng/ml and 78.7 ± 8.2 ng/ml, at 0.5, 24 and 48 hrs after exercise, respectively) were recruited for the study. Subjects participated two sessions and were randomly assigned to two groups: Steady-State (SS) or High Intensity Interval Training (HIIT) training on a treadmill. SS training consisted of a 3-minute warm-up at 2.0 mph with a 0% grade followed by the Balke Protocol. HIIT protocol consisting of a 5-minute warm-up at 3 mph at 0% grade, followed by maximum effort sprints for 30 seconds followed by a 30 second active recovery with sprints intervals beginning at 4.5mph increasing by .5mph after recovery interval. 

Results: There was a significant difference in RER between groups (t (12) = -2.30, p < 0.05, d = 0.55). However, no significant differences in VO\textsubscript{2} (t (12) = -1.06, p = 0.31, d = -0.36) and HR (t (12) = -0.82, p = 0.43, d = 0.26) were identified using a paired t-test, between treadmill conditions (SS, HIIT). Furthermore, there were no significant differences (z = -1.51, p = 0.13, d = 0.54) in RPE after conducting a Wilcoxon matched pairs signed-rank test. The results suggest that training at higher intensities for a shorter period of time yielded similar results to training at lower intensities for a longer duration. Conclusion: HIIT training allows for increased cardiovascular health in a time efficient manner, which can accommodate various schedules.

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Conclusion: This study investigated the changes in serum levels of thyrotropin (TSH), free thyroxine (T\textsubscript{3}), and thyroid stimulating hormone (TSH) in response to HIIT in healthy humans.
24 and 48 hrs post-exercise. Serum levels of TSH, FT4, and PRL were measured by ELISA using commercially available kits. Two-way ANOVA was used for statistics and data are presented as mean±SE. RESULTS: TSH levels peaked at 0.5 hr post exercise, both before (3.41±0.44, 4.85±1.54, 3.14±0.28, and 2.91±0.31 μU/ml at baseline, 0.5, 24, and 48 hrs post-exercise, respectively) and after the 3-week HIIT regimen (2.5±0.34, 4.14±0.70, 2.44±0.22, and 2.37±0.49 μU/ml at baseline, 0.5, 24, and 48 hrs post-exercise, respectively). FT4 levels peaked 24 hrs post exercise, both before (2.90±0.07, 2.72±0.04, and 2.50±0.07 μU/ml at baseline, 0.5, 24, and 48 hrs post-exercise, respectively) and after the 3-week HIIT regimen (2.0±0.17, 2.39±0.17, 1.3±0.12, and 1.7±0.07 μU/ml at baseline, 0.5, 24, and 48 hrs post-exercise, respectively). PRL levels peaked at 0.5 hrs post exercise, both before (38.80±9.90, 60.0±16.32, 27.86±4.40, and 20.14±7.90 ng/ml at baseline, 0.5, 24, and 48 hrs post-exercise, respectively) and after the 3-week HIIT regimen (25.2±0.48, 55.9±0.59, 24.0±0.20, and 16.6±1.36 ng/ml at baseline, 0.5, 24, and 48 hrs post-exercise, respectively), reaching statistical significance compared to baseline only after the 3-week regimen (p<0.01). CONCLUSION: Our findings suggest that HIIT triggers mild acute hormonal changes, particularly of PRL, which may reflect regulatory responses to exercise-induced stress; however more studies are needed to further characterize the hormonal responses to HIIT in humans.

### 3143 Board #13 June 2 8:00 AM - 9:30 AM The Physical and Psychological Effects of Tactical High-Intensity and Jiu-Jitsu Training on Law Enforcement Officers

Charlie Shervheim, Nick Powell, Maxwell Rasmussen, Jennifer Dysterheft, Hamline University, St. Paul, MN. (Sponsor: Robert Pettit, FACSM)

(No relevant relationships reported)

Law enforcement officers (LEO) require speed, strength, agility, and endurance for their job; however, the training requirements for many LEO departments are minimal. Tactical-specific high-intensity interval training (TS-HIIT) and jiu-jitsu martial arts practices are theoretically effective in improving performance in tactical fields, however no research exists this.

PURPOSE: To examine whether TS-HIIT and jiu-jitsu training is more effective than current training practices to improve physical and psychological variables of experienced LEO.

METHODS: 10 experienced LEO were recruited from local departments. Baseline testing included the Perceived Stress Scale (PSS), WHO Quality of Life (WQ), General Self-Efficacy Scale (GSES), and skills-test. The skills-test examined upper-body maneuverability, heavy-object manipulation, lower-body power output, shooting accuracy, ground grappling/gun retention, memory recall, and decision-making. LEO then completed a six-week TS-HIIT and jiu-jitsu program for three hours per week. LEO repeated baseline measures after completion of the 3-week regimen and will again at three months post-completion.

RESULTS: LEO did not improve on the grappling test. LEO recalled 30% more phrases during the memory retention test post-intervention (p = 0.01). Post-intervention, there was no significant change in shooting accuracy (p = 0.37), perceived stress levels, (PSS; p = 0.58), or perceived quality of life (WQ; p = 0.30). The decision-making task was removed due to a number of participants having already viewed the specific scenarios used during data collection. Conclusion: Preliminarily, results indicate that a TS-HIIT and jiu-jitsu program may be critical for improving LEO fitness levels, memory retention, and gun retention skills. Three-month follow-up testing will be completed January 2018 to examine skill retention.

### 3145 Board #14 June 2 8:00 AM - 9:30 AM Optimal Inspiratory Muscle Training Dose(s) to Enhance Respiratory Function Characteristics and Running Performance

Kyle R. Barnes, Sara M. Dansforth, Katie G. Smyth, Grand Valley State University, Allendale, MI. (Sponsor: Stephen Glass, FACSM)

(No relevant relationships reported)

PURPOSE: Inspiratory muscle training (IMT) is a form of resistance training for the muscles primarily involved in the processes of breathing using a resisted breathing trainer. However, the optimal IMT loading parameters to elicit specific physiological adaptations are unknown. The authors adopted a dose-response design to determine the IMT load most effective for enhancing various inspiratory muscle function characteristics and performance. METHODS: 29 trained runners performed a 1-mile (1609-m) time trial and a series of breathing tests using an inspiratory breathing trainer and software. Runners were then randomly assigned to 1 of 5, six week IMT programs ranging in resistance from 30-70% of peak strength index (S_{p}). Performance (5-km TT) was assessed at BL and POST. RESULTS: Two-way ANOVA showed a significant main effect of time on TT (F = 40.1, p < .001, η^2 = 0.74), VO2 max = (24.0 ± 2.0), n = 21, p < .001, η^2 = 0.56), and BC = (20.2 ± 2.0, n = 21, p < .001, η^2 = 0.31), and a significant group*time interaction on VO2 max (F = 4.13, p = .05, η^2 = 0.18). Both groups (p = 0.01) improved TT from BL to POST (88 ± 55 s), BL-MID (57 ± 40 s), and MID-POST (31 ± 37 s). VO2 max (46.2 ± 6.8 to 49.1 ± 7.4 ml kg⁻¹ min⁻¹) and BC (15.5 ± 6.7 to 15.7 ± 6.9 ml kg⁻¹ min⁻¹) improved from BL to POST (p = 0.01 for both). However, the VO2 max increase was larger in PETF (4.3 ± 3.6 vs. 1.7 ± 1.9 ml kg⁻¹ min⁻¹). No interaction occurred for TT (F = 0.23, p = .79) or BC (F = 0.02, p = .88). CONCLUSION: Recreational runners achieved similar improvement in 5-km performance and body composition through polarized training or CFE, but PET yielded a greater increase in VO2 max. Both programs appear efficacious for recreational athletes. Extrapolation to longer distances requires additional research.
Bone mineral density (BMD) is used to assess the risk of stress fractures in distance runners. Given that the standard assessment of BMD with Dual X-ray Absorptiometry (DXA) is very expensive, a possible solution would be to establish models that can predict BMD from data that is easier and cheaper to acquire. Artificial Neural Networks (ANN) are able to model non-linear and complex associations between biomechanical and physiological variables, and could pose a solution to the aforementioned problem. PURPOSE: Determine the feasibility of predicting BMD in distance runners with an ANN. METHODS: BMD of the femoral neck was assessed in twenty-three collegiate distance runners (16 male) using DXA. They also ran on an instrumented treadmill at their long-speed pace. Ground reaction forces (GRF) were collected and Rate of Loading (RoL) was derived. Average peak values were calculated for the right and left leg, and were pooled for all analyses. Simple and multiple linear regression models were used to assess associations between input (body mass, GRF, RoL) and output variables (BMD). In addition, a three-layer feedforward ANN with 20 hidden neurons was trained fifteen separate times to also model the same associations. The prediction function of all models was compared based on their associated correlation coefficients. Further, the root mean squared error (RMSE) of the multilinear regression model and ANN were also compared. RESULTS: Significant simple linear correlations were found between BMD and body mass (r = 0.645, p = 0.008), BMD and GRF (r = 0.534, p = 0.038), and BMD and RoL (r = 0.567, p = 0.025). In addition, a simple linear regression model (adjusted r = 0.630, p = 0.001, RMSE = 0.161) and ANN (training r = 0.865, p = 0.001; test r = 0.697, p = 0.003; RMSE = 0.161) were also able to fit predict the association between input and output variables. CONCLUSIONS: An ANN can feasibly predict BMD in distance runners, and is able to do so better than standard regression models. While the developed ANN performed well with the inputs of body mass, GRF, and RoL, there are other variables (e.g., stride parameters or calf muscle balance) that should be included in future studies, as they are easier to assess and would provide a more holistic model of known risk factors for stress fractures in distance runners.

Table: The Effect of Physiological Performance Variables on 3000m Times in Collegiate Mid-Distance and Distance Runners

<table>
<thead>
<tr>
<th>Varibale</th>
<th>Male Mid-Distance</th>
<th>Male Distance</th>
<th>Female Mid-Distance</th>
<th>Female Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>VO2max (l/min)</td>
<td>82.9±0.89</td>
<td>86.1±0.75</td>
<td>79.2±0.83</td>
<td>82.1±0.74</td>
</tr>
<tr>
<td>RE270</td>
<td>0.30±0.05</td>
<td>0.32±0.05</td>
<td>0.30±0.05</td>
<td>0.32±0.05</td>
</tr>
<tr>
<td>Tc270</td>
<td>0.30±0.05</td>
<td>0.32±0.05</td>
<td>0.30±0.05</td>
<td>0.32±0.05</td>
</tr>
<tr>
<td>Tc360</td>
<td>0.30±0.05</td>
<td>0.32±0.05</td>
<td>0.30±0.05</td>
<td>0.32±0.05</td>
</tr>
<tr>
<td>MHA</td>
<td>0.30±0.05</td>
<td>0.32±0.05</td>
<td>0.30±0.05</td>
<td>0.32±0.05</td>
</tr>
</tbody>
</table>

CONCLUSION: The effects of physiological performance variables on 3000m times can be compared for male and female collegiate distance runners. While some correlations were found between variables, further studies are needed to determine if these associations are specific to distance running.
Compression pants, waist to ankle, have grown in popularity among recreational and athletic populations for improving performance, however, minimal is known about the effects of compression pants on submaximal exercise. **PURPOSE:** The purpose of this study was to investigate the impact of wearing compression pants on physiological responses to a 12 min run. **METHODS:** College aged males (n=8) participated in three separate running sessions. Subjects initially performed a graded exercise test to anchor the RPE scale. Thereafter subjects were assigned to run on a treadmill at a set speed of 8 mph for 12 minutes either while wearing or not wearing compression pants, order of tests was randomized. Lactic acid, HR, and RPE were recorded every 3 minutes during the test, and every 3 minutes after the test for 6 minutes. Subjects were instructed to wear the pants for no longer than 30 minutes prior to the running tests. Dependent T-tests were performed on LA, HR, and RPE at each 3 minute measurement of the test and recovery, with an alpha set at p<0.05. **RESULTS:** Lactic acid levels were significantly lower (p<0.05) with compression pants on at the 12 and 18 minute marks. RPE was significantly higher (p<0.05) with the compression pants on at the 3 and 6 minute marks. No other significant differences (p>0.05) were found in RPE and no significant differences (p>0.05) were found in HR.

### Table 1: Mean LA levels and HR during CPETs in 16 male distance runners

<table>
<thead>
<tr>
<th>Test</th>
<th>With Compression</th>
<th>Without Compression</th>
</tr>
</thead>
<tbody>
<tr>
<td>LA (mmol/l)</td>
<td>9.78 (5.95)</td>
<td>11.18 (6.56)</td>
</tr>
<tr>
<td>HR (bpm)</td>
<td>135 (88.5)</td>
<td>138.5 (17.1)</td>
</tr>
<tr>
<td>RPE</td>
<td>10.65* (1.4)</td>
<td>11.88* (1.7)</td>
</tr>
</tbody>
</table>

(*p<0.05)

**CONCLUSION:** Wearing compression pants was shown to lower your lactic acid levels at the 12 minute mark and possibly at completion of submaximal exercise. RPE was shown to be higher initially but then the differences became non-significant. Compression pants were shown to not make any significant changes in HR.

**Purpose:** To determine if there are sex differences in critical speed (CS) and D', 2) to develop a model to predict CS, and 3) to determine the percent of CS various races are run at in elite track and field athletes. **METHODS:** Inclusion criteria were athletes with personal best times in each of the 1500m, 3000m, and 5000m events faster than 4:10, 8:55, and 15:20 (women) or 3:38, 7:45, and 13:30 (men) since January 1, 1997. CS and D' for each athlete were calculated. Compression pants were shown to not make any significant changes in HR. **RESULTS:** 16 women and 127 men met the initial inclusion criteria. A subset of athletes, 51 women and 48 men, also met the 10000m inclusion criteria. The average Pearson correlation coefficient for the regression line used to calculate CS and D' was >0.9999. As expected, men had a significantly faster CS (ms) than women (6:10.13 vs. 8:55.36; p<0.001), however D' (m) was not significantly different (204.0 ± 35.8 vs. 197.5 ± 39.6; p=0.18). For both men and women, 5000m time was the best predictor of CS. The men's prediction model was CS = -0.0105 * 5000m time (s) + 14.347 (R² = 0.9522; p=0.001) and the women's was CS = -0.00761 * 5000m time (s) + 142.180 (R² = 0.9313; p=0.001). 1500m race pace was 112.8 ± 2.8% (women) and 113.2 ± 2.8% (men) of CS. 3000m race pace was 106.7 ± 1.5% (women) and 107.1 ± 1.7% (men) of CS. 5000m race pace was 103.6 ± 0.7% (women) and 103.7 ± 0.7% (men) of CS. 10000m race pace was 98.7 ± 1.5% (women) and 98.6 ± 1.5% (men) of CS. There were no significant differences between men's and women's race pace as a percent of CS for any race distance (p = 0.24 – 0.55).

**CONCLUSIONS:** As CS represents the greatest wholly oxidative metabolic rate, men's faster CS is likely due to their known ability for greater oxygen delivery and consumption. Compared to women, the lack of difference in D' may be due to similar phosphocreatine stores (per kg dry muscle mass) between sexes. Additionally, coaches and athletes that want to know CS for training design or race pacing applications may be able to utilize the prediction equations if data on a full range of performances is not available.

### Table 2: Mean LA levels and HR during CPETs in 16 male distance runners

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**CONCLUSION:** Heart rate variability in middle-aged sprinters and endurance runners. **METHODS:** Participants (n=81) were 8 master sprinters (MS; 51.75 ± 11.08yrs), 8 endurance runners (EN, n=17; 51.14 ± 15.45yrs), and 60 untrained (CON, n=47) middle-aged individuals. For the acquisition of RR intervals (IRR) (Polar RS800X Heart Rate Monitor®) the participants remained seated for 15-min, with the final 10-min being considered for analysis. HRV was measured using Kubios software. A two-way ANOVA with repeated measures was applied. **RESULTS:** All studied parameters did not differ between MS and EN [Time Domain [HR (bpm) 59.00 ± 6.13 vs. 58.94 ± 12.75; [R-R (ms) 1035.43 ± 107.45 vs. 1068.77 ± 206.17]; [SDNN (ms) 57.35 ± 20.07 vs. 80.66 ± 71.07]; [RMSSD (ms) 40.88 ± 20.07 vs. 38.93 ± 20.44]]; Non-linear domain [SD1 (ms) 28.93 ± 14.20 vs. 27.56 ± 14.46]; whose demonstrated a reduced HR and elevated mean R-R intervals in comparison to both YC [HR (bpm) 69.64 ± 9.81] and (R-R 883.93 ± 124.11)], and age-matched individuals [HR (bpm) 74.88 ± 16.63) and (R-R (ms) 865.17 ± 88.39)]. In MS and EN it was observed a lower HR, and elevated mean R-R intervals in comparison to both YC [HR (bpm) 64.90 ± 8.37; (R-R 933.93 ± 126.11)] and age-matched individuals [HR (bpm) 71.39 ± 16.63; and (R-R (ms) 877.36 ± 98.18)]. These last age-related changes were not observed for MS and EN. **CONCLUSION:** For the master athlete, regardless of being endurance runner or a sprinter, both training modes are similarly beneficial, attenuating the effects of aging on the autonomic balance.

### Table 3: Mean LA levels and HR during CPETs in 16 male distance runners

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The incidence of upper respiratory illnesses (URI) within endurance sports is commonplace and often results in decreased athletic performance. For this reason, avoidance of these illnesses is of utmost importance to the athlete. Previous research has identified a positive relationship between running mileage and frequency of URI; however, defining this threshold in terms of intensity and duration of exercise has not been well established. Little is known about underlying factors influencing this relationship. Greater insight into the relationship between mileage and URI will allow for better training and can help establish best practices for creating programs that can reduce the occurrence of URIs. PURPOSE: The purpose of this study was to investigate the relationship between endurance training and immune function.

METHODS: Participants (N = 25, 13 females, 12 males; mean age 19 ± 3 years) were college undergraduate students. A survey consisting of the Wisconsin upper respiratory system measure (WURSS-21). Daily mileage, sleep, and diet logs were kept by each of the cross country athletes throughout the duration of this study. RESULTS: Correlations revealed a significant relationship between daily mileage and frequency of URI (r = −0.10, p = 0.05). Additionally, sleep and diet were significantly correlated with both mileage and URI frequency, which fulfilled prerequisites to test for moderation (Aiken & West, 1991). However, when sleep and diet were added to the model, neither was found to moderate the relationship between mileage and URI. CONCLUSION: Results suggest that daily mileage increases there is a greater likelihood for URI. It was also revealed that vitamin C intake and hours of sleep did not affect this relationship. Future research on this should explore other factors that could potentially influence the relationship between miles run per day and URI.
Acute bouts of prolonged endurance exercise have been found to significantly decrease body mass. Some researchers suggest that a decrease in body mass may improve performance in weight-bearing exercise. Yet, other researchers suggest the decrease in body mass may impair exercise performance. **PURPOSE:** The purpose of this study was to investigate the association between race time with changes in body mass (BM) and total body water (TBW) in ultramarathon runners. **METHODS:** 10 ultramarathon runners (age = 36.4 (10.0) years, race time = 5.7 (1.5) hours) were assessed with the InBody 270 bioelectrical impedance analysis (BIA) before and after a 50k race. The InBody 270 BIA measured BM, skeletal muscle mass (SMM), fat mass (FM), and total body water (TBW). Race time was recorded as the runners crossed the finish line. Statistical analysis was performed using paired t-test, multiple linear regression, and Pearson product-moment correlations. Significance was set to p<0.05. **RESULTS:** BM significantly decreased by 2.15 (1.44) kg (p=0.001) while TBW showed a nonsignificant increase of 0.93 (1.79) kg (p=0.134). SMM decreased by 1.1 (1.24) kg (p=0.023) and FM decreased by 3.67 (1.83) kg (p=0.001). There was a positive correlation between race time and age (r = 0.676, p<0.01). Multiple linear regression suggested that change in BM and TBW predicted 10% of the variance in race time. **CONCLUSIONS:** Change in BM and TBW were not significantly associated with race time. BM was significantly decreased following the ultramarathon race. A limitation of the study is the small sample size. Therefore, additional research is needed to examine the relationship between performance and changes in BM in a larger sample size of ultramarathon runners.
The influence of body composition (Bcomp), and skeletal dimensions (SkD) on mobility screening conclusions is unknown. PURPOSE: Determine if each are correlated with balance, range of motion (ROM), and Functional Movement Screen (FMS) scores in professional soccer athletes (M&F).

METHODS: Athletes provided informed consent to participate (n=18, 27±7 y, 79±9 kg / Φ16, 25±3 y, 63±4 kg). Bcomp and SkD were assessed using DXA. Balance and ROM were assessed via Y-balance (Y-bal) testing. FMS was used for movements listed in table. A two-tailed t-test and Chi-square were used for gender comparison of Y-bal and FMS respectively. Correlational analysis and Spearman’s Rank Order were used to determine if Bcomp and/or SkD correlated with Y-bal or FMS measures. Correlations were defined as weak (r<0.4), moderate (0.4-0.7), and strong (r>0.7). Type I error; a=0.05.

RESULTS:

<table>
<thead>
<tr>
<th>MEAN Y-BALANCE SCORE (reach / limb length)</th>
<th>Anterior</th>
<th>Posterior mediolateral</th>
<th>Posterior lateral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>0.65 ± 0.05</td>
<td>1.13 ± 0.08</td>
<td>1.06 ± 0.09</td>
</tr>
<tr>
<td>Women</td>
<td>0.69 ± 0.07</td>
<td>1.20 ± 0.19</td>
<td>1.10 ± 0.08</td>
</tr>
<tr>
<td>Sig.</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>

FUNCTIONAL MOVEMENT SCREEN (1-3 Scale, % of Athletes Scored In Each Category)

<table>
<thead>
<tr>
<th>FMS SCORE</th>
<th>Deep Squat</th>
<th>Hurdle Step</th>
<th>Inline Lunge</th>
<th>Shoulder Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>33%</td>
<td>8%</td>
<td>0%</td>
<td>14%</td>
</tr>
<tr>
<td>Women</td>
<td>67%</td>
<td>75%</td>
<td>100%</td>
<td>50%</td>
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<td>Sig.</td>
<td>NS</td>
<td>NS</td>
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<table>
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<tr>
<th>FMS SCORE</th>
<th>Straight Leg Raise</th>
<th>Trunk Stability</th>
<th>Pushup</th>
<th>Rotary Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>6%</td>
<td>6%</td>
<td>6%</td>
<td></td>
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<tr>
<td>Women</td>
<td>47%</td>
<td>56%</td>
<td>94%</td>
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<tr>
<td>Sig.</td>
<td>Gender Diff. p&lt;0.05</td>
<td>NS</td>
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Ankle sprains (AS) result in persistent neuromuscular deficits and increased risk of re-injury. Examining the effect of AS on lower extremity (LE) flexibility, strength, static balance (SB), and dynamic postural stability (DPS) may aid in the development of injury prevention and rehabilitation programs. PURPOSE: Determine side-to-side differences in LE flexibility, strength, SB, and DPS in intercollegiate soccer athletes with a history of ankle sprain (HAS). METHODS: Fifteen intercollegiate male and female soccer athletes with a HAS participated (Age:20±2.1 years, Height:175±9.9 cm, Weight:68.7±10.2 kg). LE flexibility tests included weight-bearing ankle dorsiflexion, active ankle dorsiflexion, and stride length (S10) dash from a static position. Two-way (4x2) ANOVA and post-hoc Tukey HSD were used for statistical assessment. Pearson correlation coefficient test was used to correlate two dependent variables. P<0.05. RESULTS: Factorial ANOVA indicated no significant interaction between sprint distance and age, F1,14=1.5, p>0.05; but significant main effect for sprint distance, F1,14=214.21, p<0.01, and age, F2,22=3.06, p<0.05. The 19-year old group significantly improved both sprint times compared to the other age groups. The correlation between sprint times and KT for individual age groups primarily showed weak to moderate non-significant correlations: 16 yr: r=0.24, NS; 17 yr: r=-0.46, NS; 18 yr: r=-0.39, NS; 19 yr: r=-0.22, NS; 20 yr: r=0.46, p<0.05; 19 yr: r=0.36, NS; 18 yr: r=0.36, NS. The correlation between sprint times for S5 and S10 for the individual age groups: 16 yr: r=-0.06, p>0.01; 17 yr: r=0.76, p<0.01; 18 yr: r=0.06, NS; 19 yr: r=0.97, p<0.01. CONCLUSION: The sprint distance main effect indicated that sprint times improve with participants’ ages. The weak correlation between sprint and KT may suggest a different training program for young soccer athletes or individual training program for different ages. The significant correlation between the linear sprint distances shows a good choice for speed training.
3165 Board #34 June 2 8:00 AM - 9:30 AM
Knee Alignment And Muscle Strength Ratios In Division III Female Soccer Players With Reconstructed Anterior Cruciate Ligament
Nina M. Robinson, Ana B. Freire Ribeiro. Augsburg University, Minneapolis, MN. (Sponsor: Dr. Mark Blegen, FACSM)
(No relevant relationships reported)

INTRO: Anterior cruciate ligament tears are very common in sports that require contact, hard landing from jumps, or cutting, like soccer. Analyzing an athlete’s knee valgus and muscle strength ratios may help reduce their risk for injury.

OBJECTIVE: To compare knee valgus angles and the hamstring to quadriceps femoris strength ratio between healthy female Division III soccer athletes and athletes with ACL reconstruction, as surrogates for knee (re)injury risk.

METHODS: Thirteen non-injured and three injured athletes completed a vertical drop jump (VDJ) from a 31 cm box and a Repetition Maximum tests (1RM) using seated knee curl and seated knee extension machines. Baseline and landing knee valgus angles (KVA) were measured using Dartfish software.

Results: There was a significant difference in quadriceps to hamstrings ratio between injured and non-injured athletes (p<0.03), with injured individuals having an average ratio of 0.89 and non-injured 0.71. No significant difference was found in KVA from VDJ between injured and non-injured subjects (p=0.87). No significant relationship was found between KVA and quadriceps to hamstrings ratios.

Conclusion: There are significant differences in hamstrings to quadriceps strength ratios in injured female DIII soccer players compared to non-injured, suggesting it is a better screening than VDJ. KVA cannot be predicted by quadriceps to hamstrings ratio and injury history.

3166 Board #35 June 2 8:00 AM - 9:30 AM
Knee Biomechanics In Division III Female Soccer Players With Reconstructed Anterior Cruciate Ligament (ACLR)
Marissa Guillou, Ana B. Freire Ribeiro. Augsburg University, Minneapolis, MN. (Sponsor: Dr. Mark Blegen, FACSM)
(No relevant relationships reported)

Purpose: To compare knee valgus angles (KVA) between healthy athletes and athletes with reconstructed ACLs in vertical drop jump and soccer specific drills.

Methods: Sixteen NCAA Division III (DIII) female soccer players, ages 20.94 ±1.29, between athletes with healthy ACL and three with an ACL reconstruction (ACLR). Knee Valgus Angles (KVA) were measured during vertical drop jump, ladder drill, dribbling drill and shooting drill using Dartfish. Paired t-tests compared the groups.

Results: There were no differences in KVA between groups in any of the drills. Drop Jump KVA mean was 12.9±(SD:11.8)(p=0.87). Mean right leg KVA on ladder drill was 19.1±(SD:9.6)(p=0.95) and 17.2±(SD:8.3)(p=0.3) for left leg. Mean right leg dribbling drill average KVA was 15.8±(SD:8.5)(p=0.11) and 12.7±(SD:7.5)(p=0.16) for left leg. Mean right leg shooting drill average KVA was 19.9±(SD:7.3)(p=0.08) and 15.2±(SD:7.2)(p=0.29) for left leg.

Conclusions: Although there were no significant differences, between the injured and non-injured athletes for any drills, KVA in the injured athletes tended to be larger in game-like drills, suggesting they could be more meaningful in injury prevention assessment.

3167 Board #36 June 2 8:00 AM - 9:30 AM
Sweat Loss In Association With Measures Of External Load In Adolescent Soccer Players

Reported Relationships: T.J. Roberts: Salary; This study was funded by the Gatorade Sports Science Institute. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc.

Background: The use of technology to track workload and measurements of sweat loss to prescribe hydration strategies are now common practice. No study has explored the association of load variables to sweat loss in soccer athletes.

Purpose: To determine the association of load measures (total distance (TD), energy expenditure (EE)), body mass (BM), and sweat loss in adolescent soccer athletes during organized practice.

Methods: Thirty-two adolescent soccer athletes (Male: n=16, 17 ± 1 y, 71.4 ± 6.7 kg; Female: n=16, 18 ± 1 y, 64.0 ± 8.4 kg) had workload measured during 5 season practices (21/9.25° C WBGT) using GPS/accelerometer technology. Total sweat loss was calculated from pre-to post-exercise change in BM, corrected for fluid/food intake (ad libitum), urine output, metabolic mass loss, and respiratory water loss. Practice type was assessed subjectively and categorized as small or large-sided games/drills based on the activities engaged in during the majority (>50%) of the practice time. Girls practice 1 and 2 and boys practice 2 were small-sided. Girls practice 3 and boys practice 1 and 3 were large-sided. Multiple linear regression analyses were used to model the effects of independent variables (BM, EE, and TD) on total sweat losses. Data are shown as mean ± SD.

Results: Boys covered 4.7 ± 1.4 km and expended 1595 ± 481 KJ (381 ± 115 kcal) in 81 ± 13 min practices. Girls covered 4.4 ± 0.9 km and expended 1310 ± 299 KJ (313 ± 72 kcal) in 81 ± 7 min practices. Total sweat loss was 1.3 ± 0.3 L in boys and 0.8 ± 0.2 L in girls. Models to predict sweat loss included: 1) BM and EE; and 2) BM and TD. Model 1 was significant in boys during practice 1 (r²=0.73, p=0.001) and 3 (r²=0.60, p=0.01), but not practice 2 (r²=0.38, p=0.06). Model 2 was significant in girls during practice 3 (r²=0.57, p=0.01), but not practice 1 (r²=0.36, p=0.11) or 2 (r²=0.32, p=0.12). Model 2 (not reported) was largely identical. Conclusion: The association between total sweat loss, BM, and workload was inconsistent among practices, which may be explained in part by practice type. Significant prediction models were found during practices that consisted of predominately large-sided game/ drill scenarios. This work provides a literature base for the exploration of associations between workload measures and physiological/metabolic variables.

Implementation of an anterior cruciate ligament (ACL) injury prevention program (IPP) has been recommended to coincide with the adolescent growth spurt as risk factors increase during and following this phase of maturation. Physiological responses to load during this stage of growth may result in a differing maximum heart rate (HRmax) during intense exercise. Understanding the relationship between physiological responses to load and maturation stage may result in more effective IPP in youth athletes.

Purpose: To examine the effects of maturation on HRmax in adolescent soccer players over a six-week training program. Methods: 34 female soccer players participated in a 6-week training study (age 13.3±1.5y; height 158±7±6cm; mass 50.0±9.6kg). Maturation groups were determined based on percent of adult stature (PAS) with 88-94% representing pubertal (n=9, PAS 91.6±2.0%) and 95-100% representing post-pubertal (n=25, PAS 97.7±1.7%). Three 30 minute sessions, separated into plyometric, resistance, and core strength training, were completed each visit for a total training time of 90 minutes three times per week. Participants wore HR monitors during each plyometric session. The initial exercises were adapted from ACL IPP, and intensity of each exercise was progressed weekly following the second week of training (5 total phases). HRmax was calculated for each participant during each session and averaged weekly. A linear mixed model (p<0.05) was used to determine the effects of HRmax over the six-week intervention in pubertal and post-pubertal female soccer players. Average HR during the first week of training was used as a covariate.

Results: A significant interaction of maturational group and training week was found (p<0.04) with HRmax. A main effect of training week was found in both pubertal (p<0.001) and post-pubertal (p<0.01) groups. HRmax was significantly increased in both groups (week 1 to week 3, p<0.05) following the first two technique focused weeks of intervention. Performance models of the pubertal group (184±3.4 BPM) was greater than HRmax compared to the post-pubertal group (172±2.2 BPM) during week 3.

Conclusions: Physiologic responses to load was dependent on maturational stage and should be further examined in relation to reduced risk of injury following IPP. Funding supported by NIAMS/NIH R21AR069873
The KF demonstrated a higher degree of the bilateral ratio in comparison to KE. CONCLUSION

- found in players in comparison to 3 (~5%) risk results in Q:Q vs. H:Q
- hoc analysis showed in dominant leg a significant difference in H:Q
- significant changes in H:H appeared (H:H
- to KE (F1
- = .07) SA in four age groups. We found a significant higher SA between KF compared to KE (F1
- = .08) and ipsilateral (F2
- = 3,124). Bilateral strength ratios (Q:Q, H:H) and ipsilateral strength ratios (H:Q) were
- 3,124). Bilateral strength ratios (Q:Q, H:H) and ipsilateral strength ratios (H:Q) were
- 3170 Board #39 June 2 8:00 AM - 9:30 AM

Differences Between the Bilateral and Ipsilateral Strength Asymmetries With Respect to Age, Contaction Velocity and Limb Preferences in Female Soccer Players.

Lucia Malá, Tomas Malý, Frantisek Zahalka, David Bujnovsky, Mikulas Hank, Michal Dragsicky. Charles University, FPES, Prague, Czech Republic.

(no relevant relationships reported)

During the soccer match, strength and power movements are accumulated on both lower extremities. This occurs in an asymmetrical manner and may gradually leads to higher shifts of myodynamic characteristics and strength asymmetries (SA). There are limited investigations of a combination of muscle SA and different age groups in female soccer players.

PURPOSE: To investigate of differences bilateral and ipsilateral SA in female soccer players of four age categories.

METHODS: Elite female players (n=67) of 4 age categories (U17=13, U19=18, U18=20 and U19=15) performed isokinetic strength testing (Cybex NORM®, Humac, USA) for knee extensors (KE) and flexors (KF) at three angular velocities (AV: 60, 180, 300 °·s
-1). Bilateral strength ratios (Q:Q, H:H) and ipsilateral strength ratios (H:Q) were evaluated. Three-way Mixed-design ANOVA with two between subject effect (Age, Limb) and one within subject effect (AV) were used for evaluation. Bonferroni’s post-hoc test and partial eta square (η
-2) were also used for data analysis.

RESULTS: We found a statistically significant effect of AV on bilateral (F2,123 = 5.52, p<0.01; Wilk’s Λ = 0.92; 95% CI = 0.80 – 0.94) and ipsilateral (F2,123 = 4.87, p<0.01; Wilk’s Λ = 0.93; 95% CI = 0.79 – 0.97) SA in four age groups. We found a significant higher SA between KE compared to KF (F1,23 = 23.89, p<0.00, η
-2=0.16). With increasing AV from 60 to 180°·s
-1, significant changes in H:H appeared (HHIH = 7.81±0.60% vs. HHIH = 11.03±0.73% p<0.01). The factor “Age” did not significantly affect SA in players (Bilateral: F1,124
-1 = 1.10, p=0.05, η
-2=0.03; Ipsilateral: F1,124
-1 = 1.85, p=0.05, η
-2=0.04). The interaction between “Age” and “Leg” had not significant effect (p=0.05) for SA in groups. Post-hoc analysis showed in dominant leg a significant difference in H:Q = 54.73±0.92% vs. H:QH = 57.61±1.17 (p=0.01). Totally, 17 – 25% risk results (≥20%) of H:H was found in players in comparison to 3 – 5% risk results in Q:Q.

CONCLUSION

- The KF demonstrated a higher degree of the bilateral ratio in comparison to KE.
- Seventeen players (25%) had SA in KF higher than 20% at least at one AV. More attention should be paid to KE, where a higher percentage of SA was observed. Higher percentage of SA was seen at higher AV. The results may be beneficial for fitness coaches, physiotherapists, doctors and other clinical staff of female soccer players.

Soccer performance is the result of technical, tactical, physiological and psychological attributes of the players. PURPOSE: The present study investigated the effect of high-intensity interval training (HIIT) and continuous moderate intensity training (CONT) on selected parameters of the cardiorespiratory function in young trained soccer players. METHODs: Thirty Greek amateur soccer players (mean ± sd, age 19 ± 2.11y, Body mass 71.19 ± 2.5 kg) were randomized into a high-intensity interval training group (HIIT, n = 10), a continuous moderate intensity training group (CONT, n = 10) and a control group (Control, n = 10). The intervention for HIIT and CONT groups was 16 more training sessions, 2 per week while CONTROL group continued regular soccer training routine. The HIIT group training sessions consisted either of 15s sprints interspersed by 15s of recovery at 120%VO
-2 max with 8 min total exercise time or they played 4×4 min (16 min total time) small-sided games (4v4) followed by 2 min recovery interval. The CONT group training sessions consisted either of 40 min continuous running at 70% VO
-2 max or 10v10 full field soccer game for 40min.

RESULTS: Mean values ± sd pre and post-training for Body weight, (HIIT: 69.49 ± 6.39 vs 69.0 ± 0.88; CONT: 71.2 ± 10.93 vs 79.2 ± 11.01 kg). 6x10 (HIIT: 13.02 ± 2.41 vs. 12.12 ± 2.49, CONT: 13.75 ± 2.13 ± 5.82, 2.21), VO
-2 max, (HIIT: 55.08 ± 4.43 vs 57.75 ± 5.63, CONT: 56.46 ± 4.61 vs 58.41 ± 5.24 ml.kg
-1.min
-1), vVO
-2 max (velocity at VO
-2 max, HIIT: 15.9 ± 0.70 vs 16.5 ± 0.52, CONT: 16.5 ± 1.51 ± 16.7 ± 1.19 km.h
-1) and vVT (velocity at ventilatory threshold, HIIT: 11.8 ± 0.87 vs 12.5 ± 0.69, CONT: 12.4 ± 1.03 vs 12.5 ± 1.13 km.h
-1). VO
-2 max, VO
-2 max and vVT improved 4.6, 3.6 and 5.6% only after HIIT training but the difference didn’t pass statistical significance due to large sd of the sample. CONCLUSIONS: In conclusion, the combination of the training regimens of this study did not improve cardiorespiratory parameters of endurance performance in already trained young soccer players. There was, though, a tendency for better adaptations favors the time efficient HIIT training.
HR monitoring, accelerometers, and GPS tracking have become popular tools to quantify activity intensity during soccer matches. Limited research has examined differences between men and women collegiate players using these tracking modalities. PURPOSE: To quantify the activity profile of Division I collegiate soccer players during games using HR response and GPS and to examine differences based on gender and position. METHODS: A team HR monitoring system was used to evaluate in-game HR response and quantify match-play movement patterns of 21 men and 21 women NCAA Division I soccer players who played >70 min in each of 3 games. Players were divided into 3 groups based on position (defender, midfielder, forward). Percentage of playing time spent above 80% of HR max and average %HRmax was calculated. Total distance/playing time and number of sprints above sprint threshold (men: accelerations >2.6m/s², women: accelerations >2.4m/s²) were also calculated. ANOVA and student’s t-test were used to determine differences. RESULTS: Forwards and midfielders had significantly greater distance/playing time and sprints/playing time than defenders (F: 115.2/min; M: 115.7/min; D: 103.0/min; F: 0.38sprints/min; M: 0.35sprints/min; D: 0.26sprints/min) (p<0.05). No positional differences were observed in average %HRmax or % of game time >80% of HRmax. Men had a greater average distance/playing time than women (111.0/min vs 105.6/min) (p<0.05). Men had significantly fewer average sprints/min above threshold than women (0.18/min vs 0.42/min) (p<0.05). No differences were observed in average %HRmax (M: 85.6%HRmax; W: 87.7%HRmax) or % of game >80% of HRmax (M: 80.6%; W: 88.3%) between genders. CONCLUSIONS: HR data illustrate that elite level soccer is a highly aerobic sport. Differences in distance/playing time and sprints based on position may be explained by positional requirements, with more constant movement for forwards. Men’s soccer moves at a faster pace, explaining the difference in distance/playing time by gender; however, relative activity intensity (%HRmax) was similar between positions and gender. The gender difference in number of game sprints may be at least partially related to the threshold differences determined by the GPS system.

Inducing fatigue prior to agility training through high intensity interval training (HIIT) has shown to yield greater agility improvements compared to agility training alone. However, high levels of neuromuscular fatigue can impair the ability to implement proper technique and may increase injury risk associated with the explosive neuromuscular demand of agility performance. PURPOSE: To investigate the fatiguing effects of agility on agility performance, and determine if performance can be fully recovered following a short rest period. METHODS: Nineteen collegiate level soccer players participated in the study, nine men (22 ± 2 yrs) and ten women (20:2 yrs). Agility T-tests were performed before (PRE), and twice following (POST 1 and POST 2) the completion of four 4-seconds cycle ergometer sprints. The four sprint intervals were separated by 25 s active recovery. POST 1 was performed immediately following the final cycle sprint whereas, POST 2 began two minutes after completion of POST 1. Repeated measures ANOVA and Bonferroni post hoc tests were used to determine significant differences in the time to complete the T-tests. RESULTS: During HIIT, average power from the first sprint to the last declined by 30.7±% 9%. Time to complete the agility T-test significantly differed among the three tests (PRE: 10.46 ± 1.7 s; POST 1: 11.67 ± 3.3 s; POST 2: 10.96 ± 1.9 s; F(2, 54) = 6.174, p = .003). Post hoc test revealed an increase in time from PRE to POST 1 (p = .002), but no difference between PRE and POST 2 (p = .473). CONCLUSION: These results show that acute fatigue from HIIT impairs planned agility, but performance can be recovered within a few minutes. Coaches can safely combine fatigue-inducing drills and planned agility training into same sessions with rest interval.

Acute hypoxic exposures on submaximum and maximum physical performance in soccer players. Runghchai C. chauchaiyakul, mahidol university, Nakhonpathom, Thailand. (No relevant relationships reported)

Acute hypoxic exposures on submaximum and maximum physical performance in soccer players. Runghchai C. chauchaiyakul 1, Panik Avirutakan2, Chusak Pattanamontri3, Somporn Wannasiri2 and Salinee Chaiyakul1

1 College of Sports Science and Technology, Mahidol University, Thailand.
2 Sports Authority of Thailand, 1 Faculty of Allied Health Science, Walailak University, Thailand.

Purpose: This study was aimed to investigate cardiorespiratory and metabolic changes during acute hypoxic exposures on physical performance in soccer players. Materials and method: Male football players, who currently trained, participated. This study was approved by the Human Research Committee of Ethical Reinforcement for Human Research, Mahidol University, Thailand (MU-CRR 2015/075 1905). A hypoxic chamber was used to simulate normobaric-normoxic (NOR, FO2 = 0.21) and hypoxic (HYP, FO2 = 0.15) condition. Cardiorespiratory and metabolic functions at rest and during exercise were monitored using an impedance cardiography (Physioflow®) and telemetry gas analyser (Oxycon Mobile®). Variables including heart rate (HR) stroke volume (SV), cardiac output (CO), respiratory rate (RR), tidal volume (VT), ventilation (VE), oxygen consumption (VO2), carbon dioxide production (VCO2) and respiratory exchange ratio (RER), were monitored. Two separated progressive exercise tests were conducted on a cycle ergometer. Results: At submaximum exercise, no significant different of all resting variables between two groups were detected. HR, SV, VT, RR, VE, SaO2 and VO2 remarkably increased in the stepwise pattern (p<0.05) in parallel with all workloads. EDV, ESV, CO and VCO2 in both groups progressively increased (p<0.05) at the moderate to high workloads (90, 120 and 150 W). HYP showed the significantly higher HR (p<0.05) for all workloads, and significantly lower EDV and ESV at 150 W. At maximum exercise, HYP showed significant reductions in maximum values of HR, SV, EDV, CO, WR and VCO2 (p<0.05), with increasing in RR, VE, VCO2, and RER (p<0.05). Conclusion: Hypoxic condition declines performance, VO2 and cardiac function at maximum exercise. Physiologic responses are mostly derived from respiratory compensation for all workloads. Thus, respiratory adjustment plays major role in acute normobaric-hypoxic condition.

Soccer is a moderate contact sport and has a higher injury rate in female adolescent. Previous researches demonstrate the unstable surface training (UST) could improve the body’s stability and movement control, thereby reducing the risk of injury during exercise. PURPOSE: The purpose of this study was to determine the effect of a 6-week unstable surface training program on dynamic balance and lower limb power in adolescent female soccer players. METHODS: Twenty female soccer players (age: 14.9 ± 0.75 yrs, height: 160 ± 6.02 cm, weight: 50.6 ± 6.5 kg) from a local Junior College of Sports Science and Technology, Mahidol University, Thailand were randomly divided into control group (n = 10) and exercise group (n = 10). All players underwent a regular soccer training 5 times per week. Participants in the exercise group received extra UST program (6 weeks, 3 times per week, 20 min per session). The training program included core muscle, lower limb strength and balance training using by the BOSU bar as a training tool. Vertical jump, 30 meters dash and the dynamic balance (Star Excursion Balance Test, SEBT) before and after the training program were assessed for all players. Paired sample t-test was used to analyze the difference between pre and post-tests in two groups. The significant level was set at α = .05.

RESULTS: In the exercise group, the SEBT scores significantly increased after UST (p = .000, pre 294.23 ±% vs post 332 ± 30%). No significant difference was found in the control group (p = .823, pre 301 ± 17% vs post 299 ± 16%). The time of 30 meters dash in exercise group was significantly improved after UST (p = .047, pre 5.38 ± 0.3 vs post 5.27 ± 0.27 s). No significant differences were found in control group (p = .017, pre 5.45 ± 0.21 s vs post 5.61 ± 0.38 s). The vertical jump height in exercise group was significant increased after UST (p = .008, pre 30.88 ± 3.82 cm vs post 32.1 ± 4.2 cm), but no significant difference in control group (p = .405, pre 31.08 ± 2.12 cm vs post 30.36 ± 3.19 cm).

CONCLUSIONS: Six weeks UST could improve the dynamic balance, vertical jump and 30 meters dash performance in adolescent female soccer players. Incorporation of UST into the routine training of female adolescent soccer players is important for the development of sports fitness and possibly exercise performance.
3177 Board #46 June 2 8:00 AM - 9:30 AM Heart rate Variability, Stress Tolerance and Performance Outcomes to Intensification and Tapering in Soccer Players


(No relevant relationships reported)

PURPOSE: The aim of this study was to examine the effect of intensification weeks (IT) followed by a 1-week tapering (TP) phase leading up to a major competition, on heart rate variability (HRV), stress tolerance (ST) measures, and physical performance in sixteen male U19 soccer players.

METHODS: The study comprised 1 baseline week, 2 weeks of intensified training followed by a 1-week taper. Daily measures of HRV, ST (DALDA questionnaire) and internal training load (ITL) were collected through the training phases. Mean values of lnRMSSD (lnRMSSD_max) and the coefficient of variation (lnRMSSD_) were determined on a weekly basis for each training phase. At the end of each training phases, the athletes performed the Yo-Yo Intermittent Recovery level 1 (Yo-Yo IR1) test, Counter movement jump, Squat jump, speed tests and a running anaerobic sprint test (Rast test).

RESULTS: A decrease in lnRMSSD_max with an increase in lnRMSSD were observed during the IT with an opposite response observed during TP. No difference was found for the Rast test among training phases (p=0.05). During IT all remaining performance variables decline (p=0.001) with a supercompensation during TP (p=0.001). A decrease in stress tolerance were found during TP (p=0.001) with a reduction during TP (p<0.001).

CONCLUSIONS: The present results suggest that decreases in vagal-related HRV with greater daily fluctuations during peak volume-based training loads may be a sign that the athletes are not ‘coping’ with the applied training load and may reflect the initial stage of physiological stress.

G-37 Free Communication/Poster - Training
Saturday, June 2, 2018, 7:30 AM - 11:00 AM Room: CC-Hall B

3178 Board #47 June 2 8:00 AM - 9:30 AM Training Strategies Maintain Performance Characteristics in Marines Selected for Marine Corps Special Operations Individualized Training Course

Scott D. Royer*, Joshua D. Winters, FACSFM, Kathleen Poploski1, John Ahl, FACSFM, Andrejs Zalaiskalns1, Scott Lepeta1, University of Kentucky, Lexington, KY.

1United States Marine Corps Forces Special Operations Command, Camp Lejeune, NC. (Sponsor: John Abt, FACSFM)

(No relevant relationships reported)

Marines must complete an intensive Assessment and Selection (A&S) course prior to becoming a United States Marine Corps Forces Special Operations Command (MARSOC) Raider. Following selection, Marines are given training recommendations designed to maintain performance characteristics deemed relevant to successfully complete a rigorous nine-month Individualized Training Course (ITC). However, the time between the two courses is highly variable and training strategies are individually implemented by the Marine. PURPOSE: To evaluate the effectiveness of current training strategies following A&S and prior to ITC.

METHODS: Fat free mass (FFM), fat mass (FM), anaerobic power (AP), anaerobic capacity (AC), aerobic capacity (VO2max), knee flexion (KF), knee extension (KE), shoulder internal rotation (SIR), shoulder external rotation (SER), trunk extension (TE) and trunk flexion (TF) isokinetic strength were collected on 27 Marines (Age: 25.6 ± 2.9 years, Height: 1.78 ± 0.05 meters, Mass: 83.0 ± 8.4 kg, Post A&S to ITC Start: 183.8 ± 68.2 days) following A&S and directly prior to ITC.

RESULTS: No significant changes were found in Marines between A&S and the start of ITC in FFM (p=0.852), FM (p=0.119), AP (p=0.590), AC (p=0.388), VO2max (p=0.594), KF (p=0.855), KE (p=0.843), SIR (p=0.868), SER (p=0.710), TE (p=0.590), and TF (p=0.971).

CONCLUSION: Performance characteristics were similar following selection and prior to the start of ITC, suggesting the current training strategies, as implemented and adopted for the varying time gaps post A&S, were effective at maintaining performance between courses. Although effective at sustaining performance levels, Marines still demonstrated deficits in AP (13.0 W/kg vs 12.65 W/kg respectively) compared to previous studies on MARSOC Raiders. Future training strategies may further benefit from an increased emphasis on AP in conjunction with current recommendations.

Additionally, further research is needed to determine how performance characteristics are effected by variance in time between courses.

3179 Board #48 June 2 8:00 AM - 9:30 AM The Influence Of Four-week Of Endurance training With Periodic CO Inhalation On Aerobic Capacity

Jun WANG, Yang HU. Beijing Sport University, Beijing, China. (No relevant relationships reported)

PURPOSE: Altitude training is commonly used to enhance aerobic capacity in competitive athletes. The rationale is hypoxic stimulation of EPO to raise blood Hb mass and concentration and therefore also O2 transport capacity. We hypothesized that periodic inhalation of low levels of CO at sea level might be an easier method to achieve the same outcome.

METHODS: 12 non-smoking male well trained football players volunteered to participate in this study. In a preliminary experiment in resting subjects, the concentrations of CO in exhaled gas and of CO and EPO in venous blood were measured before and then at 1h, 2h, 4h, 6h, 8h after inhaling a bolus of CO (1ml kg BW) through a spirometer. For the main experiment, the subjects were divided into two groups (one group given inhaled CO (INCO) and a control group not given CO (NOCO)). All subjects participated in a four-week treadmill training program, running for 50 minutes at a speed of 90% of that producing each individual–respiration threshold, 3 times a week for 4 weeks. Prior to each training session, INCO inhala a mix of CO (1ml/kg BW) and O2 (4L) over two minutes while NOCO inhale a bolus of O2 (4L) over two minutes. Before and after 4 weeks of training, total hemoglobin mass (THb), blood parameters (RBC, Hct, [Hb], MVCV), and VO2 max were measured.

RESULTS: In the first experiment, HbCO% increased from 0.7% to 5.81% (p<0.05) 1hr after CO inhalation, decreasing gradually to 1.48% after 8 hours; EPO increased significantly 2 hours (p<0.05) after CO inhalation, peaking (42.3% higher than pre 1.912 ml/uL) at 4 hours, and then decreasing gradually at 6 (2.465 ml/uL) and 8 hours (1.759 ml/uL); (2) THb and VO2 max in INCO increased significantly after training (5.9% higher and 6.7% respectively, each p<0.05). However there were no such changes in NOCO; Oxygen uptake at a given submaximal intensity declined slightly both in INCO and NOCO, with the changes being more obvious in INCO. At 8, 10 and 12km/h, VO2 decreased by 7.08%, 2.13% and 3.43% respectively in INCO and by 1.56%(p<0.057), 5.74%(p<0.081) and 0.66%(p<0.059) in NOCO.

CONCLUSIONS: Circulating EPO increases sharply after a bolus of CO (1ml/kg BW), peaking at 4 hours after inhalation; Endurance training with CO inhalation increases THb and VO2max and slightly reduced the energy cost of submaximal running.

3180 Board #49 June 2 8:00 AM - 9:30 AM Prescription of Dry-land Resistance Training by Elite Swimming Strength and Conditioning Coaches.

Emmet Crowley, Andrew J. Harrison, Mark Lyons. University of Limerick, Ireland, Limerick, Ireland. (Sponsor: Giles Warrington, FACSFM)

(No relevant relationships reported)

Purpose: No research to date has investigated the current practice of prescription of dry-land resistance training by elite swimming strength and conditioning (S&C) coaches. The aims of this study were to examine the prescription of dry-land resistance training modalities and exercises among elite swimming S&C coaches and explore coach’s rationale and justification for prescribing dry-land resistance training modalities and dry-land exercises.

Methods: Twenty-three (n = 21 males, n = 2 females) elite swimming strength and conditioning coaches from Ireland (n = 7), Great Britain (n = 5), Australia (n = 6) and the United States (n = 5) were recruited through their specific national governing bodies. Coaches completed an online questionnaire consisting of seven sections; participant information, informed consent, coach’s biography, coach education, current training commitments, dry-land resistance training modalities exercises and additional information.

Results: Results showed that coaches had varying levels of experience, education and worked with swimmers at regional (4.6%), national (59.1%) and international (36.4%) levels. The most popular S&C accreditations were; National S&C Association (29.2 %), United Kingdom S&C Association (22 %) and Australian S&C Association (7.3 %). S&C coaches reported that their primary sources of information were their own experience (52.4 %), S&C coaches (14.3 %) and academic journals (9.5 %). In total four different resistance training modalities were reported and these included 95 dry-land resistance training exercises. Conclusion: Traditional resistance training was the most commonly practiced dry-land training modality with the pull up and squat reported as the most popular exercises prescribed by elite swimming S&C coaches. Future research should focus on exploring the specificity and transfer of specific exercises to swimming performance. This study highlighted that coaches need to have a clear understanding of the mechanisms that occur during sport specific movements such as a swimming. Furthermore, there is a need for coaches to perform detailed needs analysis before prescribing dry-land resistance training programs as aquatic sports provide a unique challenge to the s &C coach.
PURPOSE: To determine the impact of various resistance training protocols and frequencies on isometric and isokinetic strength and endurance in sedentary and recreationally active females.

METHODS: Forty-six female subjects (age=22.7±4.1) were randomly assigned to one of four groups that trained the knee flexors and extensors for 6 weeks. Training groups included a traditional group (TRAD) [3 sets (10, 10, 10 reps), 3x/wk at 70-80% of one repetition maximum (1RM)], two blood flow restriction groups ([BFR-1] 4 sets (30, 15, 15, failure), 1x/wk at 20-50% 1RM; and [BFR-2] 4 sets (30, 15, 15, failure), 2x/wk at 20-50% 1RM), and one set to failure group (FAIL) [1x/wk at 75-80% 1RM]. Subjects fasted (for at least 8 hours) and were hydrated for pre and post testing sessions that included assessing isometric maximum voluntary contraction (MVC) of the knee extensors (60° of knee joint flexion), 10 repetitions of isokinetic knee extensions at 60°/s (ISO-60), and 10 reps at 180°/s (ISO-180), and 50 maximal knee extensions (50 REP) at 180°/s.

RESULTS: One-way ANOVA found no between-group differences in any of the outcome measures of interest at baseline. Repeated measures ANOVA found a significant time main effect for MVC (p < 0.01). There was also a significant time main effect (p < 0.01) and time*condition interaction (p < 0.05) for ISO-60 as well as a significant time main effect (p < 0.01) for ISO-180, with post torque values being greater than baseline. There was a significant time*condition interaction (p < 0.04) for percent decline in torque for the 50 REP test. All training groups had increases in strength (peak torque) following each training program, but the TRAD group had greater percent declines in torque from the average of first 3 reps to last 3 reps of the 50 contraction test on the posttest compared to the pretest (58% pre-training vs. 60% post-training) while the BFR-1 groups improved their ability to maintain torque over the 50 reps (63% pre-training vs. 59% post-training).

CONCLUSIONS: Findings indicate that the FAIL, BFR-1, and BFR-2 training programs can be as effective as the TRAD training program to improve isometric and isokinetic strength, but the BFR-1 group appeared to be able to maintain muscular endurance better than the TRAD group.

3182 Board #51 June 2 8:00 AM - 9:30 AM

The Relationship Between Macronutrient Consumption and an Off-Season Training Program in Female Athletes

Yvette Figueroa1, Arlette Perry, FACSM. 1Augusta University, Augusta, GA. 2University of Miami, Coral Gables, FL. (No relevant relationships reported)

Sports performance and training are impacted by energy provisions. Adequate caloric and carbohydrate intakes are necessary for positive adaptations to exercise training. Yet there is limited research examining dietary intake in relation to strength and power in female athletes.

PURPOSE: To determine whether there are significant changes in weekly total caloric and macronutrient consumption, strength, and power and to determine whether changes in caloric and macronutrient consumption are significantly and positively related to changes in strength and power across a controlled eight-week, off-season resistance training program.

METHODS: Eleven female volleyball players were examined on macronutrient consumption, strength, and power every two weeks over a period of eight weeks. A total of 5 assessments were conducted per subject. Anthropometric measures were taken to evaluate pre- and post-test measures of body mass index (BMI), lean body mass (LBM), and body fat (BF) percentage. Macronutrient consumption was measured using a three-day food log. Strength was assessed using a 3-repetition maximum (RM) bench press for upper body strength and a 3-RM back squat for lower body strength. A vertical jump was used to assess lower body power. Repeat-measures ANOVA and weighted regression analysis was used to compare assessments across time.

RESULTS: Back squat and vertical jump significantly increased across the training program (p<0.05). Changes in caloric and carbohydrate intake were significantly related to changes in vertical jump (p<0.05). Significant improvements were seen in BMI, LBM, and BF percentage (p<0.05). Bivariate correlations showed significant inverse relationships between pre-test BMI and pre-test caloric intake (p<0.05), as well as between post-test LBM and post-test carbohydrate intake (p<0.05).

CONCLUSION: Changes in caloric and carbohydrate intake positively contribute to lower body strength and power in female athletes.
Title: Evaluation of the LaxPrep ACL Injury Prevention Program

Neuromuscular-based warm-up programs are effective at reducing risk of lower extremity injury, but more research is needed on the perspective of the program instructor. LaxPrep is a lacrosse-specific, progressive 3-phase program that combines neuromuscular control, core strength, and balance training. Each phase features a series of 9-10 exercises that are to be practiced 2-3 times per week for a period of 3-6 weeks. Resistance bands are implemented in advanced phases of the program. The online training is based on the US Lacrosse website and takes 45-60 minutes to complete.

PURPOSE: To characterize respondents who completed and implemented the LaxPrep training, which program phase was reached, and common barriers to implementation.

METHODS: A web-based survey (Tonic Health) was created and sent to 390 trainees who completed the online education course and intended to implement the LaxPrep program with their team.

RESULTS: 64 trainees (16%) responded to the survey. They included coaches, athletic trainers, and others for youth, high school, and college athletes across 27 states. 28% of respondents completed Phase 1, 28% completed Phase 2, 25% completed Phase 3, and 19% did not implement the program. Program instructors for youth teams cited 2 barriers to full implementation: the inability of young athletes to perform some of the exercises in advanced phases, suggesting the need for age-specific programs; and the accessibility and expense of resistance bands. High school and collegiate players were not as willing as youth players to participate and implement the program.

CONCLUSION: Challenges to program implementation were associated with the team’s age group and included finding practice time, athlete willingness, and resistance band expense. These observations support the implementation of age-specific neuromuscular-based warm-up programs, starting at the youth level.

FUNDING: This research was supported by the US Lacrosse Center for Sport Science and the Georgetown University School of Medicine’s MedStar Health Research Scholarship.

3187 Board #56 June 2 8:00 AM - 9:30 AM

Salivary Testosterone-to-Cortisol Ratio in Collegiate Gymnasts over a Competitive Season

Scott K. Crawford, Jessica L. Calvi, Jack W. Ransone, FACSM. University of Nebraska-Lincoln, Lincoln, NE.

(NO relevant relationships reported)

Scant empirical literature can be found regarding female gymnasts’ physiological hormonal responses to training and competition, especially at the collegiate level.

PURPOSE: To understand the long-term physiological effects of a full competitive season of NCAA Division-I female gymnasts on hormonal responses.

METHODS: Participants were 8 female athletes (ages 18-22) on the active roster of a university women’s gymnastics team. Saliva samples were taken approximately 24 hours pre-competition at approximately the same time of day as schedules permitted. Saliva samples were collected via unstimulated passive drool. Salivary cortisol (C) and testosterone (T) concentration levels were determined using an enzyme immunoassay kit (Salimetrics, State College, PA, USA). Given the nested nature of the data, hierarchical linear regression models examining individual-level and team-level variables on testosterone/cortisol ratio (T:C) were conducted.

RESULTS: The initial, simplified model indicated that T:C decreased over a competitive season (p = 0.003). Specifically, it was observed that T did not change over the competitive season, but C significantly increased. To examine alternative predictors over the season, other variables were examined in a second model, namely the number of events in which an athlete competed and whether the competition was a conference or non-conference competition. Conference competitions predicted significantly higher T:C than non-conference competitions (p = 0.001), and the number of events in which individuals competed predicted significantly higher T:C (p = 0.001). Surprisingly, the interaction between time and conference showed a significant decrease in T:C (p = 0.001), and the main effect of time became non-significant (p = 0.186). CONCLUSION: This is the first study of its kind to examine hormonal changes over a competitive season in female gymnasts. These findings indicate that the athletes had significant increases in cortisol without a corresponding increase in testosterone throughout the season, resulting in a decreased anabolic-catabolic balance. This perhaps contributed to an overtrained state as the season progressed. Further research should be conducted with this athlete population to optimize training and competition stress and recovery periods.

3188 Board #57 June 2 8:00 AM - 9:30 AM

The Effects Of The Alchemy Philosophy On Cardiovascular Health, Flexibility, And Strength

Chloe Tuna, Lana Prokop, Mark Blegen, FACSM, Joshua Guggenheimer. St. Catherine University, St. Paul, MN.

(NO relevant relationships reported)

Various styles of fitness training target different aspects of health. By utilizing different modalities of fitness, overall health can be improved. Alchemy is a relatively new type of exercise class that offers a blend of flexibility, strength, and cardiovascular training in a group fitness setting. Little research has been done to examine the effectiveness of the Alchemy approach on fitness outcomes.

PURPOSE: To examine the effects of eight weeks of Alchemy training on flexibility, strength, and cardiovascular performance in healthy adults.

METHODS: 12 men and 20 women were recruited to participate in this study. The pre-intervention protocol included testing peak torque of the knee joint and examining the strength of the hamstrings and quadriceps. A Vo2max test was completed to examine cardiovascular health. Flexibility was tested by examining ROM of hip flexion, ankle arc flexion, knee hyperextension, and closed chain dorsiflexion. Participants height and weight were also recorded. The eight-week intervention instructed participants to attend at least two Alchemy classes per week. All classes include disciplines of yoga, strength and cardiovascular training. After the intervention, participants return for post-intervention testing to examine changes in fitness areas.

RESULTS: 32 participants (age 31.7 ± 8.9 yrs, weight 67.9 ± 13.4 kg, height 168.2 ± 7.5 cm) completed a battery of fitness tests, which included average peak torque (APT) of the quadriceps and hamstrings of both legs (APT right extension 106.7 ± 26.6, APT left extension 105.4 ± 24.3, APT right flexion 53.8 ± 14.8, APT left flexion 50.9 ± 13.3). Mean Vo2max was 50.1 ± 10.5. Flexibility as measured by right and left hip flexion, right and left ankle arc, right and left closed dorsiflexion, and right and left knee hyperextension was 106.1 ± 13.2, 106.5 ± 13.9, 74.8 ± 10.8, 78.5 ± 10.8, 35.2 ± 5.4, 34.1 ± 6.2, 7.9 ± 2.6, 8.3 ± 3.0, respectively.

CONCLUSIONS: These results suggest that the participants are in good physical health, which may lead to small changes from an Alchemy-based training intervention. However, there did appear to be a bilateral discrepancy in quadriceps and hamstring torque production which may be worth further examination in the future.
Rock climbing is a popular sport with very dedicated athletes and fan base. Climbing performance, especially for new climbers, should increase when climbers develop the appropriate muscle strength to execute a variety of different climbing holds.

**PURPOSE:** This study investigated which of four popular rock-climbing holds caused the greatest recruitment of the Palmaris Longus (PL) and the Flexor Carpi Radialis muscles (FCR). **METHODS:** Muscle activation was measured in eleven experienced rock climbers: seven males and four females. Electromyography (EMG) sensors were placed on PL and FCR muscles. Participants performed four different types of rock climbing holds in random order. The PL activation, in all holds, was greater than the FCR activation. **RESULTS:** The Sloper hold caused greater PL activation than the Jug, Crimp, or Pinch holds as well as greater activation for the FCR in the Crimp and Pinch holds.

<table>
<thead>
<tr>
<th>Muscle Activation While Performing Climbing Holds</th>
<th>Climbing Hold Type</th>
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<tbody>
<tr>
<td>Muscle Type</td>
<td>SLOPER</td>
</tr>
<tr>
<td>Palmars Longus m.</td>
<td>108.468</td>
</tr>
<tr>
<td>Flexor Carpi Radialis m.</td>
<td>26.1</td>
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*p = p<.05 compared to SLOPER in Palmars Longus

**CONCLUSION:** Developing rock climbers should be able to increase their physical capacity to climb more quickly if they supplement their training with exercises aimed at increasing the strength and endurance of their PL muscle as it is highly recruited when executing holds. Ability to climb more difficult routes may advance quickly by training the Slopers as it performs required the greatest recruitment of both the PL and FCR muscles.

**Purpose:** To evaluate the reliability of a novel agility protocol using a wireless light system, consisting of pre-planned and reactive agility components. **METHODS:** Seventeen male athletes (19 ± 1 yrs; 85.1 ± 9.4 kg) completed 3 sessions, each separated by 3-7 days. Each session consisted of a standardized warm-up followed by 5 trials of the protocol, assessing time to complete each trial. Subjects reported to the laboratory at the same time of day for all 3 sessions to avoid differences in circadian rhythm. Pre-trial urine specific gravity measurements, 24-h dietary recalls (to assess macronutrient intake), and visual analogue ratings (to assess physical and mental fatigue) were measured, and results suggested no baseline differences between sessions (p>0.05, ANOVA). A two-way (day x trial) repeated measures ANOVA was used to assess differences in completion time, followed by Tukey’s post hoc test where main effects were found. Reliability was determined using coefficient of variation (CV). **RESULTS:** Main effects were evident for day (p<0.0001) and trial (p=0.0001), yet no interactions were present. Post-hoc results revealed significantly slower completion times during day 1 (27.76 ± 1.33 sec), but no significant difference between day 2 (27.17 ± 1.38 sec) and day 3 (27.13 ± 1.18 sec). Completion times (intra-day) were significantly slower during trial 1 (27.49 ± 1.37 sec) and trial 2 (27.49 ± 1.37 sec), but no differences existed between trials 3, 4, and 5 (27.25 ± 1.30 sec, 26.91 ± 1.27 sec, and 27.04 ± 1.16 sec, respectively). The reliability analyses suggested a high consistency (for mean of trials 3-5) within each day (CV = 2.2%, 2.2%, and 1.3% for days 1, 2, and 3, respectively) as well as between days 1-3 (CV = 1.8%). **CONCLUSIONS:** The evaluated protocol is a reliable tool that may be used for future research investigating agility performance. An initial familiarization session is warranted, followed by a minimum of two familiarizations (or warm-up trials) prior to performing an initial test trial in each successive visit. This study was funded by the Gatorade Sports Science Institute. The authors are employed by the Gatorade Sports Science Institute, a division of PepsiCo, Inc. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc.

**PURPOSE:** Stride-leg ground reaction forces have been used to predict wrist velocity during baseball pitching and are likely influenced by stride length. The purpose of this study is to determine the effect of stride length on peak vertical ground reaction forces (Fpeak) of the stride leg and wrist velocity in skilled baseball throwers. **METHODS:** Ten collegiate baseball pitchers (6 right-handed, 4 left-handed) completed one laboratory testing session in which they were instructed to throw a baseball as fast and accurately as possible. After a standardized warmup, a total of 15 throws (5 Normal-stride [NS], 5 Over-stride [NS +10% [OS]], and 5 Under-stride [NS -10% [US]]) were performed on a dimensionally correct pitching mound equipped with a force platform (1200 Hz). Marker trajectory data (32 reflective markers) was tracked from 10 high-speed cameras at 240 frames/sec. Fpeak was normalized for body weight (N/BW) and wrist velocity (m/s) was measured at ball release. **RESULTS:** When all stride lengths were combined, significant correlations were found between Fpeak and wrist velocity (r=0.47; p<0.01). However there was no effect of stride length on either Fpeak (NS=1.63±0.20, OS=1.59±0.19, US=1.60±0.22, p>0.05) or wrist velocity (NS=18.27±1.03, OS=17.95±1.00, US=18.12±0.85, p>0.05). **CONCLUSIONS:** These results confirm the relation between Fpeak and wrist velocity. However, the data indicate that skilled throwers are able to compensate for changes in stride length up to 10% to maintain performance.

**PURPOSE:** Pilates training engages core musculature and utilizes controlled repetitions of various movements to improve muscular strength and endurance, flexibility, balance, and posture. Although a growing body of research identifies the benefits of Pilates training for middle-aged and older adults, little emphasis has been placed on evaluating athletic populations. **METHODS:** To determine the effects of a short-term Pilates training program on postural stability, balance, and core isometric back strength in NCAA DI and competitive club sport athletes. **METHODS:** The experimental group of 16 off-season college-aged female athletes participated in a supervised Pilates training program, which took place two times each week for six weeks. The 30-minute Pilates session consisted of body weight training that progressed to the incorporation of dumbbells. Pre- and post-test measurements were taken in three functional tests, which included Force Plate Tandem Balance (FPTB), Limits of Postural Stability (LPS), and Biering-Sorensen Back Extension (BSBE). A control group of 10 college students, who maintained their normal physical activities, but were not involved in the Pilates training program, completed pre- and post-testing for comparison. **RESULTS:** There were no significant differences between the experimental and control groups at baseline testing. The control group did not show any significant changes between pre- and post-test measurements. The experimental group decreased path length in the FPTB assessment (39.8 inches vs. 36.5 inches, p<0.05). The experimental group also exhibited significant improvement in postural control score on the LPS assessment (37.1 vs. 47.4, p<0.001). Finally, there was a significant increase in seconds held during the BSBE assessment among the experimental group (172.4 seconds vs. 187.7 seconds, p<0.05). **CONCLUSION:** A six-week progressive Pilates program contributed to significant decreases in single-foot sway, increases in postural stability, and increases in isometric back strength in female college-aged athletes.
Effect of Suspension Training on Selected Health Related Fitness and Functional Movement
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Although body weight training is included in the 2017 ACSM Top Fitness Trends, there is relatively little research quantifying the effects of suspension training on health-related fitness and functional movement. PURPOSE: To examine the impact of suspension training on selected health-related fitness variables and functional movement. METHODS: Fifteen individuals (11 females; 4 males; Age = 22.2 ± 3.2 yrs; Height = 172.0 ± 11.4 cm; Body Mass = 69.8 ± 19.2 kg) in a suspension training course completed 11 workout sessions over a 6-week period. Throughout each 30-minute exercise session, six body positions were utilized across push, pull, rotational, squat and lunge movements. Pre- and post-health-related fitness assessments included body composition, muscular endurance, flexibility, and a functional movement screen. Dependent t-tests were used to determine if there were mean changes in health-related fitness and functional movement. Due to multiple comparisons, Bonferroni correction was used, therefore, alpha level was set at .008. Cohen’s Delta effect size was calculated for functional movement. RESULTS: There were no significant changes in mean fat mass, percent body fat, and push-ups. There were, however, positive changes in mean lean body mass (55.5 ± 18.4 kg to 56.3 ± 18.6 kg), sit and reach (42.2 ± 8.5 to 45.5 ± 8.3 cm, p= .004), and functional movement screen score (15.7 ± 2.1 to 17.7 ± 2.0). A large effect size was present for functional movement (Cohens’ Delta = 0.98). CONCLUSION: Suspension training had a significant impact on lean body mass, flexibility and functional movement in as few as 11 thirty-minute sessions.

The Effects of Ballistic Exercise on Cognitive Function
Allan Shook, Joshua A. Logan, Toria A. Crispin. Slippery Rock University, Slippery Rock, PA. (No relevant relationships reported)

A strong connection between physical activity and cognition has been well documented in health science. Prior research suggests a strong relationship between both aerobic exercise training and slow-controlled resistance training with improvements in cognitive function (CF). Little research exists on the influence of high-force production (ballistic) strength training on CF. PURPOSE: To determine the effects of ballistic strength training on CF in an apparently healthy, college-aged population. METHODS: 21 low-risk participants (age 18-25 years) who had refrained from any ballistic strength training for at least six months were recruited to the treatment group. 19 individuals (age 18-25 years) served as controls. Treatment and control groups continued previous aerobic and traditional (slow-controlled) resistance training during the study. Both groups completed concurrent (CONG) and incongruent (INCONG) sections of The Stroop Test and the Trail Making Test, Part B (TMT-B), at baseline, and eight weeks later. The Stroop Test assessed the number of correct answers on CONG and INCONG questions and the completion time of the test. The TMT-B measured the correct completion time of the test. The treatment group met twice weekly for eight weeks and completed a ballistic training protocol. Pre- and post-test comparisons within and between subjects on CF were assessed. RESULTS: Completion time for both CONG and INCONG sections of The Stroop Test significantly improved from baseline to post-test for all participants (1.65 ± 3.59, p = .006, 2.17 ± 4.60, p = .005, respectively); however, there was no significant difference in between groups (F = 0.21, p = .847, F = 2.696, p = .450, respectively). All participants significantly improved from baseline to post-test on the TMT-B (9.74 ± 10.48, p < .001); however, there was no significant difference between the treatment and control group from baseline to post-test (1.82 ± 3.08, p = .564). CONCLUSION: CF improved in the treatment and control group but was not statistically different. Future research could investigate if ballistic strength training influences CF in sedentary individuals.

Assessing Changes in Absolute and Relative One-repetition Maximum Bench Press After a Six-week Blindfolded Training
Ali Boolani1, Masoud Moghadam2, Timothy Baghurst2, Timothy Jones3, Essameldin Hamido3, Bert Jacobson, FACSM. 1Clarkson University, Potsdam, NY. 2Clarkson University, Potsdam, NY. 3Oklahoma State University, Stillwater, OK. 3Tennessee State University, Nashville, TN. (Sponsor: Bert Jacobson, FACSIM) (No relevant relationships reported)

PURPOSE: This study investigated changes in one-repetition maximum (1-RM) strength on the bench press following 6 weeks of vision-deprived resistance training in college-aged individuals. METHODS: Fifty-three resistance-trained individuals (males = 40, females = 13; age = 19.67 ± 1.12, height = 174.25 ± 9.58 cm; weight = 85.89 ± 22.18 kg; body fat % = 13.98 ± 10.54) were recruited to participate in a 6-week resistance training intervention. Testing procedures were completed pre- to post-training intervention, including the 1-RM bench press and body composition using BODPOD. Participants were matched by 1-RM/lean mass relative bench press strength and randomly assigned to either the experimental (E) or control group (C). Both groups completed 3 sets of the following upper-extremity exercises: barbell bench press, lat pull-down, standing shoulder press, overhead triceps extension, and biceps curl) 2 days a week for 6-weeks. The experimental group performed the exercises blindfolded and the C group were visually unimpaired. The participants progressively increased the loads and decreased the repetitions every 2 weeks (weeks 1-2 = 12-15 reps; weeks 3-4 = 8-12 reps; weeks 5-6 = 6-8 reps). A repeated-measures ANOVA was used to assess changes in 1-RM bench press between the groups. RESULTS: Statistical analysis yielded a significant (p < .001) improvement in absolute (E pre= 73.9±34.3 kg, post=79.5±33.8 kg, C pre=84.2±35.2 kg, post=87.7±35.9 kg), relative to body weight (E pre=0.9±0.3, post=0.9±0.3, C pre=1.0±0.4, post=1.0±0.4), and relative to lean mass (E pre=1.1±0.3, post=1.2±0.3, C pre=1.1±0.4, post=1.2±0.4) 1-RM bench press between the pre- to post-testing. However, there were no significant differences between groups (p > .05). CONCLUSION: Although there were no statistically significant differences between groups, there was a 7.6% change for the blindfold group compared to a 4.2% change for the blindfold group compared to the control group. The large standard deviations may explain why a statistical significance was not found. Further research needs to be conducted with better matching criteria.
**RESULTS**

Our post-hoc analysis of the results showed that subjects rested 120 seconds between sets and were told to exert maximal effort during the set sequence, which limited the risk of an order effect and fatigue's impact on the results. The average force per set was calculated by adding the Impulse weight sled per set. A Latin Squares design counterbalanced each participant's genotype score, which helped in obtaining high and low endurance groups (score>0 and score<0). We used independent analysis of variance (ANOVA) to define the combination of aerobic exercise (AE) and resistance exercise (RE) within a previously demonstrated reduced peak power when AE precedes RE. However, postural requirements of the lower body, as compared to the upper body, may give rise to unique responses following CT. Thus, further investigation as to specific peak power alterations of the upper body muscles are warranted.

**METHODS**

To explore if and how the endurance genotype score would affect the cardiovascular adaptation under reduced oxygen caused by the altitude elevation. The need to reduce the risks by implementing an exercise-based health and wellness program within the university workplace should be considered in university workplaces.

**CONCLUSION**

These results demonstrated that the implementation of AE prior to RE, as compared to RE alone, compromises peak concentric power adaptations of the arm extenders. The noticeable decrement in peak concentric power between pre- and post in the CT intervention (21%), relative to a similar study with the same testing protocol which targeted the lower body (10%), gives credence to the possibility that upper and lower body muscles respond differently to concurrent training.

**RESULTS**

The combination of aerobic exercise (AE) and resistance exercise (RE) within a given training protocol, termed concurrent training (CT), lacks sufficient analysis concerning the upper body. In the lower body knee extensor muscles, we have previously demonstrated reduced peak power when AE precedes RE. However, the study also looked at the number of ACSM cardiovascular disease risk factors and different physical activity levels among university faculty. The results indicate that the university faculty had better quality of life scores in certain parts of the SF-36 sub-scales when being active and HEPA active.

**METHODS**

An SF-36, I-PAQ, and Health Questionnaire form was handed out to the participants to complete to the best of their knowledge. A Tukey-Kramer post hoc test was performed to prove honestly significant difference. The results indicate that the university faculty had better quality of life scores in certain parts of the SF-36 sub-scales when being active and HEPA active. The university faculty seem to be at risk for some cardiovascular disease risk factors in which the need to reduce the risks by implementing an exercise-based health and wellness program within the university workplace should be considered in university workplace policies.

**RESULTS**

The combination of aerobic exercise (AE) and resistance exercise (RE) within a given training protocol, termed concurrent training (CT), lacks sufficient analysis concerning the upper body. In the lower body knee extensor muscles, we have previously demonstrated reduced peak power when AE precedes RE. However, the study also looked at the number of ACSM cardiovascular disease risk factors and different physical activity levels among university faculty. The results indicate that the university faculty had better quality of life scores in certain parts of the SF-36 sub-scales when being active and HEPA active. The university faculty seem to be at risk for some cardiovascular disease risk factors in which the need to reduce the risks by implementing an exercise-based health and wellness program within the university workplace should be considered in university workplace policies.
A family history of type 2 diabetes (FH2) is considered a risk factor for insulin resistance and poor cardiorespiratory fitness. However, it is not known if exercise induced improvement in maximal aerobic capacity (VO\textsubscript{max}) is impeded by a FH2.

**PURPOSE:** The purpose of this study was to determine if normoglycemic, sedentary, Hispanic men with FH2 have a lower VO\textsubscript{max} compared to those without a family history of type 2 diabetes (FH1) and if the improvement in VO\textsubscript{max} after 8-weeks of combined exercise training is comparable to FH1 and FH2.

**METHODS:** 19 participants (mean ± SD: age:23±0.56 yrs; BMI: 26.9±0.98 kg/m\textsuperscript{2}) underwent 8 weeks of combined exercise training (35 min aerobic at 60-70%VO\textsubscript{max} followed by full-body resistance exercises (3x/week)). VO\textsubscript{max} was measured using ParvoMedics 2400 metabolic measurement system during a standardized graded exercise test performed on a treadmill. Body composition was assessed by DEXA.

**RESULTS:** VO\textsubscript{max} was significantly lower in FH2 compared to FH1 at baseline (3.57 ± 1.7 vs. 4.08 ± 0.15 L/min; p<0.04). After 8 weeks of combined exercise training FH1 significantly improved VO\textsubscript{max} (3.57 ± 0.17 to 3.82 ± 0.16 L/min; p=0.002), whereas no improvement was observed in FH2 (4.08 ± 0.15 to 4.21 ± 0.17 L/min; p=0.16). There was no difference in VO\textsubscript{max} between groups after 8 weeks of exercise training (p=0.67). Lean body mass significantly improved in both groups (FH1: 56.6 ± 2.1 vs. 58.5 ± 2.1 kg; p<0.01; FH2: 51.8 ± 1.95 to 53.4 ± 1.79 kg; p=0.01) and fat mass remained unchanged (p=0.38).

**CONCLUSIONS:** A family history of diabetes may negatively impact cardiorespiratory fitness in a normoglycemic, sedentary, Mexican American population. A combined exercise training program (8 weeks) is effective in normalizing this defect.

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**Board #71**

**Effects Of Chronic Endurance Exercise Training On Serum 25(OH)D Concentrations In Elderly Japanese Men**

Xiaoan Sun, Zhen-Bo Cao, Kumpei Tanisawa, Hirokazu Taniguchi, Takafumi Kubo, Mitsuhiro Higuchi, FACSM. 1School of Public Health, Xi'an Jiaotong University Health Science Center, Xi'an, China. 2School of Kinesiology, Shanghai University of Sport, Shanghai, China. 3Department of Physical Activity Research, National Institutes of Biomedical Innovation, Health and Nutrition, Tokyo, Japan. 4Faculty of Agriculture, Ryukoku University, Shiga, Japan. 5Graduate School of Sport Sciences, Waseda University, Saitama, Japan. 6Faculty of Sport Sciences, Waseda University, Saitama, Japan. (Sponsor: Mitsuhiro Higuchi, FACSM)

**RESULTS:** The purpose of this study was to investigate if normoglycemic, sedentary, Hispanic men with FH2 have a lower VO\textsubscript{max} compared to those without a family history of type 2 diabetes (FH1) and if the improvement in VO\textsubscript{max} after 8-weeks of combined exercise training is comparable to FH1 and FH2.

**METHODS:** 19 participants (mean ± SD: age:23±0.56 yrs; BMI: 26.9±0.98 kg/m\textsuperscript{2}) underwent 8 weeks of combined exercise training (35 min aerobic at 60-70%VO\textsubscript{max} followed by full-body resistance exercises (3x/week)). VO\textsubscript{max} was measured using ParvoMedics 2400 metabolic measurement system during a standardized graded exercise test performed on a treadmill. Body composition was assessed by DEXA.

**RESULTS:** VO\textsubscript{max} was significantly lower in FH2 compared to FH1 at baseline (3.57 ± 1.7 vs. 4.08 ± 0.15 L/min; p<0.04). After 8 weeks of combined exercise training FH1 significantly improved VO\textsubscript{max} (3.57 ± 0.17 to 3.82 ± 0.16 L/min; p=0.002), whereas no improvement was observed in FH2 (4.08 ± 0.15 to 4.21 ± 0.17 L/min; p=0.16). There was no difference in VO\textsubscript{max} between groups after 8 weeks of exercise training (p=0.67). Lean body mass significantly improved in both groups (FH1: 56.6 ± 2.1 vs. 58.5 ± 2.1 kg; p<0.01; FH2: 51.8 ± 1.95 to 53.4 ± 1.79 kg; p=0.01) and fat mass remained unchanged (p=0.38).

**CONCLUSIONS:** A family history of diabetes may negatively impact cardiorespiratory fitness in a normoglycemic, sedentary, Mexican American population. A combined exercise training program (8 weeks) is effective in normalizing this defect.

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**Board #72**

**The Effect of Hyperthermic Whole Body Heat Stimulus (Sauna) on Heat Shock Protein 70 and Skeletal Muscle Hypertrophy Young Males**

Brandon Jones, Scott Drum, FACSM. Northern Michigan University, Marquette, MI. (Sponsor: Scott Drum, FACSM)

**RESULTS:** The aim of this study was to investigate if stimulating HSP70 by using a sauna (45 ± 5°C, 80% Humidity) three times per week, for 15 minutes, could aid skeletal muscle hypertrophy during six weeks of resistance training in a young (21.38 ± 1.9 yrs.), recreationally trained male population.

**METHODS:** Thirteen subjects were randomly distributed into 3 groups [resistance training + sauna (RT+S), RT + Relaxation (RT+R), and control (CON, n=3) or no training]. Primary dependent variables, observed in a pre- and post-test format, included: lean body mass (LBM), HSP70 concentration, and a 5 repetition maximum (5RM) back squat.

**RESULTS:** When comparing groups (i.e., RT+S, RT+R, and CON), no significant main effects or interactions were observed (p > 0.05) over the 6-week intervention period for LBM, HSP70, and 5RM. The hypothesis that HSP70 would be upregulated to a greater extent with continually larger LBM and 5RM improvements in RT+S vs. the other groups was not supported.

**CONCLUSIONS:** Although HSP70 and LBM were highest in RT+S after 6-weeks of heavy resistance training, RT+R improved the most on 5RM. Sauna use in combination with resistance training does not appear to augment muscle hypertrophy or strength. Despite this, it appears using sauna post RT does not hinder muscle growth and may be a viable strategy for maintaining muscle mass.
Previous research has shown upper-body muscular strength gains are independent of fat-free mass (FFM) in men. Further, initial strength is typically higher when evaluated with machine weights (MW) than with free weights (FW). Lacking is information comparing the training effects of FW versus MW in men with comparable initial strength levels.

**PURPOSE:** To evaluate the effect of resistance training (RT) using different modes on changes in upper-body muscular strength when controlling mode-specific initial strength.

**METHODS:** College men (n = 1,331) enrolled in a RT course volunteered to participate and initially performed 1RM bench press using free-weights (FW), seated horizontal press (SHP) or supine vertical press (SVP). Each participant performed 12 weeks of linear periodization mode-specific RT using progressively heavier loads and reduced repetitions designed to achieve maximum strength improvement. Each participant performed auxiliary upper- and lower-body supplemental exercises in 3 sets of 6-10 repetitions.

**RESULTS:** A mode x strength level ANOVA noted significantly greater improvement with SHP (12.5 ± 7.6 kg) than with SVP (10.7 ± 7.6 kg) which was greater with FW (6.8 ± 5.9 kg) but no significant difference among low (10.3 ± 7.4 kg), average (10.4 ± 6.2 kg), and high (9.8 ± 7.9 kg) strength levels. The interaction was not significant (p = 0.45). The relationships between initial strength and strength change was nonsignificant and similar in SHP (r = -0.01), FW (r = -0.05) and SVP (r = 0.06).

**CONCLUSIONS:** Men of differing strength levels gain similar amounts of upper-body strength when training with different RT modes. In participants with equal initial strength, training with one mode does not appear to offer any significant advantage over training with a different mode.

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**Abstracts were prepared by the authors and printed as submitted.**
3209 Board #78 June 2 8:00 AM - 9:30 AM
Influence of Psychosocial Wellness Factors on Training Duration in Triathletes
Michelle B. Stockton1, Barbara McClanahan2, Christopher Yukadinovich2. 1University of Memphis, Memphis, TN. 2St. Jude Children’s Research Hospital, Memphis, TN. (Sponsor: Lawrence Weiss, FACSMM)
(No relevant relationships reported)

PURPOSE: Training duration is an important factor in athletic performance, especially long endurance events such as triathlons. While the majority of attention in training duration has focused on physical factors, psychosocial wellness factors may also influence training duration. Therefore, the purpose of this study was to explore the influence of psychosocial wellness on triathlete training duration.

METHODS: Participants established their own training regimen and recorded training duration (minutes) for each sport. Total training duration was calculated by summing training duration for each sport across six months. Participants also completed a multi-dimensional wellness assessment during the laboratory visit. The 70-item self-report assessment consisted of seven subcategories with Likert scale responses 1-5. Total scores were calculated for each category as well as a composite wellness score.

RESULTS: Participants were 14 male and 9 female triathletes. Total training duration for all participants was 12,880 (±5536) minutes over 6-months with males reporting an average of 13,435 (±990) total minutes, and females reporting 12,017 (±4961) total minutes over the same period. Preliminary analyses using multiple linear regression indicated that the multiple-dimensions of psychosocial wellness (drugs and driving, social, emotional awareness, emotional control, intellectual, occupational, and spiritual) explained 73.8% of the variance in total training duration for all the participants (p = .002). Social (β = .804), intellectual (β = -.757), occupational (β = .091), and spiritual (β = .749) were significant predictors at the univariate level. For males, the multiple-dimensions of wellness explained 94.3% of the variance in total training duration (p = .002) with social (β = 1.226), intellectual (β = -.650), occupational (β = 1.332), and spiritual (β = -.914) being significant predictors. For females, the psychosocial wellness factors did not significantly influence training duration.

CONCLUSIONS: Study results illustrate the importance of understanding potential psychosocial influences on training duration for triathletes. Further research is needed to determine the multiple dimensions of psychosocial wellness on all aspects of training in order to develop ideal strategies for optimal performance.

3210 Board #79 June 2 8:00 AM - 9:30 AM
Effects Of High Concentration Oxygen Intervention On Physiological Recovery From High Intensity Hammer Throwing Training
Chung-Wen Chen1, Szu-Kai Fu2, Jen-Chun Lo1, Kuo-Wei Tseng2, Chang-Chi Lai2. 1National Taiwan Sport University, Taoyuan City, Taiwan. 2University of Taipei, Taipei City, Taiwan. (No relevant relationships reported)

Purpose: To investigate the effects of high-concentration oxygen inhalation on repeated hammer throwing efficiency and the recovery of physiological fatigue. METHODS: Five hammer players completed 10 throws with both normobaric oxygen and high-concentration oxygen interventions with a 7-day interval. Each bout consisted of 10 repeated throws with a 5-minute rest between each throw. For high-concentration oxygen intervention, each subject was given 5 minutes of highly concentrated oxygen intervention × times was found in all dependents variables (Distance, La, RPE, HR and heart rate) during the repeated throws. Conclusion: The results suggested that high-concentration oxygen inhalation intervention did not improve the rate of blood lactate metabolism, and the recovery of heart rate and rating of perceived exertion after high intensity throws.

3211 Board #80 June 2 8:00 AM - 9:30 AM
Effects Of A Caffeine-carbohydrate Mouth Rinsing On Sprinting Kinetics And Kinematics In Fasted Athletes
Jad-Adrian Washi1, Christopher Martyn Beaven2. 1national Sports Institute Of Malaysia, Kuala Lumpur, Malaysia. 2University Of Waikato, Hamilton, New Zealand. (No relevant relationships reported)

Carbohydrate mouth rinsing during an intermittent fasting has been reported to be advantageous for endurance performance; however, there appears to be no clear effect on repeated sprints. What has not been investigated previously is the effects of combined caffeine and carbohydrate (CAF-CHO) mouth rinsing on sprint-endurance performance commonly performed by track and field athletes during a fasted state.

PURPOSE: To determine the influence of CAF-CHO mouth rinsing on sprinting kinetics and kinematics, as well as subjective exertion during a speed-endurance bout performed in a fasted state. METHOD: In a counterbalanced, single-blind random order design, eleven (n = 11) well-trained National level male sprinters and middle-distance to fourteens performed three 15-second all-out sprints on a Woodway nonmotorized force treadmill, interspersed with 2-min active recovery between sprints, Athletes rinsed 25 ml of CAF-CHO (4g carbohydrate, 5mg caffeine), or a similarly coloured placebo solution (PLA) prior to warm-up (30-min pre-trial), 1-min pre-trial, and the mid-way of each period of active recovery. On one occasion, no mouth rinse (NMR) was administered. The study was conducted within the second and third quarters of Ramadan, and each session separated by at least 72 hours.

RESULTS: At the start of each trial, the rating of perceived exertions (RPE), readiness to train, blood glucose, and lactate concentrations were similar (p > 0.05). A significant primary effect of trial (3 x 15 seconds sprint) was observed for the distance (p = 0.019), revealing a longer average distance achieved in the CAF-CHO compared to PLA trial (69.80 ± 3.37 vs. 68.08 ± 3.22, p = 0.026; EF: 0.5), and NMR (69.49 ± 3.82, p = 0.680; EF: 0.2). The difference between NMR and PLA also approached significance (p = 0.073; ES: 0.5). The CAF-CHO intervention also obtained better results in all other sprint measures such as average velocity, peak acceleration, and peak horizontal force, although these differences were not significant. Post-trial RPE was higher during NMR (7.23 ± 1.92) as compared to CAF-CHO (6.54 ± 2.15) and PLA (6.38 ± 1.94) (p = 0.247).

CONCLUSION: In challenging metabolic conditions, CAF-CHO mouth rinsing might have potential to improve measures of sprint training performance with a positive ergogenic effect on speed endurance performance.
Introduction: Depth jumps (DJ) are popular high-intensity plyometric exercises typically reserved for highly-trained individuals. DIs cause an individual to undergo high amounts of stress during the eccentric and concentric phase. This extreme loading allows individuals to increase lower body strength and power output. Muscular strength and power have a transfer effect to sprint speed; however, few have examined if implementing DIs into training can increase sprint speed.

Purpose: The purpose of this study was to determine the effect of implementing DIs into a sprint training program would increase sprint speed more so than sprinting alone.

Methods: 5 collegiate level and 13 club level athletes participated in this study (6 males and 13 females). Subjects performed 3 maximal 40-yard sprints with 3 to 5 minutes of rest between sprints. Subjects were randomized into either a control group, a sprint training group, or a DJ group. The DJ and sprint group performed 2 training sessions/week, with both groups performing the same sprint training protocol. The DJ group had DIs of varying intensities. Following 6 weeks of implementation, subjects were retested on the 40-yard sprints in the same manner as before.

Results: One-way ANOVA were conducted using paired comparisons to determine significant differences. No significant differences were observed after implementation for the 40-yard sprint (-24.1±4.3s) (P>0.05), 20-30 yard split (-13.1±11s) (P>0.05), and a 20-40yard split (-20.1±18s) (P>0.01). No differences were observed between groups. The DJ group changes showed the largest effect sizes of any group in these measures; 1.12, 1.6, and 2.5 respectively.

Discussion: The effect sizes of changes in sprint speed demonstrate that DIs may benefit sprint speed. It can be concluded from this study that maximal sprint speed was improved more so than acceleration due to the improvements observed from 20-30yards and 20-40yards. These indicate the maximal speed phase of sprinting. Further research is needed to determine if DIs can improve sprint performance in highly-trained athletes.

Abstracts were prepared by the authors and printed as submitted.
SATURDAY, JUNE 2, 2018

The concept of leg dominance is complicated as bilateral muscular strength/power asymmetry is linked to poor performance and/or injury risk. Bilateral asymmetry during 2-leg (2L) jumping appears to define performance, rather than limit it. During 2L jumping, the leg that developed the greatest torque/velocity is defined as dominant. PURPOSE: to investigate the relationship between apparent leg dominance in jumping and sprinting. METHODS: Men (n=18); football, basketball) and women (n=17); basketball, soccer, volleyball) athletes competing in intercollegiate sports completed repeat trials of sprint and jump testing. Sprint: three trials of a 12-m sprint with step-by-step kinematic data collected with an infrared timing system. Jump: repeat trials of 2L and single-leg (1L- left leg; 1R-right leg) squat jump without countermovement conducted on individual force plates to determine jump impulse (IMP). Jump height (JH) was calculated from flight time (Δt). Data were averaged across trials. Asymmetry index was calculated as (L-R)/(0.5*(L+R)). Bilateral facilitation/deficit was determined from jump performance as (1L+1R)/2L. Differences were tested with ANOVA; p<0.05. RESULTS: Men (1.70±0.17 s) were faster than women (1.82±0.11 s). Horizontal acceleration (a) decreased from the first to last stride while horizontal velocity (v) increased throughout. In contrast, step-by-step a was asymmetric while v increased linearly. a and v were always greater in men. There were no differences in 1L and 1R JH (left & right men: 22.0±11.7 & 23.5±11.6 cm; women: 12.4±2.7 &12.7±2.9 cm, respectively). 1L and 1R (men: 39.6 ± 3.6 cm; women: 26.4±4.2 cm) JH was greater in men. Bilateral asymmetry (AI range 40 to -58%) was noted in IMP. AI was 33% in the KETO group and 30% in the CON group. CONCLUSION: A 6-week ketogenic diet did not affect the performance of short-duration high-intensity exercise. Our data does not support the hypothesis that ketogenic diets induce detrimental in the performance of activity that is anaerobic in nature. The current study took place over a 6 week period, allowing for keto-adaptation to occur; results may be different if a shorter time period were utilized.
with short distance sprinting which appears to define leg dominance in sprinting. There appears to be a dominant leg during sprinting and 2L jumping, which is not consistent across performance.

Board #86 June 2 8:00 AM - 9:30 AM
Acute Effects of Beta-Alanine on Exercise Performance Variables.
Emmanuel Lavarias, Zinong Li, Yunaee Lee, E. Todd Schroeder, FACSM. University of Southern California, Los Angeles, CA.

Beta-Alanine (BA) is converted to carnosine which serves to lower acid levels in the muscle by acting as an intramuscular buffer to H+ ions. BA supplementation may increase carnosine synthesis in muscle, leading to reduced muscle fatigue with exercise. PURPOSE: To determine the effects of an acute dose of BA (4 grams, 30 min before testing) on muscular power, muscular endurance and aerobic performance. METHODS: 21 recreationally active men (24.5±1.5 yrs, 1.8±0.1m, 79.2±9.3kg) and 15 women (25.7±2.2 yrs, 1.6±0.1m, 55.1±8.1kg) participated in a placebo controlled, double blind cross-over design study. Subjects were tested on 3 separate days with a 24-hour washout period between test visits. Subjects consisted of 4 tests done in the following order: vertical jump on a jump mat, repetition of 70% leg press and chest press max until failure, and a 4-kilometer time trial (4km) on a cycle ergometer. The first testing visit established the 1-repetition maximum on the leg and chest press and familiarization with testing procedures. Subjects were randomized to BA or placebo on the 2nd and 3rd visit. Comparisons of the effects of BA and placebo on exercise test values were made using two-way ANOVA with repeated measures (p<0.05). RESULTS: BA showed a significant increase from baseline in the number of reps performed on both the leg press (15.7±5.5 vs. 22.9±7.3 repetitions, p<0.001) and chest press (12.0±5.8 vs. 17.7±5.4 repetitions, p<0.001). Placebo showed a small non-significant increase from baseline in the number of reps performed on both the leg press (15.7±5.5 vs. 17.3±5.3 repetitions, p=0.055) and chest press (12.0±5.8 vs. 12.6±5.6 repetitions, p=0.059). The increases in the BA group were statistically different from the change in the placebo group (leg press, p=0.001 and chest press p=0.001). BA showed a significant increase from baseline in aerobic power (132.4±49.1 vs 144.0±48.8 Watts, p=0.001) during the 4km. Placebo showed a small non-significant increase from baseline in aerobic power (132.6±49.1 vs 134.3±49.4 Watts, p=0.080) during 4km. The increase in aerobic power in the BA group was statistically different from the change in the placebo group (p<0.001).

CONCLUSION: A single 4 gram dose of BA improves muscular endurance and aerobic power in recreationally active men and women.

Board #87 June 2 8:00 AM - 9:30 AM
The Influence of Different Walking Conditions on Walking Parameters
Tomoeaki Sakai1, Takahiro Nakano1, Kosho Kasugra1, Kazuo Oguri2,1.Nagoya Gakuin University, Seto, Aichi, Japan. 2.Gifu University, Gifu, Japan. 1.Gifu Shotoku Gakuen University, Gifu, Japan. 2.Gifu Shotoku Gakuen University, Gifu, Japan. (No relevant relationships reported)

PURPOSE: This study investigated the relationship between characteristics of walking parameters and walking parameters of different walking conditions. METHODS: The participants were 54 university students who had the habit of exercising (32 men and 22 women, 19.6±0.7 years). Participants were asked to walk on flat and sloped ground. On the flat ground, they were asked to walk freely with a subjective intensity of “Light (ratings of perceived exertion (RPE) 11)” and “Somewhat hard (RPE 13).” The average slope was 4% for both upward and downward conditions and participants walked freely on both. Participants wore a wearable device attached to the left wrist that measured their walking speed, cadence, stride, and heart rate. RESULTS: On the flat ground, in all walking parameters, RPE 13 showed significantly higher values compared to RPE 11 (walking speed: 5.35 ± 0.49 vs. 4.48 ± 0.43 km/h, cadence: 121.9 ± 8.8 vs. 133.0 ± 7.3 steps/min, 73.2 ± 6.8 vs. 65.8 ± 6.8 cm, respectively; P<0.05). On the sloped ground, walking speed on the upward slope showed significantly lower values compared to that on the downward slope and the free-walking speed on flat ground(upward slope: 4.85 ± 0.27 km/h, downward slope: 5.27 ± 0.38 km/h, flat ground: 5.25 ± 0.30 km/h). However, heart rate was significantly higher on the upward slope than in other conditions (118.8 ± 16.9 beats/min, 103.5 ± 14.0 beats/min, 107.8 ± 18.2 beats/min, respectively). Multiple regression analysis was performed with walking speed as the dependent variable and cadence and stride as independent variables. Results showed that for walking on the flat ground, the standardized coefficient for stride was higher than that for the cadence under all conditions. Although the same trend was found for walking on downward slopes, for walking on upward slopes, the standardized coefficient for cadence was higher than that for the stride. CONCLUSIONS: Walking parameters tended to be similar for walking on flat ground even when conditions changed; however, it became clear that characteristics of walking parameters on upward slopes varied from those of other conditions.

Board #88 June 2 8:00 AM - 9:30 AM
Physiological Performance Predictions Based on Simple Assessments

Muscular strength and cardiovascular capacity are important determinants of athletic performance. Fundamental assessments include lower body strength (e.g., squat max), upper body strength (e.g., bench press max), and aerobic capacity (VO2 max). For coaches who lack equipment to measure these parameters, it is important to know if there are feasible alternatives to accurately evaluate their athletes. PURPOSE: To determine if simple strength and aerobic assessments can be used in the place of equipment-intensive testing to evaluate college athletes. METHODS: Fourteen collegiate male rugby players were recruited and tested. Independent variables were age, height, weight, vertical jump, and 10-yard dash. Dependent variables were body fat percent (BF%) via hydrostatic weighing, bench press max, squat max, and VO2 max. Data were collected twice during the competitive season, one month apart. Multiple linear regression tested how well the simple assessments predicted the traditional performance measurements. RESULTS: On average, athletes were 19.6 years of age with a BMI of 25.2 kg/m2, 13.4% body fat, VO2 max of 45.5 ml/ kg/min, bench press of 186.7lb, squat max of 269.5lb, 10-yard dash of 1.7 seconds, and vertical jump of 22.2 inches. At baseline, BMI (p=0.001) and 10-yard dash (p=0.023) predicted BF% (R2=0.001). Significance was preserved at follow-up (R2=0.751; p<0.001). At baseline, holding age constant, 10-yard dash predicted VO2 max (β=−31.4; p=0.002); the model was significant (R2=0.714; p<0.004) and was strengthened at follow-up (R2=0.780; p<0.001). Holding age and BMI constant, 10-yard dash predicted bench press (β=−22.2; p=0.023); the model was significant (R2=0.732; p<0.001) and retained at follow-up (R2=0.750; p=0.000). At baseline, holding BMI constant, squat max was predicted by vertical jump (β=−8.9; p<0.005) and 10-yard dash (β=−263.5; p=0.013). The model was significant (R2=0.923; p<0.001) and retained at follow-up (R2=0.913; p<0.001). CONCLUSIONS: In a sample of college rugby athletes, age, height/weight, vertical jump, and 10-yard dash were sufficient predictors of BF%, bench press, squat, and VO2 max. Our results indicate that it may be reasonable for comprehensive athletic evaluation to be simplified to accommodate a lack of equipment.

Board #89 June 2 8:00 AM - 9:30 AM
Relationship Between Blood Clock Gene Expression, MEQ Score, and Exercise Performance
Karina Ando1, Masaki Takahashi2, Shigenobu Shibata1, Hideyuki Takahashi1, 1.Japan Institute of Sports Sciences, Tokyo, Japan. 2.Waseda University, Tokyo, Japan. (No relevant relationships reported)

PURPOSE: To examine the relationship between human clock gene expression, chronotype, and morning/ evening exercise performance. METHODS: Fifteen healthy young males were recruited for this study. The peak time of Period 3 (PER3) expression in hair follicle cells was evaluated as an indicator of the biological circadian rhythm and the Morningness-Eveningness Questionnaire (MEQ) score was used to determine the chronotype (morning, intermediate, or evening). Hair follicle cells were collected over a 24-h period at 4 intervals from 06:00 hours by firmly holding and pulling the facial hair root. Morning and evening exercise performance was evaluated using a beep test. The tests were performed at least one week apart using a cross-over design at 10:00 and 18:00 hours. As a physiological index, oral temperature was measured before exercise, and heart rate was measured before and during exercise. Partial correlation was used to examine the relationship between MEQ score and the peak time of PER3 expression, exercise performance, and oral temperature. Partial t-tests were used to compare physiological variables between morning and evening performances. RESULTS: There was a moderate positive correlation between the peak time of PER3 expression and r (r=0.811, p<0.001). Significant, positive correlation was found between the oral temperature at 10:00 and improvement in performance at 18:00 (evening performance) compared to that at 10:00 (r=0.735, P<0.05). There was no relationship between the MEQ score and performance. There was no significant correlation between the peak time of PER3 expression and the MEQ score. CONCLUSIONS: The present study suggested that the internal clock time evaluated based on gene expression may affect exercise performance. When the peak time of PER3 expression is late, performance may be higher at 18:00 compared to that at 10:00. Higher body temperature at 10:00 may be a good marker for higher performance at 18:00. Further research is required to investigate the relationships among circadian rhythm of clock gene expression, chronotype, and performance in competing athletes.
The relationship between relative intensity and changes in blood pH and ammonia are not well characterized. PURPOSE: The primary aim of the study was to determine how changes in relative exercise intensity following repeat sprint performance affect changes in blood pH and blood ammonia concentrations. METHODS: Healthy college-age males (n = 12) completed 30 second Wingate cycle sprint test as a familiarization trial. A minimum of 48 hours after the familiarization trial, participants returned to the lab. Resting venous and capillary blood samples were obtained to determine blood ammonia, pH, and lactate levels. Participants then completed 3 Wingate sprint tests, separated by 5 minutes each. Finger capillary blood was immediately obtained after each test to determine lactate and pH values. After the final test, an additional venous blood sample was obtained to determine blood ammonia values. RESULTS: Data are shown as 1st vs. 2nd vs. 3rd tests, respectively. There was a significant effect for time for peak power (750.08 ± 35.55 vs. 675.42 ± 30.01 vs. 615.60 ± 37.72 Watts); F = 4.66, p < 0.05, mean power (632.67 ± 30.71 vs. 561.25 ± 22.17 vs. 524.40 ± 26.46 Watts); F = 5.04, p < 0.04, (pH 7.72 ± 0.01 vs. 7.63 ± 0.02 vs. 7.62 ± 0.02); F = 70.18, p < 0.01, and lactate (12.36 ± 1.14 vs. 14.10 ± 1.33 vs. 16.95 ± 1.22 mmol/L); F = 42.02, p < 0.01, body temperature increased from pre-to-post exercise (33.03 ± 0.99 vs. 1.07 ± 0.22 mmol/L); t = 3.62, p < 0.01, but there was no correlation between post-exercise ammonia values and change in peak or mean power. There was a weak, but significant correlation between change in peak power and change in pH (R² = 0.34, p < 0.05) and change in mean power and change in pH (R² = 0.44, p < 0.02). CONCLUSIONS: Greater reductions in peak power and mean power correlated with change in blood pH, but not post-exercise ammonia values.

PURPOSE: This study investigated the impact of lower body temperature changes on neuromuscular function in elite Taekwondo athletes. METHODS: Twenty-eight Taekwondo athletes (15 males, 13 females; age: 22.8 ± 2.2 yrs, height: 172.7 ± 7.5 cm, body mass: 66.9 ± 6.7 kg) completed an experimental protocol that consisted of two trials. Each trial consisted of a familiarization trial and a main trial. A thermal dressing (5°C) was applied to the lower body of the participant for 30 minutes. The dressing was then removed and the subject rested for 10 minutes. After that, the subject performed 3 Wingate sprint tests, separated by 5 minutes each. Finger capillary blood was immediately obtained after each test to determine lactate and pH values. The order of the main trials was randomized. RESULTS: Calf skin temperature was 33.2±1.1 and 33.2±0.5°C before and 12.2±1.5 and 40.1±1.3°C after cooling and warming test, respectively. Hmax increased by cooling from 4.5±1.9 at rest to 5.6±1.7 mV (p<0.05) while no changes were noticed after warming (p>0.05). No changes were found in Mmax after both thermal treatments. H/Mmax ratio was increased after the cooling from 51.3±9.6 to 65.3±17.8% (p<0.05) while no changes were found in warming treatment (from 47.0±28.5 to 65.3±17.8%, p>0.05). Dynamic balance significantly increased after warming (p<0.05), but static balance was not changed after warming (p>0.05). Cooling decreased both static and dynamic balance. Drop Jump reduced by cooling from 53.3±12.9 to 45.1±11.0 cm, but other jump performances were not significantly changed after thermal treatments. CONCLUSIONS: Hmax, which represents neural activation, was increased after cooling. Mmax, which is directly related to muscle neuron activation, was not significantly changed by thermal treatment. These explain an increase of H/Mmax ratio after cooling. Cooling impacts on motor neuron pool activation. Balance and jump performances decreased after cooling, and dynamic balance increased after warming.

PURPOSE: The purpose of this study was to determine whether lower body temperature changes impact motor neuron pool activation. Balance and jump performances decreased after cooling, and dynamic balance increased after warming. Cooling impacts on motor neuron pool activation. Balance and jump performances decreased after cooling, and dynamic balance increased after warming.

RESULTS: These results indicate that wrestlers should train to react to a variety of contact pressures on the upper arm.
The ageing is a progressive process that reduces the functional abilities that affect the life in humans. Furthermore, studies have indicated that the ageing is associated with morphological changes in the hippocampus, the last condition seems induces cognitive deficiencies. PURPOSE: To determine the effect of a functional exercise training on cognitive performance and systemic BDNF in an elderly Mexican population.

METHODS: 19 elderly-healthy participants (Age = 69.1 ± 7.5 yr.; body weight (BW) = 74.3 ± 12.8 kg; height = 155 ± 0.7 cm; BMI = 29.7 ± 5.6 kg/m²) were recruited in this study. The subjects were randomly divided in two groups: Control (C; n=11; 10 women; 1 man) and Functional Exercise (FE; n=8; 6 women; 2 men). Before to start the FE program. The physical activity level (PA) and the years of education (YE) were determined in the groups. The PA was not statistically different in the groups (C: 6.24 ± 3.05 vs FE: 8.7 ± 1.49, p= 0.07). The YE was similar between the groups (C: 5.81 ± 1.5 vs FE: 6.9 ± 2.9 yr, p=0.3). After this, the FE program was applied. The protocol consisted in 36 sessions of aerobic and stretching exercises. 24 hours of exercise, the program the miniminal test and the 6-minute walking test (6MWT) was applied in the two groups. The systemic BDNF levels at basal state also were evaluated. RESULTS: The FE walked more distance in the 6MW test compared with C (C:274.3±4.2 vs FE: 274.3± 0.8 (p<0.01). There was a positive correlation between the distance walked in the 6MW test and the cognitive performance (r=0.68, p<0.01). Finally, FE showed lower systemic BDNF levels than C (C: 18 676 ± 2264 pg/ml vs FE 15 766 ± 204 pg/ml, p<0.01). CONCLUSION: The data of the present study suggest that FE to long-term improved the cognitive performance in older people. However, the last effect was not accompanied with a higher BDNF concentration in the periphery at least in a Mexican population.
CONCLUSION: Neither average off-season PL or PL-Min were able to predict changes in CMJ force-velocity parameters. The average volume and intensity of off-season practice sessions did therefore not affect the jumping ability of female Division I basketball players.

Impaired lower extremity muscle strength can put athletes at risk of injuries. Assessing the relationship between muscle strength and knee instabilities during overhead squat (OHS) can help prevent injuries of collegiate female athletes. Purpose: Examine the relationship between lower extremity muscle strength and the depth and knee wobbling during overhead squat (OHS). Methods: Eight in-season Division I collegiate women’s tennis athletes and 10 in-season Division I collegiate women’s basketball athletes (age: 18.94 ± 1.35 yrs, height: 1.75 ± 0.08 m, weight: 71.61 ± 14.05 kg) participated. Participants’ knee flexor, extensor, and hip abductor muscle strength were measured with a hand held dynamometer and the average of three trials was normalized by body weight (%BW). Participants then performed three consecutive OHS as low as possible and were video recorded for post processing from the frontal and sagittal planes. Following the assessment, participants were grouped into Above Parallel (AP) or Below Parallel (BP) depth and knee wobbling or no wobbling during OHS. Results: The mean differences of knee flexor, extensor, and hip abductor strength were compared for BP and AP groups. Three participants were grouped into BP and 15 were grouped into AP. An independent t-test showed significant differences of left hip abductor strength of AP (mean=17.82 ± 4.05 %BW), compared to BP (mean=21.67 ± 1.41 %BW); t(18)=–2.900, p= 0.016. No significant differences were found between muscle strength and knee wobbling. Conclusion: Overall, no relationship between knee wobbling and the lower extremity strength was found. However, there was a statistically significant relationship in OHS depth and hip abductor strength on the left side. Previous studies have demonstrated decreased hip abductor strength may cause patellofemoral pain syndrome (PFP) and knee valgus. Future studies should look at increasing hip abductor strength and its effects on PFP and knee valgus during functional movements.

Previously, ratings of performance self-efficacy (PSE) have been positively related to athletic performance. However, it has been proposed that sleeping dysfunction may disrupt PSE predictions. PURPOSE: Therefore, the purpose of this investigation was to examine the relationship between insomnia and hypersomnia on self-predicted acute one-repetition maximum (1RM) back squat performance. METHODS: Fifty-eight resistance-trained males (n=41) and females (n=17) (age: 23±3 yrs; body mass: 80.64±16.49 kg) completed the Oviedo Sleep Questionnaire (OSQ) prior to performing a 1RM back squat. Additionally, participants completed a PSE questionnaire regarding what they believed they were 100%, 75%, and 50% confident they could squat for a 1RM. Then following a brief dynamic warm-up, subjects completed a 1RM back squat protocol. The difference of each PSE value was then taken from the 1RM and converted to percentage (1RM-PSE) to assess differences between predicted and actual 1RM outcomes. Next, the 1RM-PSE value was converted to a percentage to determine the percentage difference between actual 1RM and predicted 1RM at each level of confidence. Pearson’s product moment correlations were used between the insomnia and hypersomnia subscales of the OSQ and the percentage 1RM-PSE difference at each confidence level. RESULTS: Participants squatted a greater amount than predicted at 100% (r=0.71; p<0.01), 75% (r=0.60; p<0.01), 50% (r=0.48; p<0.05) and 25% (r=0.34; p=0.02), but not at the 50% confidence level (r=0.21; p=0.12). Hypersomnia was inversely and significantly related to the 1RM-PSE percentage difference at the 50% confidence level (50%: r=-0.26, p<0.01) and approached significance at the 75% confidence level (r=-0.23, p=0.08). However, hypersomnia was not significantly related to the 1RM-PSE percentage at 100% confidence (r=0.18, p=0.18). The insomnia subscale was not significantly related to performance at any level of prediction confidence (100%: r=-0.04, p=0.79; 75%: r=0.07, p=0.63; 50%: r=-0.04, p=0.78). CONCLUSIONS: These results indicate that hypersomnia (i.e. acute excessive sleepiness) is associated with worse than predicted maximal strength performance in the squat at lower PSE confidence level. Therefore, acute sleep patterns should be considered as a readiness assessment.

Flexible resistance training programs allow for athletes to autoregulate daily training variables based upon readiness prior to the training session. Although factors such as physical recovery, anxiety, and sleep can affect acute performance there is no consensus regarding the best training evaluation to assess readiness to train. In fact, somatic and cognitive anxiety have been both positively and negatively related to athletic performance, thus the findings for these factors as readiness indicators are equivocal. The Revised Competitive State Anxiety Inventory-2 (CSAI-2) is a common scale which allows for the acute assessment of both anxiety traits. PURPOSE: Therefore, the purpose of this investigation was to examine the relationship between somatic and cognitive anxiety using the CSAI-2 scale on maximal repetitions performed at 70% of one-repetition maximum (1RM) in back squat. METHODS: Fifty-eight resistance-trained males and females (age: 23±3 yrs; body mass: 80.64±16.49 kg) completed the CSAI-2 questionnaire prior to performing a 5-minute dynamic warm-up and a 1RM back squat. Following 1RM testing, subjects had a standardized rest period of 10 minutes prior to completing two single-repetition sets on the squat at 30%, 40%, 50%, 60%, 70%, 80% and 90% of the established 1RM for which the data is included elsewhere. After the submaximal single repetition sets, subjects had a 10-minute rest period before completing one set on the back squat to volitional failure at 70% of the established 1RM. Pearson’s product moment correlations were then utilized to determine the relationship between somatic and cognitive anxiety subcales of the CSAI-2 to determine if any relationship existed with the number of repetitions completed at 70% of 1RM. RESULTS: Somatic anxiety (r=–0.20, p=0.13), cognitive anxiety (r=0.19, p=0.17) and self-confidence (r=0.05, p=0.72) subscales of the CSAI-2 were not significantly correlated with back squat performance during maximal repetitions to failure at 70% of 1RM. CONCLUSIONS: None of the CSAI-2 subscales were related with repetitions performed to volitional failure in the squat. However, we caution that this analysis did not examine maximal strength performance, and should only be applied to repetitions performed to failure at submaximal intensities.

Several psychological factors have been linked to acute strength performance through a variety of psychometric analyses. Recent research suggests that the “grittier” a person is, the greater their perseverance and passion for long-term goals. Although grit has shown promise in predicting long-term performance, the relationship between grit and acute strength performance is yet to be determined. PURPOSE: Therefore, the purpose of this investigation was to examine the relationship between grit as determined by the Short Grit Scale (Grit-S) and total repetitions performed to volitional failure at 70% of one-repetition maximum in the back squat. METHODS: Fifty-eight resistance-trained males and females (age: 23±3 yrs; body mass: 80.64±16.49 kg) completed a Grit-S prior to performing a one-rep max back squat (1RM). Following a 5-minute dynamic warm-up, subjects completed a validated 1RM back squat protocol. Following 1RM testing, subjects had a standardized rest period of 10 minutes prior to completing two single-repetition sets on the squat at 30%, 40%, 50%, 60%, 70%, 80% and 90% of the established 1RM for which the data is included elsewhere. After the submaximal single repetition sets, subjects had a 10-minute rest period before completing one set on the back squat to volitional failure at 70% of the established 1RM. A Pearson’s product moment correlation was utilized to determine any relationships between Grit-S total repetitions performed at 70% of 1RM. RESULTS: There was a wide range of repetitions performed to volitional failure (28–28) with an average of 14±4 repetitions. However, grit as determined by the Grit-S was not significantly related to total repetitions performed at 70% of 1RM in the back squat (r=–0.11, p=0.42). CONCLUSIONS: These results indicate that higher levels of grit are not associated

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with repetitions performed to failure and submaximal back squat intensities. However, we suggest that the Grit-S should be used to assess long-term commitment to athletic training as well as a possible indicator of chronically improved performance.

**RESULTS:** We followed the same players for a period of 5 years and we recorded their FT and PS, N = 414 (age 19.8 ± 1.3 yr; weight 89.9 ± 8.3 kg). Grip strength (GS), vertical jump height (VJ), and squat IRM (SQ) were examined with regards to batting average (% (bavg%)), slugging % (slg%), on-base % (ob%), earned run average (era), batting average against % (bavg-against%), and strikeout per innings pitched for 9 innings (so/ip)%.

**CONCLUSIONS:** The results indicate that FT correlates with PS. GS, VJ, and SQ appeared to provide the greatest predictive power of PS. FT accounted for 9% of the variance in era PS. Besides GS, VJ, and SQ, a prudent PT approach for performance coaches may be to also focus on improving other FT variables, such as bench press, standing long jump, 10-m sprint, back strength, and flexibility. This approach may translate to improved PS other than era PS.
Athletic ability, performance, and motor skills depend greatly on human proportionality. Practicing sports at a high level is associated with a person’s ability to meet the biomechanical demands of a particular sport or playing position. The ideal somatotype of athletes in different sports and within the same sport has been described. However, there is limited evidence regarding the association between the anthropometric characteristics, such as body weight (BW), body height (BH), and body fat % (BF%) of collegiate baseball pitchers and baseball performance statistics (PS). PURPOSE: To compare BW, BH, BF% and selected baseball-specific PS, such as earned run average (era), batting average against (b-avg-a%), and strike-out per innings pitched for 9 innings (so/ip)*9 in NCAA Division I pitchers; to examine the relationship between BW, BH, BF% and baseball-specific PS. METHODS: During a 5-year period, 210 collegiate pitchers (age 19.7 ± 1.2 y; weight 92 ± 8.2 kg) were assessed for body weight (BW), body height (BH), and body fat % (BF%). The following pitchers’ baseball statistics were collected: era, b-avg-a%, and (so/ip)*9. BW, BH, BF%, and PS were normalized to z-scores. Missing data were estimated from least squares prediction from non-missing variables. Forward multiple stepwise regression was used to evaluate the relative impact of BW, BH, and BF% on PS (IMP Pro 15).

RESULTS: BH is significantly correlated both with b-avg-a% (r=0.18, p=0.0104) and era (r=0.22, p=0.0101). BW is significantly correlated with (so/ip)*9 (r=0.22, p=0.0101). BF% is significantly correlated with era (r=-0.26, p=0.0472). Strike-out per innings pitched for 9 innings was selected as the independent variable with the highest goodness of fit significantly correlating with BW (p=0.0004), BH (p=0.0004), and BF% (p=0.0022) adjusted R=0.12.

CONCLUSIONS: The results indicate that BW, BH, and BF% of pitchers correlate with BW, BH, and BF%. The selected anthropometric variables accounted for 12% of the variance in (so/ip)*9. Runs are usually scored by hits. Coaches and trainers want pitchers to prevent runs. Therefore, they may need to account for other factors besides BW, BH, and BF%.

Individuals new to triathlon may have difficulty accurately predicting their finish time. Equations (Schabort et al., Hue et al.) have been developed that predict Olympic distance triathlon finish time. However, triathletes were elite level with a sample size of 10 or fewer, making it uncertain if they are applicable to a larger sample of amateur triathletes. An online calculator (QT2) is also available to predict triathlon times, but it has not been validated. PURPOSE: To assess the criterion and convergent validity of two scientific equations and the QT2 in predicting actual finish time of an Olympic distance triathlon for amateur triathletes. METHODS: Participants were collegiate, amateur triathletes who completed an Olympic distance triathlon during 2017. Participants performed six exercise tests, as close to their race as possible, either before or after, and all tests were performed on separate days. Body composition was assessed via BodPod. Three of the exercise tests (peak treadmill speed, 4 W/kg cycle, 30-minute bike/20-minute run) were used in the scientific equations. For these, participants visited the laboratory at Michigan State University or Eastern Michigan University on three separate occasions. Blood lactate was measured for each test. The remaining three exercise tests, which participants completed on their own (400y swim, 20-minute cycle, 5k run), were used in the QT2. Pearson correlations evaluated relationships for criterion and convergent validity. Eight amateurs could not complete the 4 W/kg cycle, so analyses were run with their data removed.

RESULTS: Twenty-seven triathletes (20.6 ± 2.0 years, 37.0% female, actual finish time 2:48:00 ± 0:34:32) have completed testing. The QT2 (r=0.865, p<0.001), Hue (r=0.883, p<0.001), and Schabort (r=0.392, p=0.05) were associated with actual finish time. The QT2 and Hue (r=0.859, p<0.001) and Schabort and Hue (r=0.394, p=0.05) were associated with each other. When athletes who modified the 4 W/kg cycle were removed from the analyses, relationships with Schabort disappeared.

CONCLUSIONS: The QT2 and Hue equation were closely associated with actual finish time. The QT2 involves easily accessible tests, unlike both scientific equations, which require blood lactate testing. Because of this, the QT2 may be preferred by amateurs.
The Effects of Simulated Altitude Masks on Aerobic Endurance in Trained Individuals
Melissa Renee Cook. Indiana Wesleyan University, Marion, IN. (No relevant relationships reported)

Oxygen-dependent exercise at altitude has demonstrated ability to increase maximal oxygen uptake over time. Traditional means of altitude training can be time-consuming and expensive, so alternative methods that simulate altitude exposure have been developed. These masks maintain that they induce the same cardiorespiratory fitness changes that an athlete training at altitude would experience. They also claim that these improvements occur in a shorter training period than typical altitude training protocols. However, there is little research to support these claims. PURPOSE: The purpose of this study is to measure the potential effects of training at a simulated altitude on aerobic endurance using a two-week YMCA cycle ergometer protocol. METHODS: Based on subjects’ VO_{2}max scores, 17 subjects were put into one of three groups, a control group (CG), a group training without the mask (No-mask), and a group training with the mask (Mask). Each training session had the participants cycle for twelve minutes, at 50-60% of their heart rate reserve (HRR), followed by a 3-minute cool-down. Eight training sessions were completed within two weeks. RESULTS: Using a 3X2 mixed ANOVA, for within subjects, there was a significant increase in VO_{2}max (F(1,2,14)=8.73, P<.05). Means ± SD for CG were pre 44.72±9.69 and post 45.07±8.96ml/kg/min. Means ± SD for no-mask group were pre 42.70±8.83 and post 44.10±11.74ml/kg/min. Lastly, the means ± SD for mask group means were pre 45.50±8.72 and post 47.91±8.96ml/kg/min. There were no significant differences in VO_{2}max between the control and experimental groups (F(1,2,14)=170, P>.05) either. Although between groups data was not statistically significant, there was a greater increase in the mask group’s aerobic endurance compared to the two other groups. CONCLUSION: When looking at the increase in VO_{2}max in response to a leg ergometer protocol, all three groups demonstrated an increase in VO_{2}max at the completion. Those who trained with simulated altitude masks showed the greatest improvement from pre- to post-testing, which could be a result of the mask use, in addition to the participant’s outside training. The improvement shown in the other two groups may be a result of the participants’ continued training outside of the study, as well as other factors.

Dynamic Strength Following Focal Knee Joint Cooling
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Focal knee joint cooling (FKJC) has been found to increase quadriceps strength during isometric contraction. It is unknown, however, if a similar response will follow by 2 minutes. RESULTS: Using a 3X2 mixed ANOVA, for within subjects, there was no significant increase in VO_{2}max (F(1,2,14)=.873, P>.05). Means ± SD for mask group were pre 44.72±9.69 and post 45.07±8.96ml/kg/min. Means ± SD for no-mask group were pre 42.70±8.83 and post 44.10±11.74ml/kg/min. Lastly, the means ± SD for mask group means were pre 45.50±8.72 and post 47.91±8.96ml/kg/min. There were no significant differences in VO_{2}max between the control and experimental groups (F(1,2,14)=170, P>.05) either. Although between groups data was not statistically significant, there was a greater increase in the mask group’s aerobic endurance compared to the two other groups. CONCLUSION: When looking at the increase in VO_{2}max in response to a leg ergometer protocol, all three groups demonstrated an increase in VO_{2}max at the completion. Those who trained with simulated altitude masks showed the greatest improvement from pre- to post-testing, which could be a result of the mask use, in addition to the participant’s outside training. The improvement shown in the other two groups may be a result of the participants’ continued training outside of the study, as well as other factors.

Sleep time influences lean body mass in dieting adults; sleep has not been demonstrated to influence anabolic processes in collegiate athletes. Longer sleep time is correlated with improved performance in sports.

Purpose: We followed 14 baseball players to describe sleep patterns and investigate their relationship to strength gains from weight training and performance parameters over a semester. Methods: The study was approved by Roanoke College IRB. 14 baseball players were chosen at random and agreed to participate. Body composition was determined pre and post study by bioimpedence. Sleep/wake time were recorded using Actigraph monitor. Participants followed standard pre-season conditioning & weight lifting regimen; 3 lift maximum pre and post study were recorded for biceps curl, dip, chest press, shoulder press, pull up and squat. Pitchers accuracy of fastball and skill pitches (curve, etc) were recorded during games. Results: 13 of 14 athletes completed the study. 1 withdrew due to injury. The players sleep profile showed a significant difference between the shortest (311±48 min/night) and longest sleepers (430±54 min/night) (p<0.05). For statistical evaluation, “short sleepers” (<6.0 hours, n=8) and “long sleepers” (>6 hours, n=5) categories were used. Body composition: long sleepers tended to gain less body fat (0.22 +/- 0.64%) compared to short sleepers (0.63 +/- 1.65%) but was not significant (p=0.61) Long sleepers had high strength gains in all 6 weight categories compared to short sleepers but changes were not significant (p=0.6). Pitching accuracy (strikes/total pitches) for fast ball correlate with night-before-performance sleep time, but were not significant. Conclusion: This study demonstrates remarkable variation of sleep time in baseball athletes over a semester; the shortest sleepers had about 180 fewer hours of sleep than longest sleepers. Pilot data on weight training and performance demonstrates interesting trends relative to sleep time, but the study is not powerful enough to generate statistically significant. Our body composition results agree with previously published data and suggest further study is warranted.

Numerous studies over the last decade have shown a relationship between countermovement vertical-jump (VJ) performance and training load in both competitive team-sport athletes as well as in elite runners. As such, VJ performance serves as a marker of neuromuscular fatigue. However, less clear is the degree to which this relationship persists in non-elite, recreational ‘run’ athletes. ‘Jump Test’ is a footwear-integrated self-testing utility that measures and analyses repeated-VJ performance. PURPOSE: To determine how repeated-VJ performance, as measured before each training bout by average flight time and monitored via ‘Jump Test’, varies with training load in recreational ‘run’ athletes over a six-week period. METHOD: Eleven moderately trained (1-6 runs/week, 10-60 miles/week; >3 months) subjects (2F, 9M; 33.6 +/- 4.5 years) were enrolled voluntarily. Subjects followed a six-week training program devised to monitor and manipulate training loads that could be deemed counter-productive to performance (i.e. induce over-reaching if not over-training). Training was divided into three 2-week phases: baseline training (BL), overload training (OL), and active recovery (AR). Each weekday subjects performed the ‘Jump Test’ and rated their perceived level of muscle soreness. Training data was collected and analyzed via the mobile application Under Armour, Connected Fitness. Chronic and acute training loads were computed. Training phase comparisons were made using paired t-tests.

RESULTS: VJ performance decreased progressively throughout the first week of OL (z-score, -0.2 +/-1.0, OL vs. 0.3 +/-0.8; BL, p < 0.01). Furthermore, reduced jump scores correlated with an increase in chronic training load (5.8 +/-3.8, OL vs. 3.1 +/-1).
2.5, BL: r = -0.45, p < 0.01) and an overall increase in subjects’ self-reported muscle soreness (2.7 ± 0.9, OL vs. 3.4 ± 1.0, BL; r = -0.3, p < 0.01) during that week.

CONCLUSION: Performance was measured with a shoe-borne, jump-testing utility in recreational athletes over six weeks of variable training load. It was found VJ performance fluctuates with training load and perceived muscle soreness. The close relationship demonstrated between jump scores and self-reported measures suggests ‘Jump Test’ is a practical tool for monitoring neuromuscular fatigue and informing training load.

Previous research has evaluated the quality of recovery from bouts of athletic events. Various measures have been used to assess recovery, yet most methods were somewhat problematic for rapid data collection. When costs are a limitation, it may be best to seek less expensive alternative methods of evaluating recovery. PURPOSE: To evaluate potential fatigue of collegiate ultimate frisbee athletes over two days of tournament play (TP) utilizing the perceived recovery status scale (PRSS) and ratings of perceived exertion (RPE). METHODS: Nineteen college-aged males participated in the study. Occurring over two days of TP, PRSS and RPE were recorded during 5 frisbee matches with each match separated by 30min. Two minutes prior to the first and second half, PRSS was recorded for each athlete and 2 minutes after each half, RPE was recorded. RESULTS: Significant differences occurred in PRSS with a decrease in values from the 2nd to the 5th matches (p = 0.006) and within the 2nd half of comparable matches (p = 0.031). No RPE recordings were significant. CONCLUSION: The results suggest that much of the variance in fatigue and fatigue-related measures occur between the 2nd and 5th matches of TP. The cumulative effects of fatigue during TP may have been a result of several potentially uncontrollable factors. Note, decreased perceived recovery could be related to the increased stress levels that occurred because of the amplified significance of the final match. Future research may evaluate other quantifiable recovery data (i.e. HRV and GPS) during tournament play.

The vertical jump (VJ) test is often used to assess an individual’s lower body peak power. The standard recovery time between subsequent jumps is typically 30 seconds (secs) with a completion of 3-6 jumps. Prior studies have reported no significant difference between 30 vs. 60 secs recovery on VJ performance. However, it may be possible that a shorter passive recovery (PR) period may allow for maintenance or improvements in jumping performance versus the standard recovery time and therefore, potentially contribute to a more time efficient testing session. In contrast to this, if an individual is not completely recovered before their next jump, it is possible that their performance may be diminished compared to earlier jumps. To the best of the researchers’ knowledge, the impact of a shorter PR period, such as 15 vs. 30 secs PR, on VJ performance has not been assessed. PURPOSE: To investigate potential differences between a 15 vs. 30 secs PR period on VJ performance in no less than averagely fit college-age males. METHODS: After measuring descriptive data (Ht., Wt., B%5±age), 31 averagely fit college-age males completed an 8 minute (min) 8.99 cm). PR, on VJ performance has not been assessed. PURPOSE: To investigate potential differences between a 15 vs. 30 secs PR period on VJ performance in no less than averagely fit college-age males. METHODS: After measuring descriptive data (Ht., Wt., B%5±age), 31 averagely fit college-age males completed an 8 minute (min) dynamic warm-up on a cycle ergometer. Subjects were given a 4 min PR during which their reach height was measured. Following the PR, four familiarization jumps were completed using a VJ measurement device. After another 4 min PR, the subjects completed 2 series of jumps, with 6 trials each, in a counterbalanced order with either 15 (FIF) or 30 (THI) secs of recovery between each jump. The FIF and THI jump series were separated by 6 min of PR. Excluding the first jump, the highest jump for FIF and THI were compared using Paired-Samples t-Tests with significant differences occurring at p < 0.05. RESULTS: Significant differences (p = 0.016) occurred between FIF (69.64 ± 8.61 cm) and THI (70.35 ± 8.99 cm). CONCLUSION: The current results suggest that 30 secs of PR between jumps is optimal recovery for performance during the VJ test, while 15 secs of PR may hinder peak VJ performance in averagely fit college-age males. Although THI was less than a centimeter above FIF, a sufficient number of subjects had improved performance during THI. Future research may assess the impact of 15 vs. 30 secs PR on VJ performance using highly fit collegiate athletes that use vertical jump as a sport specific movement.

The strength training is the most efficient modality to improve muscle volume and strength in health and disease. Recently, a new method of training including static stretching named Fascia Stretch Training (FST-7) has emerged. It is argued that the FST-7 could induce greater muscle swelling, known as an important hypertrophic stimulus. However, the acute responses to FST-7 have not been established. PURPOSE: To compare mechanical and metabolic responses from FST-7 with traditional strength training protocols.

METHODS: Twelve resistance-trained men (age: 29.0 ± 6.1 years; weight: 84.4 ± 10.3kg; height: 1.78 ± 0.01m) participated of the study. The volunteers attended to the laboratory in four non-consecutive days. The first session was used to familiarization with the testing procedures. On the following sessions, volunteers performed randomly one of the three training protocols: 1) FST-7: seven sets of 10 isokinetic knee extension with a 40-sec rest-interval and 20-sec of quadrieps static stretching; 2) Control (CON): seven sets of 10 isokinetic knee extension with a passive 40-sec rest-interval; and 3) Traditional (TRA): seven sets of 10 isokinetic knee extension with a passive 120-sec rest-interval. Total work (TW) of each protocol was recorded. Muscle swelling (MS) and blood lactate (BL) was measured before and after each exercise protocol. Repeated measures multifactorial ANOVA was used to analyze data.

RESULTS: On TW, there was a significant main effect for protocol (F = 23.84; p < 0.001). FST showed a lower TW (11823 ± 1755.06) than CON (13976.08 ± 2378.07) and TRA (15510.77 ± 2250.56). On MS, there was no significant protocol and time interaction (F = 0.380; p = 0.69). All protocols showed a similar increase in MS after treatment session (p < 0.001). On BL, there was no significant protocol and time interaction (F = 2.186; p = 0.14). All protocols showed a similar increase in BL after training session (p > 0.05).

CONCLUSIONS: FST, CON and TRA induce a similar increase in metabolic responses. However, FST produce lower mechanic stress than CON and TRA. These results suggest that FST may not be a superior stimulus than previous traditional strength protocols to induce muscle hypertrophy.
**3249 Board #118**

**June 2 8:00 AM - 9:30 AM**

**Could Knee Extension And Leg Press Exercises Induce Different Time Course Of Muscle Recovery?**


(No relevant relationships reported)

Single- and multiple-joint (MJ) resistance exercises are recommended for strength and hypertrophic gains. However, the levels of mechanical strain and hence muscle damage may be distinct between MJ and SJ resistance exercises. Studies comparing symptoms of muscle damage following MJ and SJ exercises are lacking. PURPOSE: This study investigated the time course of symptoms of muscle recovery after two knee extension exercises in resistance-untrained men.

METHODS: Seven men (25 ± 4 yrs) were randomly assigned to perform a unilateral MJ multiple-joint resistance exercise (i.e. leg press, LP) and a unilateral single-joint resistance exercise (i.e. seated knee extension, KE) with the contralateral limb. Participants performed 8 sets of 10 repetition maximum of both exercises with 2 min rest between sets. Muscle edema (ME), peak torque (PT), 1-legged countermovement (CMJ), and muscle soreness (MS) were measured pre, post, 24, 48, 72 and 96h following exercise.

RESULTS: ME of the rectus femoris returned to baseline at 48h after LP exercise, and at 24h after the KE exercise. ME of the vastus lateralis recovered at 24h after both exercises. PT recovered at 24h, and there was no difference between both exercises (p>0.05). CMJ returned to the baseline values 72h after the LP exercise, and 24h after the KE exercise. Muscle soreness of the rectus femoris was greater at 48h after KE when compared to LP exercise. There was no difference between exercises in the magnitude of MS response in vastus lateralis (p>0.05).

CONCLUSIONS: Resistance-untrained men experience different muscle recovery following LP and KE exercises. The MJ condition was more stressful for knee extensors muscles than SJ, taking more time to recover from muscle damage.

**3250 Board #119**

**June 2 8:00 AM - 9:30 AM**

**Assessment of Countermovement Jump Performance Recovery in Professional Soccer Players Using an Inertial Sensor**

Malachy P. McHugh, FACSM, Tom Clifford, Will Abbott, Susan Y. Kwiecien, 1, Filipe Dinato de Lima, 1, Joseph J. Devita, 1, Glyn Howatson, FACSM, 1 Nicholas Institute of Sports Medicine and Athletic Trauma, Lenox Hill Hospital, New York, NY. 1Newcastle University, Newcastle, United Kingdom. 1Brighton and Hove Albion F.C., Lancing, United Kingdom. 1Northumbria University, Newcastle, United Kingdom. (No relevant relationships reported)

Purpose

We recently demonstrated accelerated recovery of strength and more rapid resolution of pain in professional soccer players wearing phase change material (PCM) cooling garments post game. During that study, recovery of countermovement jump (CMJ) mechanics was assessed using a wireless inertial sensor (BTS G-Sensor 2, Brooklyn, NY). The purpose of this study was to compare recovery of CMJ mechanics between PCM and control and thereby determine if this sensor is useful for assessing recovery.

Methods

In a randomized, crossover design, 11 elite professional soccer players wore either PCM shorts cooled to 15°C (PCMcold) or ambient temperature (PCMamb; control) for 3 h after a game. CMJ performance was assessed pre game and at 12, 24, 36 and 48 h post game. The following metrics were assessed: flight height (calculated from time in air), jump height (flight height + difference between standing height and takeoff height), low force (unweighting during initiation of countermovement), countermovement (distance dropped during countermovement), force at end of countermovement, rate of force development, eccentric power, peak propulsive force, maximum power, and peak landing force. Data are expressed as % of baseline and analyzed with Treatment (PCMcold vs. PCMamb) by Time (Baseline, 12, 36, 60 h post game) repeated measures ANOVA.

Results

Over the 3-day post-game period PCMcold resulted in better CMJ flight height (PCMcold 104% of baseline, PCMamb 90%; P=0.007) and jump height (PCMcold 110%, PCMamb 95%; P=0.035). Other kinetic and kinematic measures were not different between PCMcold and PCMamb. Overall, low force was progressively higher on the days after the game (P=0.018, 55% higher at 60 h) indicating that players did not unweight themselves as much during the initiation of the countermovement. Additionally, peak landing force was progressively higher on the days after the game (P=0.012, 89% of baseline at 60 h). These effects on low force and landing force did not impair recovery of jump heights as jump heights had fully recovered by 60 h. Conclusions

**3252 Board #121**

**June 2 8:00 AM - 9:30 AM**

**Reproductibility of the RMSSD Index of Heart Rate Variability in Recovery After Exercise**

Lucieli T. Cambri, Jaqueline A. Araújo, César S.A. Mello, Geovane J. Tolazzi, Fabiula I. Novelli, Gisela Arsa. Federal University of Mato Grosso, Cuiabá, Brazil. (No relevant relationships reported)

Heart rate variability (HRV) is an important parameter that allows evaluates parasympathetic reactivation after physical exercise. However, because it is a cardiac phenomenon evaluated in non-stationary conditions, it is fundamental to evaluate its reproducibility in post exercise recovery. PURPOSE: To analyze whether the RMSSD index of HRV shows reproducibility in both passive and active maximal exercise recovery.

METHODOLOGY: Eleven young healthy (22.1 ± 3.2 years, 23.5 ± 2.3 kg/m²) and untrained men (36.1 ± 5.2 mL/kg/min) were evaluated. HRV was evaluated by LinRMSSD (heart rate monitors - transformed into a natural logarithm), which reflects the parasympathetic activity, after maximal progressive exercise (cycle ergometer) every 30s throughout the 10 min of test and retest of passive recovery (seated position) and active (5 min at 15W e then at 5 min passively) after exercise. The Shapiro Wilk test was used to test the normality of data, test T-Student’s and Wilcoxon were used to compare each recovery of test and retest (p<0.05). Intraclass correlation coefficient (ICC) was used to evaluate the relative reproducibility and standard error of measurement (SEM) and coefficient of variation (CV) to the absolute reproducibility.

RESULTS: There was difference between test and retest for LinRMSSD only at 120s (p =0.00) in passive recovery and at 420s (p = 0.04) in active. Reproducibility was observed to both recovery types - in passive recovery: very high at 90, 270, 330 and 420s and highly at 60, 120 to 240, 300 to 450, 510, 540, 600s (ICC: 0.72 - 0.89); at active recovery: high at 30, 150, 240, 270, 330 to 420, 480, 510 and 540s (ICC: 0.70 - 0.87) and moderate at 60, 120, 180, 210, 300, 450, 570 and 600s (ICC: 0.50-0.69). During passive recovery CV varied between 12.83 - 39.73% and SEM between 0.33 - 1.14 ms and during active recovery varied between 16.58 - 39.51% and 0.43 - 1.05 ms. CONCLUSION: The RMSSD index is reproducible in the better CMJ performance when players wore PCM cooling shorts post game is evidence of accelerated recovery. This inertial sensor provides a portable and practical means of assessing recovery in elite soccer players.
both passive and active recovery after maximal exercise in young men. Therefore, it can be used as a reliable index to evaluate cardiac parasympathetic reestablishment after maximal exercise. Supported by CNPq (process 443361/2014-2) and CAPES.

Self-efficacy (SE) is defined as an individual’s belief in their ability to successfully complete a task. According to SE theory, physiological and affective states can exert influence on efficacy beliefs, thereby affecting performance outcomes. Additionally, fluctuation in daily readiness can also impact performance outcomes due to factors such as stress, sleep problems, or poor physiological recovery from previous bouts of training. To evaluate daily readiness through the assessment of these performance factors, a variety of scales and questionnaires exist. One such assessment, the Perceived Recovery Status (PRS) scale, asks individuals to indicate how well recovered they feel on a 0-10 Likert scale. However, despite widespread usage of the PRS scale, no study has examined if pre-training recovery is indeed related to increased SE. PURPOSE: To investigate the relationship between recovery as indicated by the PRS scale and SE in resistance trained individuals prior to a one-repetition maximum (1RM) back squat test. METHODS: Fifty-eight resistance-trained males (n=41) and females (n=17) (age: 23.3±3 yrs, body mass: 80.6±16.4 kg) completed the PRS scale and a modified version of the Self-Efficacy Questionnaire for Athletes (mSEQ-A), prior to a 1RM back squat test. The mSEQ-A required participants to rate, on a 0-100 Likert scale, how confident they were that they could beat their previous back squat personal record by any load. Next, following a 5-minute dynamic warm-up, subjects completed a validated 1RM back squat protocol. A Pearson’s product moment correlation was used to determine any relationships between PRS ratings and SE beliefs. RESULTS: Mean PRS rating was 7.7±1.5, while mean mSEQ-A rating was 52.4±35.7. Regression analysis revealed that the PRS scale was significantly related to SE as determined by the mSEQ-A (r=0.39, p=0.05). CONCLUSIONS: The PRS scale was significantly related to SE. These findings reflect the fact that individuals who perceived themselves to be more well-recovered, also perceived themselves to be more likely to succeed in a 1RM test.

Electromagnetic field application (EFA) has demonstrated increased vasomotor regulation in the clinical population. It is unknown if EFA can positively influence subsequent anaerobic performance than passive recovery by analyzing blood lactate and anaerobic performance variables across Wingate tests. METHODS: Subjects completed an incremental test to determine their peak power output, and 50% of peak power was used as the active recovery intensity. A 15 minute recovery time frame was used. Blood lactate measurements were collected after the first Wingate, at five-minute increments of the recovery protocol, and after the second Wingate. RPE was also collected after each Wingate test. RESULTS: A significant interaction was found between recovery and time for blood lactate (F= 6.935, p = 0.000). Blood lactate levels were significantly lower for the active recovery trial at all time points of recovery, but no significant difference in performance was observed for any of the variables measured between the passive and active trials. CONCLUSION: Based on previous research, the lower lactate values and performance might not be as connected as previously thought. However, the lower lactate levels can still be beneficial to recovery after intense exercise and repeated attempts, but there may be no effect of blood lactate clearance on performance. It is possible that a buildup of H+ ions decreases muscle cell contractility enough for both recovery types that differences in performance between the two conditions are miniscule and therefore may be negligible when using the current parameters.

Impedance threshold devices (ITD) were initially developed to maintain blood pressure during battlefield trauma. By creating a greater negative intrathoracic pressure, venous return is enhanced (Ryan et al., 2008). Conortino et al. (2005) found that spontaneous breathing through an ITD increased stroke volume and cardiac output during the initial 10 s of standing from a squat position and was an effective countermeasure against hypotension initiated by the squat-to-stand test. PURPOSE: This study evaluated the efficacy of using an ITD during recovery following three consecutive 30 s, high-intensity exercise bouts on a bicycle ergometer. METHODS: Fifteen participants (11 men, 4 women, 24 ± 1 years-of-age, M ± SEM) completed two exercise conditions separated by at least 7 days: control (no ITD) and breathing through an ITD during recovery (ResQGARD®, Advanced Circulatory Systems, Eden Prairie, MN). Each exercise bout was performed with a resistance set at 60 g/kg body weight followed by a 4 min recovery between bouts. RESULTS: Ratings of perceived exertion ranged between 15 and 9.5 on the Borg scale of 20 during the three exercise bouts with ratings slightly lower during the ITD condition (F1, 14) = 4.774, p < .05. There was a significant interaction effect for ratings of perceived recovery (F3, 40) = 2.980, p < .05) with participants indicating they felt better recovered after bout 3 when using the ITD. There was also a significant interaction effect for mean power (F3, 29) = 3.842, p < .05) with power better maintained during bout 3 when using the ITD (416 ± 32 W vs. 400 ± 34 W for the control condition). In contrast, there were no significant effects of the ITD on peak power or blood lactate compared to the control condition. CONCLUSION: Using an ITD between repeated bouts of high-intensity exercise may help individuals feel better recovered and, thus, able to maintain higher mean power during subsequent exercise bouts.
Individuals are often instructed to use a foam roller as a warm-up (WU), despite a lack of evidence supporting performance enhancement claims attributed to foam rolling. Self-myofascial release (FR-SMR) is an alternative method employed by athletes to enhance performance; however, more research is required.

**Purpose:** To determine whether variations of an acute bout of FR-SMR WU will affect maximal muscular strength and power performance differently than a placebo SMR WU

**Methods:** Adult men (N=3) and women (N=3) [N=6, age=23.5 ± 3.39 years, height=66.08 ± 4.77 cm, and average mass=76.42 ± 17.57 kg] were recruited for the study. This study was an intra-participant design consisting of one condition comparing the impact of three different WU conditions on two performance tests. Each participant randomly performed one of the three WU conditions each day: 1) FR-SMR plus dynamic WU (FR-D), 2) FR-SMR only (FR), and 3) FR “shadowing” plus dynamic WU (noFR-D). The “shadowing” condition involved the foam rolling movements without the actual roller. Training routines were separated by a week, for a total of three weeks. The performance tests were completed after each WU in the following order: a countermovement squat jump (CMSJ) on a force platform and 10 repetitions maximum (10RM) bench press. The CMSJ was used to measure relative maximal power and the 10RM bench press was used to assess relative maximal strength. A one-way multivariate ANOVA was used to test significance in performance between WU conditions (p < 0.05).

**Results:** There were no significant differences in maximal strength or power between FR-D, FR, and noFR-D (relative maximum power: FR-D=54.93 ± 3.92 W/kg, noFR-D=56.03 ± 5.95 W/kg, FR=56.59 ± 4.08 W/kg; relative maximum strength: FR-D=0.83 ± 0.34 kg/kg, noFR-D=0.82 ± 0.33 kg/kg, FR=0.88 ± 0.36 kg/kg) (p=0.980).

**Conclusions:** Integration of FR SMR into a WU offers no additional benefits to produce maximal strength or power. While FR did not enhance maximal strength and power, FR did not appear to be detrimental to the production of maximal strength and power.

**References:**

- John Paul M. Arreglado, Samantha Silva, Edward Jo. *Cal Poly Pomona, Pomona, CA.*
- (No relevant relationships reported)
Muscle cross sectional area (CSA) has historically been used as a measure for skeletal muscle size, however, functional cross sectional area (FCSA), defined as the area of muscle isolated from adipose tissue within the CSA, is more closely associated with muscular health. The visible adipose tissue beneath the muscle fascia, defined as intramuscular adipose tissue (IMAT), has also been linked to metabolic abnormalities at increased levels in clinical populations. In contrast, in some healthy populations IMAT may be used as a fuel source for physical activity (PA) and dietary intake may influence IMAT.

PURPOSE: This study examined factors that predicted FCSA and IMAT in the knee extensors (KE) of younger and older men and women. METHODS: Ninety-eight participants (46 male, 52 female) were classified as younger (20-35 yr) and older (50-65 yo) as well as sedentary (< 2 days per week) and active (3+ days per week) based on self-reported age and concurrent resistance and aerobic exercise training status. All participants completed anthropology measurements, lower body muscle function testing, a 3-day dietary intake log, and wore an accelerometer for seven days. Participants then completed magnetic resonance imaging (MRI) scanning of the lower limbs. Muscle CSA was determined by manually tracing the KE and IMAT and FCSA were predicted based on total CSA.

RESULTS: IMAT (cm^2, Allison M. Barry^1, Sherri N. Stastny^1). Functional cross-sectional area (CSA) was 22% greater in the soleus and 15% greater in the plantaris (P<0.05), while myonuclei per fiber increased by 32% and 41% in the soleus and plantaris, respectively (P<0.05).

CONCLUSIONS: Normalized muscle wet weight and muscle CSA are returning towards baseline, while the fiber-type distribution shifted from slow-to-fast. Myonuclear density following detraining is currently being quantified. Myonuclear density following detraining is currently being quantified. Myonuclear density following detraining is currently being quantified.

PURPOSE: To determine if myonuclear accretion in skeletal muscle is permanent following a period of prolonged detraining after training utilizing a novel, progressive weight-centered wheel running (PoWeR) protocol. METHODS: PoWeR training involved the progressive addition of weight (2-6g) to an un-balanced running wheel over 8 weeks. Four month old female C57BL/6J mice (n=8-10/group) performed PoWeR, while another cohort performed PoWeR followed by 12 weeks of detraining. Age-matched ambulatory controls were used for baseline comparisons. Following training and detraining, the soleus and plantaris muscles underwent immunohistochemical analyses. RESULTS: Wet weight of the soleus muscles, when normalized to body weight (mg/g), was greater in the PoWeR trained mice when compared to the in the controls, 0.48 ± 0.05 and 0.36 ± 0.02, respectively (P<0.05). Similarly, normalized plantaris muscle mass was increased following PoWeR training (0.51 ± 0.04) when compared to the controls (0.58 ± 0.05; P<0.05). This resulted in a 32% and 14% increase in normalized wet weight after PoWeR in the soleus and plantaris muscles, respectively (P<0.05). Fiber cross-sectional area (CSA) was 22% greater in the soleus and 15% greater in the plantaris (P<0.05), while myonuclei per fiber increased by 32% and 41% in the soleus and plantaris, respectively (P<0.05).

Additionally, there was a fiber-type shift toward a more oxidative phenotype in the soleus and plantaris. After detraining, normalized muscle wet weight and muscle fiber CSA are returning towards baseline, while the fiber-type distribution shifted from slow-to-fast. Myonuclear density following detraining is currently being quantified. PoWeR provides a methodological advantage over exercise models currently used in mice since it is non-surgical, and elicits oxidative and hypertrophic adaptations in both slow-twitch and fast-twitch muscles. Moreover, the data gathered in this study will provide new insight into the plasticity of myonuclear number following detraining of hypertrophied muscles.

Resistance training (RT) increases the skeletal muscle mass and strength. It has been reported that activation of the mammalian target of rapamycin (mTOR) signaling, which is important for skeletal muscle protein synthesis, is attenuated by increasing exercise bout. However, the effect on proteolytic response is unclear. PURPOSE: The present study aimed to investigate the changes in proteolytic responses to repeated bouts of resistance exercise. METHODS: Male Sprague-Dawley rats were randomly assigned into four groups: Sedentary (SED), exercise-resisted with bout (1B), 2 bouts (2B), 3 bouts (3B). RT protocol consisted of 50 repetitions of maximal isometric contraction of the right gastrocnemius muscle by direct electric stimulation under anaesthesia. Muscle samples were taken immediately after each exercise session. RESULTS: Phosphorylation of p70S6K increased in all trained groups (1B: 15 fold, 2B: 10 fold, 3B: 8 fold; P<0.05). And there was also significant difference between 1B and 3B. The protein ubiquitination increased in all trained groups of 1.2-fold in SED (P<0.05). And Light chain 3 (LC3), which is a marker for autophagy, increased in all trained groups of 1.5-fold in SED (P<0.05). MurF-1 mRNA showed a significant 3.1-fold increase with training (P<0.05). However, there were no effect of repeated bouts of RT in muscle proteolytic response. CONCLUSIONS: The present results suggest...
that the muscle protein proteolytic response was activated by RT. In addition, the activation of mTOR signaling attenuated with the increase in RT bouts, but the level of activation of proteolytic response did not change.

METHODS: This study is based on a previous study, were healthy subjects performed three 30-s sprints with 20 minutes rest in between. Subjects ingested a flavoured drink containing EAAs and maltodextrin (nutrient-free) or only flavoured water (placebo) during the sprint exercise session up to 15 min after the last sprint in a randomized order with one month interval. Blood samples were collected before during and up to 200 minutes after the last sprint and were analyzed for EEA, insulin lactate and glucose. Human myoblasts were isolated from vastus laterals and differentiated into multinucleated myotubes, which were cultured with EAA isolated from 5 subjects from the sprint exercise study described above. Blood samples, obtained at 80 min after the last sprint, were chosen since the peak values for the accumulation of insulin and EAA occur approximately at that time point.

RESULTS: Both serum insulin (6-fold; P<0.05) and plasma leucine levels (2.6-fold; P<0.01) were higher after nutrient compared to placebo 80 min post-exercise. Plasma lactate and glucose levels did not differ between the conditions. Myotube size was 16% larger after exposure to post sprint exercise serum obtained during nutrient as compared to placebo (P<0.05).

CONCLUSIONS: Systemic factors may stimulate muscle hypertrophy after sprint exercise when combined with nutrient ingestion. If such a systemic effect may be counteracted by intracellular metabolic perturbations after sprint exercise is not known.

Comparison of resistance training (RT) methodologies is a critical component of determining appropriate and specific recommendations for health and human performance. Repetition maximum (RM) training typically consists of performing each exercise to momentary failure, thus providing a RM each day of training. Relative intensity based on sets and repetitions (RiSR) conversely uses a percentage of a maximum or estimated maximum, typically not leading to failure. PURPOSE: To compare 10-weeks RiSR or RM resistance training on skeletal muscle fiber size and protein accretion in well-trained subjects. METHODS: Fifteen well-trained males (age = 26.9±3.9yrs, body mass = 86.2±12.1kg) participated in the study (RiSR group, n=7; or RM group, n=8). Muscle biopsies of the vastus laterals were sampled 72 hours before beginning the intervention and again 72 hours after the final training. The 10-week RT program consisted of several phases: strength-endurance, maximum strength, a planned overreach, and a taper. The RM group achieved a daily maximum in each lift while the RiSR group used a variety of submaximal training loads not leading to muscular failure. Workloads measured by volume load were similar between groups (p=0.05). A 2x2 mixed design ANOVA and effect size using Hedge’s g were performed for Type I cross-sectional area (CSA), Type II CSA, myosin heavy chain (MYH2), MYH7, and MYH17. RESULTS: RiSR significantly increased: Type I CSA (p = 0.018) and Type II CSA (p = 0.012). None of the MYH proteins reached statistical significance for either group (p>0.05). Between-group effects favored the RiSR group for all variables: Type I CSA (p = 0.012), Type II CSA (p = 0.48), Type II CSA (p = 0.50), MYH1 (p = 0.31), MYH2 (p = 0.87), and MYH7 (p = 0.59). CONCLUSIONS: These results suggest RT utilizing a RiSR approach may provide superior intramuscular outcomes compared to RM training in higher level lifters.

Anterior cruciate ligament (ACL) injuries induce quadriceps muscle maladaptations that contribute to protracted weakness. We have previously shown negative morphological and cellular changes in the quadriceps following an ACL injury that promote a pro-fibrotic muscle environment. There are many unknown initiators and contributors to fibrotic pathways and understanding the mechanisms, cell types, and factors involved in the progression of fibrosis is critical for developing treatment strategies.

PURPOSE: To determine the contribution of myostatin to the development of a pro-fibrotic muscle environment following an ACL injury.

METHODS: We obtained muscle biopsies from the injured and non-injured vastus laterals of young adults (n=9), 3±1 y. Expression of myostatin, transforming growth factor-β and other regulatory factors were investigated. Immunohistochemical analyses were performed to assess fibrogenic cell expansion, and primary fibroblasts were isolated from muscle biopsies and subsequently treated with myostatin in vitro.
RESULTS: Injured limb skeletal muscle demonstrated an approximate 100% increase in myostatin gene (p < 0.005) and protein (p < 0.0005) expression, which correlated (p < 0.05) with fibroblast abundance in the injured limb. Human fibroblasts expressed the activin type IIB receptor, underscoring the regulatory ability of myostatin. Treatment with myostatin induced a 70% increase in the proliferative rate of primary human muscle-derived fibroblasts (p < 0.05).

CONCLUSIONS: These findings support an integral role for myostatin in promoting fibrogenic alterations within skeletal muscle following an ACL injury. Supported by NIH grants: K23 AR062069 and P30 AG028832 and the John Sealy Memorial Endowment Fund.

3270  Board #139  June 2 9:30 AM - 11:00 AM
Comparisons The Strength Performance of Sarcopenia Defined by AWGS & EWGSOP
Categories Among Elderly
Yu-Tzu Liu, Li-Lan Fu. National Taiwan Sport University, Taoyuan, Taiwan.

(NO relevant relationships reported)

PURPOSE: The aim of the present study was to identify a better criteria of sarcopenia for community-dwelling older Taiwanese.

METHODS: Sixty-two community dwelling people (48 men and 14 women) over 65 years were recruited from Taoyuan, northern Taiwan. Participants were interviewed by trained investigators using Short Portable Mental Status Questionnaire (SPMSQ) and Physical Activity Readiness Questionnaire. Body composition was measured by skinfold (SF) and Body Mass Index (BMI). Strength functional performances were obtained by sit to stand (SS), arm curl (AC), eight-inch walk (EW), grip strength (GS), knee strength (KS) using the standard procedures. Sarcopenia was defined according to the Asian Working Group for Sarcopenia (AWGS) and Report of the European Working Group on Sarcopenia in Older People (EWGSOP). One-way ANOVA test was used to compare the differences within groups.

RESULTS: Of the 62 subjects (76.79 ± 5.32 yrs), 18 were classified in sarcopenia group (ASG) and 44 were normal group (ANG) by AWGS. Ten were classified in sarcopenia group (ESG) and 53 were normal group (ENG) by EWGSOP. The strength performances were different in ASG and ANG, included in SS, AC, EW, GS left and GS right hand (p<0.05), except KS extension and flexion (p<0.05). The strength performances were also different in ESG and ENG, included in AC, EW, GS left and GS right hand, except SS, KS extension and flexion (p<0.05), as listed in Table 1.

CONCLUSIONS: Both AWGS and EWGSOP can effectively define sarcopenia in community-dwelling older Taiwanese, especial AWGS. Supported by NSC 97-2410-H-179-007-MY2.

Table 1. Strength performance different between Sarcopenia and normal elderly

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<tr>
<td>SS (times)</td>
<td>10.62 ± 4.05 *</td>
<td>13.87 ± 3.24</td>
<td>11.78 ± 4.28</td>
<td>13.76 ± 3.22</td>
</tr>
<tr>
<td>AC (times)</td>
<td>13.31 ± 7.00 *</td>
<td>18.30 ± 6.63</td>
<td>14.71 ± 6.64 *</td>
<td>18.29 ± 5.09</td>
</tr>
<tr>
<td>EW (second)</td>
<td>7.63 ± 2.33 *</td>
<td>6.08 ± 1.68</td>
<td>7.55 ± 2.87 *</td>
<td>5.94 ± 1.61</td>
</tr>
<tr>
<td>GS left (kg)</td>
<td>21.52 ± 3.65 *</td>
<td>29.82 ± 7.00</td>
<td>22.82 ± 7.00</td>
<td>30.24 ± 7.19</td>
</tr>
<tr>
<td>GS right (kg)</td>
<td>21.28 ± 2.90 *</td>
<td>30.71 ± 6.46</td>
<td>23.34 ± 4.57 *</td>
<td>30.94 ± 6.69</td>
</tr>
<tr>
<td>KS extension (kg)</td>
<td>20.23 ± 8.34</td>
<td>23.55 ± 6.10</td>
<td>22.29 ± 7.89</td>
<td>23.04 ± 6.25</td>
</tr>
<tr>
<td>KS flexion (kg)</td>
<td>12.52 ± 5.18</td>
<td>13.46 ± 3.57</td>
<td>13.83 ± 5.01</td>
<td>13.02 ± 3.43</td>
</tr>
</tbody>
</table>

3271  Board #140  June 2 9:30 AM - 11:00 AM
Long-term Physical Inactivity Exacerbates Hindlimb Unloading-induced Soleus Muscle Atrophy In Young Rats
Toshinori Yoshihara1, Takamasa Tsuchi1, Chang Shoo-wen1, Toshiharu Natsume1, Ryu Kagiki1, Noriko Ichinoseki-Sekine1, Shuichi Machida1, Takao Sugiraa2, Hisashi Naito1. 1Juntendo University, Inzai, Japan. 2Juntendo University, Bunkyo-ku, Japan. 1The Open University of Japan, Chiba, Japan. 2Yamaguchi University, Yamaguchi, Japan.

(NO relevant relationships reported)

Physical inactivity (sedentary lifestyle) in adulthood increases a degree of aging-related skeletal muscle weakness; however, it has been unclear whether long-term physical inactivity in childhood exacerbates subsequent disuse-induced skeletal muscle atrophy.

POURPOSE: This study investigated the effects of long-term physical inactivity in childhood on subsequent hindlimb unloading-induced muscle atrophy in rat soleus muscle.

METHODS: Forty-eight 3-week-old male Wistar rats were assigned randomly into control (CON, n = 24) or physical inactivity (IN, n = 24) groups. Rats in the IN group were housed in a narrow cage with half of the usual floor space to limit the range of their movement. After 8 weeks (12-week-old), the rats (CON & IN) were exposed to hindlimb unloading. The soleus muscles were quickly removed before 10 d, n = 6 (each group), 1 d, yd = 6 (each group), 3 days (3d, n = 6 each group) and 7 days (7d, n = 6 each group) after unloading. mRNA and protein levels were determined by RT-PCR and Western blot analysis. Statistical significance was established at p<0.05.

RESULTS: Although 7-days of hindlimb unloading significantly decreased soleus muscle weight (CON, -28%; IN, -33%, p<0.05), the decrease was drastically in IN group (Inactivity × Unloading, p = 0.0009). A significant interaction between inactivity and unloading (p<0.01) was observed on the HDAC4 and NF-κB protein expressions. The HDAC4 and NF-κB expressions in the IN group increased significantly 1 day after onset of hindlimb unloading (CON; 1.4 and 1.2, IN; 5.1 and 2.7 fold change from each 0d, respectively). Moreover, their downstream targets Myogenin and MubRF1 mRNA levels were upregulated by long-term physical inactivity (Inactivity × Unloading, p<0.05).

CONCLUSIONS: Our data suggest that long-term physical inactivity exacerbates hindlimb unloading-induced disuse muscle atrophy in young rat soleus muscle, which may be mediated by HDAC4 and NF-κB-induced MuRF1 mRNA upregulation. Supported by JSPS KAKENHI Grant Number 17K01765.

3272  Board #141  June 2 9:30 AM - 11:00 AM
Blood Lipid is Associated with Skeletal Muscle PPARδ Protein Content after a 10-week Resistance Exercise Training
Vincent C.W. Chen1, Chang Wook Lee2, James D. Fluckey1, Steven E. Riechman3. 1Georgian Court University, Lakewood, NJ. 2University of Houston-Victoria, Victoria, TX. 3Texas A&M University, College Station, TX.

(NO relevant relationships reported)

Peroxisome proliferator activated receptors (PPARs) are main regulators of blood lipid profile while PPARδ is the most abundant PPARs isoform in skeletal muscle. Although skeletal muscle is a major player in lipid metabolism, the association between muscle PPARδ and blood lipid profile is currently unknown.

PURPOSE: The purpose of this study was to investigate the association between muscle PPARδ protein content and blood lipid in the context of resistance exercise training.

METHODS: Fifteen untrained, healthy young men (n=8) and women (n=7) performed a 10-week progressive whole-body resistance exercise training program. Muscle samples were obtained from the vastus lateralis muscles 24 hours before the first exercise and 24 hours after the last exercise. Blood samples were collected from antecubital veins immediately before the first and the last exercises. Western Blotting was conducted to quantify the PPARδ protein content, and serum lipid profile was analyzed.

RESULTS: While PPARδ protein content was not correlated with blood lipid profile before the training, it was negatively correlated with total cholesterol (R=-0.731, R-square=0.534, P=0.04) and LDL (R=-0.746, R-square=0.557, P=0.033) after the training.

CONCLUSION: The results imply that resistance exercise training may enhance the regulation of blood lipid via PPARδ.

3273  Board #142  June 2 9:30 AM - 11:00 AM
Comparing The Effects Of Nexeutrine And Exercise In Modulating The Pathophysiology Of cachexia In Treatment Naive Prostate Cancer Mouse Model
Darpan Patel, Derek Wallace, Kira Pamerleau, Paul Rivars, Nicolas Musi, A Pratap Kumar. University of Texas Health Science Center at San Antonio, San Antonio, TX.

(NO relevant relationships reported)

Oncologists encourage nutritional and physical interventions to improve outcomes in cancer patients with cachexia; however, it is inconclusive how these interventions

Abstracts were prepared by the authors and printed as submitted.
affects the pathophysiology of cachexia. **PURPOSE:** To compare the effects of Nextrixine™ (Nex; a natural bark extract of the Amur cork tree) and exercise in modulating the pathophysiology associated with cachexia in treatment naïve transgenic adenocarcinoma of mouse prostate (TRAMP) model. **METHODS:** Forty-five, 10-week old male TRAMP mice were randomized to control (Con), Nex (600 mg/kg pelletled into chow) or exercise (Ex; voluntary wheel running). At 4, 8, 12 and 20 weeks, gastrocnemius muscle was collected to quantitate intramuscular IFG-1, myostatin, TNF-α, proteolysis-inducing factor (PIF) and ubiquitin (Ub). An ANOVA with Tukey’s post hoc test was done with significance set at p<0.05. **RESULTS:** Analysis of gastrocnemius mass revealed significant group differences (F=4.159, p=0.02) with both Nex and Ex groups having greater mass compared to Con (p<0.05). A treatment response was observed for myostatin (F=4.762; p=0.01), PIF (F=8.633, p<0.001) and Ub (F=19.55, p<0.001). Specifically, Ex mice had significantly lower concentrations of myostatin, PIF and Ub compared to Con (p<0.01). Group comparisons at 20 weeks showed significantly lower concentrations of PIF (F=22.85, p<0.001) with Ex (p<0.001) and Nex (p<0.03) significantly lowering PIF concentrations compared to Con. Time point comparisons for Ub revealed significant differences at weeks 4 (F=32.35, p<0.001) and week 8 (F=6.24, p<0.002), respectively, with Ex mice having significantly lower concentrations of Ub compared to Con mice (p=0.004) at both time points. **CONCLUSION:** The results of this study suggest that Nex and Ex similarly maintain muscle mass in treatment naïve TRAMP mice by reducing tumor specific cachetic protein PIF. Exercise was capable of reducing downstream Ub; however, the mechanisms by which Nex elicits a protective effect require further study.

**3274 Board #143 June 2 9:30 AM - 11:00 AM Dietary Protein Intake and Muscular Health with Aging: Countermeasures for Sarcopenia and Dynapenia**

Kara A. Stone,1 Christopher J. Kotarsky,1 Nathan D. Dicks,1 Daniel M. Streeter,1 Allison M. Barry,1 Kyle J. Hackney,1 North Dakota State University, Fargo, ND. University of Wyoming, Laramie, WY. University of Utah, Salt Lake City, UT.

(*No relevant relationships reported*)

Protein intake and aerobic and resistance exercise have been suggested as effective stimuli for muscle growth and function in the young and old. However, the magnitude of these stimuli combined is not completely understood. **PURPOSE:** To examine relationships between total protein intake and combined aerobic and anaerobic training on muscle size and strength in sedentary and active adults. **METHODS:** A total of 98 subjects were divided into the following groups: active younger females (AYF), sedentary younger females (SYF), active older females (AOF), sedentary older females (SOF), active younger males (AYM), sedentary younger males (SYM), active older males (AOM), and sedentary older males (SOM). Subjects completed an assessment of knee extensor peak torque (KEPT), a 3-day dietary intake log, and magnetic resonance imaging (MRI) scan for muscle cross-sectional area analysis of the right quadriceps (CSAq). Two stepwise regression models were used to examine the relationship of gender, protein intake, activity level, and age, with CSAq and KEPT. **RESULTS:** Mean differences are displayed in the table below. Gender, protein intake, age and physical activity were predictive for CSAq (F (9, 93) = 11.798, R² = 0.725, p < 0.01). Additionally, gender, age, and physical activity were predictive for KEPT (F (1, 94) = 14.309, R² = 0.631, p < 0.01). **CONCLUSION:** The results suggest that changes in skeletal muscle size and strength are related to differences in age, gender, total daily protein intake, and physical activity. Furthermore, concurrent exercise appears to be an intervention to potentially mitigate sarcopenia and dynapenia in older adults.

<table>
<thead>
<tr>
<th>Group</th>
<th>CSAq (cm²)</th>
<th>KEPT (N-m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AYF</td>
<td>28.5 ± 7.3</td>
<td>75.5 ± 32.99</td>
</tr>
<tr>
<td>SYF</td>
<td>25.4 ± 7.5</td>
<td>58.4 ± 32.99</td>
</tr>
<tr>
<td>AOF</td>
<td>24.3 ± 7.5</td>
<td>65.4 ± 32.99</td>
</tr>
<tr>
<td>SYM</td>
<td>21.5 ± 7.5</td>
<td>74.5 ± 32.99</td>
</tr>
<tr>
<td>AOM</td>
<td>19.5 ± 7.5</td>
<td>71.5 ± 32.99</td>
</tr>
<tr>
<td>SOM</td>
<td>18.5 ± 7.5</td>
<td>64.5 ± 32.99</td>
</tr>
</tbody>
</table>

*d denotes significance from AOF, † denotes significance from AYM, ‡ denotes significance from SYM, ‡‡ denotes significance from AOM, ‡ denotes significance from AOF, /* denotes significance from CSAq, †† denotes significance from SY, †‡ denotes significance from AOM, †‡‡ denotes significance from AOF. All significance levels set at p<0.05.

Funding: Sanford Health/ NDSU Collaborative Research Seed Grant Program

**3275 Board #144 June 2 9:30 AM - 11:00 AM Constant And Progressive Resistance Exercise Reduces Anabolic Signaling But Increased Myofiber Hypertrophy In Human Skeletal Muscle**

Dr. Sebastian Gehlert, Universität Hildesheim, 31143 Hildesheim, Germany.

(*No relevant relationships reported*)

**PURPOSE:** To determine the effects of progressive (PR) and constant (CO) loading induced by resistance exercise (RE) on anabolic signaling, myofibrillar damage and selective type I and II myofiber hypertrophy when RE is prolonged and interrupted over time. **METHODS:** 15 healthy male subjects (24 ± 3 years) conducted six weeks of progressive (PR) (n=8) or constant (CO) (n=7) RE on a leg extension and leg press machine. Subjects conducted in sum 14 training units with 3 training sessions per week. Each session consisted of 3 sets with 10-12 repetitions on each machine. At baseline (T0) after the 1st (T1), 3rd (T2), 7th (T3), 10th (T4), 13th (T5) and 14th (T6) RE session, skeletal muscles biopsies from vastus lateralis muscle were collected at 45min post RE. Subjects of PR increased RE load by 5% each week while in the CO group RE-load was constant. Continuous training was performed up to T5 and stopped for 10 days followed by a final T14. **RESULTS:** In PR and CO increases in p70S6k and rpS6 phosphorylation (P<0.05) were detected at all time points (T1-T6) compared to T0. However, rpS6 and p70S6k was decreased from T1 to T4 in PR (p=0.05) but not in CO. Reduced signaling recovered after pausing RE in PR with an increase from T5 to T6 (p<0.05). Myofibrillar damage was increased in PR and CO (p<0.05) at T1 but gradually decreased up to T5 in both groups. There was a tendency for lower myofibrillar damage in PR at T4 and T5. Type I myofibers showed increased myofiber diameter (8%) at T3 (p<0.05) with no group differences. Type II fibers increased (12%) in both groups (p<0.05) but more in PR than CO at T5 (p<0.05). **CONCLUSIONS:** While PR offers increased potential for type II myofiber hypertrophy and increases sarcomeric stability over the time course of repeated RE compared to CO, it is associated with decreased anabolic signaling upon repeated RE stimulation. Anabolic signaling does not reflect structural adaptability but its decreased sensitivity towards loading.

**3276 Board #145 June 2 9:30 AM - 11:00 AM Amino Acid Transport and Metabolism Alterations Following 12 Weeks of Resistance Training with Supplementation**

Paul A. Roberson1, C. Brooks Mobley1, Cody T. Haun1, Petey W. Mumford1, Matthew A. Romero1, Wesley C. Kephart1, Shelby C. Osburn1, Christopher G. Vanni1, Christopher M. Lockwood1, Michael D. Roberts1, Auburn University, Auburn, AL. 2Lockwood, LLC, Draper, UT.

(*No relevant relationships reported*)

**PURPOSE:** Amino acid transporters within skeletal muscle have gained attention for their potential role in stimulating muscle protein synthesis (MPS). The purpose of this study was to determine if amino acid transporters and proteins involved in amino acid metabolism are related to skeletal muscle hypertrophy following resistance training with different nutritional supplementation strategies. **METHODS:** 43 untrained, college-aged males were separated into a Multidextrin Placebo (PLA, n=12), Leucine (LEU, n=14), or Whey Protein Concentrate (WPC, n=17) group and underwent 12 weeks of total-body resistance training performed 3 days per week while supplementing twice daily. Each group’s supplement was standardized for total energy, fat, and LEU and WPC groups were standardized for total Leucine (6 g/d). Skeletal muscle biopsies were obtained prior to training (PRE) and ~72 h following subjects’ last training session (POST). **RESULTS:** LAT1 protein levels demonstrated a time effect (p<0.001; 3.01-fold increase) and group effect (p=0.043), whereby PLA increased significantly more than LEU and WPC (p<0.05; 5.01-fold vs. ~2-fold increase). A time effect was observed for PAT1 (p=0.047; 1.36-fold increase) and BCKDHA (p<0.001; 1.81-fold increase) protein levels, while SNAT2, BCAT2, and ATF4 protein levels were unchanged (p>0.05). Changes in muscle fiber cross sectional area (CSA) induced by resistance exercise (RE) on anabolic signaling, myofibrillar damage and selective type I and II myofiber hypertrophy when RE is prolonged and interrupted over time.
Ghrelin attenuates muscle atrophy in tumor-bearing mice

Haiming Liu, Jose M. Garcia.
University of Washington, Seattle, WA.

(Congression relationships reported)

Cachexia is a multi-organ syndrome characterized by muscle and fat wasting. Ghrelin is a hormone known to release growth hormone and to stimulate appetite by binding to its receptor growth secretagogue receptor (GHSR)-1a. However, recent data suggest that not all effects of ghrelin are mediated through this receptor.

**Purpose**: To investigate if ghrelin attenuates cancer-induced muscle atrophy in a GHSR-1a-independent manner.

**Methods**: Resistancetrained young male C57BL/6J mice weighing 22±3 g Skeletal (4×3) were fasted 24 h following sacrifice. Serum ghrelin and body mass were measured 0.5 h after gavage with ghrelin (20, 100, or 500 μg/kg) or vehicle. Lean body mass (LBM) and fat mass were measured by NMR before tumor inoculation and 1 wk later. Tumor-bearing mice were randomized from baseline to receive one of two daily treatments: ghrelin (200 μg/kg, s.c.) or vehicle. Body composition was measured by NMR 2 wk after tumor inoculation.

**Results**: Tumor implantation induced a significant decline in body weight and fat mass. Ghrelin treatment attenuated the decrease in LBM (r = 0.760, p < 0.01) and FFM (r = 0.714, p < 0.05) but was higher in HIR versus LOR both pre- and post-intervention.

**Conclusion**: No systemic intramuscular hormones are related to RET-induced skeletal muscle hypertrophy in response-trained young men. Instead, these data demonstrate that intramuscular androgen receptor content may be an important component of the individual variation between high- and low-hypertrophy responders to RET.

Supported by NSERC of Canada grant to SMP and trainee award to RWM.
The studies with handgrip strength have been using the protocol of American Society of Hand Therapists (ASHT), in which the elbow is maintained flexed at 90°. However, people with Parkinson’s disease (PD) show general loss of strength and the contraction of the muscles used to sustain this position may be not possible and may reduce the value of handgrip strength. PURPOSE: To investigate if there is difference in handgrip strength in people with PD between the two elbow positions: flexed (ASHT protocol) and extended. METHODS: Handgrip strength was measured in both arms in 31 persons (22 men and 9 women), age 66.06 ± 8.48, diagnosed clinically with PD and with the elbow at two positions: flexed (ASHT protocol) and extended. Conclusions were made using paired t-test and clinical effect with test of Cohen. A p-value of <0.05 was adopted. RESULTS: Handgrip strength of the right arm with the extended elbow was similar to that obtained with the flexed elbow (p > 0.05; d = -0.12). There are not statistical difference between elbow positions in both arms side.

<table>
<thead>
<tr>
<th>Side</th>
<th>Elbow in Extension (Mean ± SD)</th>
<th>Elbow in Flexion (Mean ± SD)</th>
<th>p</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>31.48 ± 8.72</td>
<td>29.61 ± 8.63</td>
<td>0.64</td>
<td>-0.04</td>
</tr>
<tr>
<td>Left</td>
<td>28.58 ± 8.30</td>
<td>29.61 ± 8.63</td>
<td>0.07</td>
<td>-0.12</td>
</tr>
</tbody>
</table>

**p** = significantly; **d** = Cohen test

**CONCLUSIONS:** There are no differences between elbow positions, people with PD can do handgrip strength with elbow in extension if will be more comfortable.

In addition to motor deficits, cognitive issues are common among individuals with Parkinson’s disease (PD). Executive function plays an important role in performing multi-tasks, such as dual task walking (DTW). Compromised gait and cognitive functions are often observed in people with PD when they perform DTW, which can affect their activities of daily living. Limited research examined the brain activity during DTW in people with PD.

**PURPOSE:** To analyze cortical hemodynamics of the prefrontal cortex (PFC) during DTW in individuals with PD. METHODS: 11 individuals with PD (aged 72.8 ± 5.53) and 10 controls (71 ± 10.56) participated in this cross-sectional study. All participants completed a series of walking trials under three test conditions including usual walking (W), walking with serial three subtraction (WS3), and walking with foot angle (FA) were examined during both trials. An unpaired, Welch’s t-test was applied to compare the mean differences in duration, timing, and magnitude of activation for these muscles during each step. CONCLUSION: Uniformity of the timing and magnitude of muscle activation was related to gait patterns in individuals with PD. Increased step to step variability of MG, BF, and MH activation and timing suggested a less stable gait pattern with functional consequences in people with PD.

**RESULTS:**

- Values from W to WS3 by 39.6% as well as from W to WQA by 26.7% but no change in compared to LSW.
- Table 1 - Comparisons between elbow positions.

**Analysis of Cortical Hemodynamics During Dual Task Walking In Individuals With Parkinson’s Disease**

Takuto Fujii, Taeyou Jung, Ovande Furtado, Travis Watkins, Justin Shumueee, Emui Lee. California State University, Northridge, Northridge, CA.

**No relevant relationships reported**

**DIFFERENCES IN MUSCLE ACTIVITY DURING CYCLING IN HEALTHY AGING AND PARKINSON’S DISEASE: PILOT**

Rebecca J. Daniels, Christopher A. Knight. University of Delaware, Newark, DE.

Coordination in cycling, defined by EMG burst timing, is well studied in healthy adults and trained cyclists. Limited is known about these parameters in older adults (OA) and people with Parkinson’s disease (PD), though cycling is a commonly prescribed exercise modality in these populations. PURPOSE: To investigate muscle activity patterns during cycling in OA and PD compared to healthy young adults (YA). It was hypothesized that people with PD would exhibit less discrete bursts, evidenced by prolonged burst duration, compared to OA and YA. METHODS: Participants were 4 OA (73.3 ± 4.9 years, BMI = 27.2 ± 5.7 kg/m², 3 males), 6 adults with PD (71 ± 11.9 years, BMI = 30.7 ± 7.3 kg/m², 6 males, Hoehn & Yahr stage 1-3), and 5 YA (21 ± 1.6 years, BMI = 22.6 ± 1.8 kg/m², 4 males). Electromyograms (EMG) were recorded from the vastus lateralis (VL), medial vastus (VM), biceps femoris, soleus (SO), tibialis anterior (TA), and rectus femoris (RF) of the dominant leg during recumbent bicycling. Subjects cycled at 60, 80, and 100 revolutions per minute (RPM) at the lowest resistance setting. EMG was rectified and normalized to the peak EMG during the 80 rpm condition in each muscle. A 4th order low pass Butterworth filter with a cutoff of 7 Hz was used to create linear envelopes. Timing of the EMG burst onset and offset were calculated in relation to top dead center, as well as EMG burst duration over 10 revolutions per subject in the 60 and 100 RPM conditions. A 2x3 repeated measures analysis of variance was used to compare the timing of EMG activity for each muscle between the 60 and 100 rpm conditions among the groups. Significance was set at p < 0.05. RESULTS: There were no significant group by cadence interactions. Cadence effects were observed in burst duration of TA (F = 9.53, p < 0.01), SO (F = 12.98, p < 0.01), VL (F = 10.97, p < 0.01), RF (F = 6.21, p < 0.01), and GA (F = 7.89, p < 0.01). Compared to YA, people with PD had 86.6° longer burst durations in TA (F = 6.34, p < 0.01), 69.1° in VL (F = 8.73, p < 0.01), and 65.7° in GA (F = 5.57, p < 0.01). CONCLUSION: Although preliminary, these results suggest that increased burst durations in key muscles during cycling alter coordination in people with PD.

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Dynamic balance is often impaired in people with Parkinson’s Disease (PD). Control leading to and during a turn for people with PD further challenges dynamic balance and is a common contributor to a loss of balance. During a task with a turn, people with PD modify walking patterns in order to maintain dynamic balance. These modifications, however, may vary among people with PD. Identification of walking behaviors that contribute to impaired dynamic balance is key to improve function and development of balance-focused interventions for people with PD.

**PURPOSE:** To determine differences in spatiotemporal measures between straight-line walking and walking with a turn in people with PD.

**METHODS:** Ten adults with PD (28±8M, age: 69.9±8.9; height: 169±6.8;1 cm; weight: 75.3±8.3 kg) walked across a 6 m pressure sensitive walkway in 1) a forward direction (F) and 2) a forward walk including a 180° turn (T). The right (R) leg was identified as the OGT leg and the left (L) leg identified as the IN leg. Participants were categorized based on time to complete the Timed Up and Go (TUG) test. Five adults had TUG times faster than the mean, 9.27, and five were slower. Step length (SL), width (SW), and foot angle (FA) were examined during both trials. An unpaired, Welch’s t-test was used for analysis by groups.

**RESULTS:** Those with faster TUG times had larger SL (L: p < 0.0006; R: p < 0.0004) and SW (L: p < 0.0004; R: p < 0.0008) bilaterally during F trial compared to slower. During the T trial, the faster group increased SL bilaterally (L: p < 0.0022; R: p < 0.001) and SW (L: p < 0.0004; R: p < 0.0008) bilaterally during F trial compared to slower. Dynamic balance is often impaired in people with Parkinson’s disease (PD). Control leading to and during a turn for people with PD further challenges dynamic balance and is a common contributor to a loss of balance. During a task with a turn, people with PD modify walking patterns in order to maintain dynamic balance. These modifications, however, may vary among people with PD. Identification of walking behaviors that contribute to impaired dynamic balance is key to improve function and development of balance-focused interventions for people with PD.
CONCLUSIONS: Individuals with faster TUG times demonstrated increased SL, SW, and reduced RFA during straight-line walking. Individuals with decreased SW may have compensated for impaired stability by decreasing SL. When walking included a turn, individuals with faster TUG times increased SW in the IN leg and increased the FA of the OUT leg compared to those with a slower TUG time, suggesting that people with PD who have functional impairments may utilize different strategies than those with without. Increased understanding of spatiotemporal aspects including during a turn is critical to optimize treatment.

INTRODUCTION: Regulation of balance requires attentional involvement inversely proportional to efficacy of postural control system. Sample entropy (SE) of center of pressure (CoP), a non-linear measure, reflects complexity of postural control system indicating attentional involvement. Parkinson patients (OAP) may require more attention during standing than healthy controls (OAH). Due to internal perturbations during standing, respiration may affect balance in individuals with deteriorated postural control systems.

PURPOSE: To investigate 1) effects of breathing and visual conditions on attention and balance 2) group effect on respiratory complexity, attention, & balance between OAP & OAH.

METHODS: 12 subjects, OAH (n=6) & OAP (n=6), were recruited and instructed to stand on force plate, feet oriented 15° apart and look at 5cm-diameter spot eye level on wall 1.5m away. Subjects were asked to maintain balance for 2 minutes under eyes open and eyes closed conditions and thoracic (Th), abdominal (Ab), & neutral breathing conditions. Meanwhile, Th and Ab motion was recorded through Bioanalysis system, all equipment synched. SE was calculated in Matlab for CoP in anteroposterior (X) (SampEn|X) and mediolateral (Y) (SampEn|Y) directions and Th (SampEn|Th) and Ab (SampEn|Ab) motion. CoP-related measures were calculated in Bioanalysis software for average velocity (v̅) (cm/s), 95% sway area (SA) (cm²), and average displacement in X (Dx) and Y (Dy) directions (cm).

RESULTS: Group, breathing, & visual effects were examined on non-linear and CoP-related measures via Factorial MANOVA with later application of ANOVAs as needed. Significant group and visual effects were seen in CoP-related measures, Wilks’ Lambda = 0.00 (p < 0.00) and 0.781 (p < 0.034), respectively. OAP showed greater D(.536±.241 vs. 2963.±.4242), SA (10.7677±10.6278 vs. 8.5563±6.3065), and v (3.126±14.1616 vs. 2.318±.9371) than OAH, while EC showed greater v (3.190±1.2207 vs. 2.334±.7770).

CONCLUSION: OAP showed similar attentional involvement and respiratory complexity with OAH during standing balance, though OAP displayed worse balance performance than OAH. Breathing condition did not significantly affect attentional involvement or balance performance. Visual condition significantly affected balance performance.

The Effects of Cadence on Torque Asymmetry

Ashley N. Fox, John W. Farrell, III, Rebecca D. Larson. University of Oklahoma, Norman, OK. (Sponsor: Christopher Black, Ph.D., FACSM)

Bilateral asymmetry in peak crank torque has been observed in both cyclist and non-cyclist. However, the relationship between exercise intensity, cadence rates, and bilateral asymmetry is not fully understood. Additionally, a need for establishment of normative values for bilateral asymmetry still exists. PURPOSE: Therefore, the purpose of the current study was to examine bilateral asymmetry in peak crank torque during 3 graded exercise tests (GXT) at 3 different cadence zones. METHODS: 20 subjects, 10 females and 10 males, participated in this study. Subjects were classified during 3 visits subjects, both groups performed 3 GXTs at 3 different cadence zones. Cadence zones consisted of Self-Selected (SS), High (100 to 115 mm), and Low (55 to 70 mm). The first GXT was performed at the SS cadence with the initial stage (IS), the stage in which the onset of blood lactate accumulation (OBLA) occurred, and the stage in which peak power output (PPO) was achieved for the different 3 GXTs. Two way repeated measures ANOVA was used to determine if significant differences between groups and conditions existed.

RESULTS: Significant group by condition interactions were present. No significant condition differences were present between all cadence zones (IS, OBLA, or PPO) (P<0.05). No significant group differences were present at IS or OBLA. However, significant group differences were present at PPO (7.69±5.6 vs. NCT 4.42±4.47). CONCLUSION: The findings of the current study suggest that torque is unaffected by cadence selection at IS, OBLA, and PPO. The current study also showed that significant differences did not exist between the CE and NCE in torque asymmetry until PPO. This finding suggests that at PPO cyclist may be altering their kinematics in order to maintain desired cadences or power outputs more so than non-cyclists. Therefore, further research is needed to understand the potential effect on cycling performance.
CONCLUSION: The heel strike was found to induce the knee VL+IR combined with hip AD+IR moments, which forced the joints to move toward the “position of no return”, implying that the heel strike may increase the risk of ACL injury. Decelerating with footsoft is therefore recommended for a safety multi-articular biomechanics.

3289  Board #158 June 2 9:30 AM - 11:00 AM
Motor Unit Discharge Characteristics And Walking Performance Of Individuals With Multiple Sclerosis.
Leah A. Davis1, Awad M. Almuklass2, Hamilton Landon3, Taian Vietco1, Alberto Botter2, Roger M. Enoka1. 1University of Colorado Boulder, Boulder, CO. 2King Saud bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia. 3Politecnico di Torino, Torino, Italy.

Purpose: To examine the associations between strength, force steadiness, and muscular unit action potentials.

Methods: Twelve individuals with MS (n=23), 9 men, 53 ± 7 yrs attended 1 to 3 evaluation sessions that were performed before, immediately after, and 4 wks after a clinical trial of neuromuscular electrical stimulation. Outcomes included 3 questionnaires (Patient Determined Disease Steps [PDDS], Modified Fatigue Impact Scale [MFIS], and MS Walking Scale-12 [MSWS-12]), 25-ft walk test, 6-min walk test, and maximal torque and force steadiness (10 and 20% MVC) for lower leg muscles. High-density surface EMG recordings were obtained from the tibialis anterior (TA), soleus (Sol), and medial gastrocnemius (MG) during the steady contractions and decomposed into distance times of motor unit action potentials.

Results: Greater levels of self-reported disability (PDDS, MFIS, MSWS-12) were associated with less distance walked in 6 min and longer times to walk 25 fl. Mean interspike intervals (ISI) were 110 ± 23 ms and 102 ± 22 ms (10% and 20% MVC force, respectively) for TA motor units (n = 1,634), 138 ± 36 ms and 135 ± 34 ms for MG motor units (n = 5,646), and 150 ± 33 ms and 145 ± 34 ms for Sol motor units (n = 9,020). A multiple regression model explained 40% (P<0.05) of the variance in 6 min distance with two predictor variables: mean ISI of MG (partial r = 0.48) and MVC dorsiflexor torque of the more affected leg (partial r = 0.37). Similarly, another multiple regression model explained 47% of the variance (P<0.001) in 25 fl time with three predictor variables: mean ISI of soleus (partial r = 0.51), MVC dorsiflexor torque of the more affected leg (partial r = 0.43), and force steadiness of the plantar flexors (partial r = 0.39)

Conclusion: Moderate amounts of the variance in two walking tests for persons with MS were explained by mean discharge times of action potentials by motor units in plantar flexor muscles during steady submaximal contractions, the strength of the dorsiflexor muscles in the more affected leg, and force steadiness during an isometric contraction.

This research was supported by the Eunice Kennedy Shriver National Institute of Child Health & Human Development of the NIH (R03HD079508).

3290  Board #159 June 2 9:30 AM - 11:00 AM
Overground Locomotor Training in Incomplete Spinal Cord Injury: Effects on Balance and Gait
Brian T. Neville, Clinton J. Wutzke, Donal Murray, Caitlin A. Bryson, Kerry J. Bollen, John P. Collins, Andrew A. Guccione. George Mason University, Fairfax, VA. (Sponsor: Randall Keyser, FACSMM)

Introduction: Restoration of ambulatory function in individuals with motor-incomplete spinal cord injury is the primary aim of rehabilitation. However, optimal training methods to improve balance and gait in this population have not been established. Purpose: To determine changes in balance and gait following a task-specific, performance-based training protocol for overground locomotor training (OLT) in individuals with motor-incomplete spinal cord injury (SCI). Methods: Convenience sample, pilot study. Nine males and three females (38.5±16.4 years old, AIS C or D, >6 months post-SCI) participated in two 90-minute OLT sessions per week for 12 to 15 weeks. OLT sessions are built on three principles of motor learning: practice variability, task-specificity, and progressive overload (movement complexity, resistance, velocity, volume). Training uses only voluntary movements without body weight support, robotics, or other assistive devices. Subjects used ambulation aids as necessary. Outcome measures occurred at baseline and post-intervention. Measures of interest include Berg Balance Scale (BBS) and Functional Ambulation Inventory (SCI-FAI) for all participants. Spatiotemporal measures were collected from participants that walked on a pressure-sensitive walkway. Results: 11 participants completed OLT and one participant completed 15 of 24 sessions due to scheduled surgery. The BBS scores showed a mean score improvement of 4.3±4.6 (p<0.01). SCI-FAI scores showed a mean score improvement of 2.13±3.76 (p<0.007), with six of the participants scoring at least 16 out of 20 possible points post-training. One individual progressed from using a rolling walker pre-training to no assistive device post-training. SCI-FAI score for this individual did not change [19/20] but preferred gait speed increased 168% [0.30 to 0.81 m/s], step length increased 104% [0.33m to 0.68m], and mean center of pressure to center of mass (CoP-CoM) distance in the sagittal plane increased 132% [2.55cm to 5.91cm] after training. Conclusion: This pilot demonstrates improvements in balance and some gait characteristics using a novel task-specific, performance-based OLT for chronic motor incomplete SCI.

3291  Board #160 June 2 9:30 AM - 11:00 AM
Decline in Gait Speed Across Clinical Populations Indicates Increased Risk of Falling
Cortney Armitano, Steven Morrison. Old Dominion University, Norfolk, VA.

(no relevant relationships reported)

The process of aging is typically associated with a general decline in sensorimotor and neuromuscular function that becomes apparent during movement including gait. Spatiotemporal measures at preferred walking speed have been used to quantify functional capacity of a person’s walking ability and, clinically, to assess the impact neurological disorders have on gait. For example, persons with multiple sclerosis (MS) and Type 2 diabetes (T2DM) often present with gait and balance problems which can lead to increased risk of falling. Purpose: This study was designed to assess differences in gait and falls risk for healthy individuals compared to persons diagnosed with MS or T2DM. METHODS: Twenty three healthy adults (controls), 23 persons diagnosed with MS, and 23 individuals with T2DM participated in this study. Falls risk was assessed using the Physiological Profile Assessment (PPA). For gait, participants performed 3 trials at their preferred gait speed while walking across a pressure sensitive mat. Measures of velocity, step length, stride length, and step time were used to assess a gait. Within-subject, repeated-measures generalized linear model was used to analyze the data. RESULTS: The results revealed significant differences in falls risk between the three groups with the MS persons exhibiting the greatest risk score (MS 2.51±1.4, T2DM 0.84±0.7, control 0.22±0.6). There was significant group difference in walking velocity with the MS persons walking at a significantly slower velocity (F=2,64=14.12, p<0.001). The differences in walking speed were also reflected by significant differences in step length (F=2,64=12.50, p<0.001) and stride length (F=2,64=11.39, p<0.001) between the three groups. The changes in step/stride length were not reflected by similar changes in step/stride time. CONCLUSION: Overall, significant differences in walking speed and spatiotemporal parameters were found between healthy adults and individuals with MS and T2DM. The decline in gait speed appears to be associated with an increased risk of falling. The basis for the reduction in gait speed would appear to be driven by reductions in the length of the step/stride taken rather than alteration of the duration of the step/stride events.
Method: Twelve male college students (age: 20.9±0.7, height: 172.0±2.1cm, body mass: 63.0±3.4 kg) were tested. Four sole thickness (original commercial shoe, 1, 2, and 3 cm increased thicknesses) were tested using a universal testing machine (Instron-5544, US). The running tests were performed on a treadmill with a fixed speed (3.33 m/s) and continued for 8min. Walking tests were performed on a force platform (AMTI, US, 400×600mm). A motion capture system (VICON, Oxford, UK) was used to obtain kinematic data. Wireless surface electromyography testing system (Noraxon, US) was used to obtain the surface electromyography (sEMG) data. One-way analysis of variance with repeat measures (ANOVA) was used to compare differences in muscle activity, kinematic, and kinetic outcome variables. Statistical significance was set at α = 0.05.

Results: The 1 cm sole thickness has the highest elastic modulus (0.80MPa) and the 3cm is the lowest (0.25MPa). The co-contraction index value of 1cm group was significantly less than the others in both initial (0.55±0.14, P<0.05) and final (0.3±0.13, P<0.05) stage of running. At the toe off, the knee angle of 2 cm (131.0±9.5 deg, P<0.05) and 3 cm (132.7±4.6 deg, P<0.05) group increased significantly comparing to 0cm (125.5±5.4 deg) group in walking test.

Conclusion: The outside thickness of 1cm reduced muscle co-contraction during running. Knee joint increased with the increasing of sole thickness at the time of toe off when walking.

Osteoarthritis (OA) is the most common joint disorder in the US. Pain management has been a commonly investigated treatment for knee OA, little is known about the effects pharmacologic interventions on gait. PURPOSE: To investigate the effects of pharmacological interventions on gait. METHODS: A 47-year-old male (1.7 m, 75 kg) with a diagnosed left knee medical compartment OA with severe bone on bone joint increased the elastic modulus (0.80MPa) and the 3cm is the lowest (0.25MPa). The co-contraction index value of 1cm group was significantly less than the others in both initial (0.55±0.14, P<0.05) and final (0.3±0.13, P<0.05) stage of running. At the toe off, the knee angle of 2 cm (131.0±9.5 deg, P<0.05) and 3 cm (132.7±4.6 deg, P<0.05) group increased significantly comparing to 0cm (125.5±5.4 deg) group in walking test.

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Local Dynamic Stability is Affected By Soldier-Relevant Torso Loads and Gait Speeds

Kari L. Loverro1, Elliot Saltzman2, Leif Hasselquist3, Cara L. Lewis1, 1Boston University, Boston, MA. 2National Soldier Research Development and Engineering Center, Natick, MA. (No relevant relationships reported)

For soldiers, falling while carrying heavy loads can lead to serious injury. Nonlinear analyses, such as local dynamic stability (LDS), can quantify gait stability. LDS can be affected by both load and speed. Studies on soldier-relevant torso loads at multiple speeds are lacking.

PURPOSE: To determine if soldier-relevant loads at 3 speeds affect LDS of the trunk and pelvis during gait.

METHODS: 10 healthy adults (5M, 5F) walked on a treadmill at 3 speeds (1.15, 1.35, 1.55 m/s) under 3 loaded vest conditions (1.3, 15, 27 kg). Trunk and pelvis marker data were collected for 2 min. Short term local divergence exponents (LDE) of marker velocity data in the mediolateral, anteroposterior and vertical directions (ML, AP, V) were calculated to quantify LDS by measuring the rate at which each stride changes from the prior stride. Larger LDE values indicate decreased LDS. Linear regressions analyses tested the effects of load (L1, L2, L3) and speed (S1, S2, S3). Results: LDS decreased with increased load in all directions at the trunk (LDE Mean±SD: ML: 0.44±0.02, 0.45±0.02 for L2 and L3 respectively, p = 0.001; AP: 0.39±0.02, 0.41±0.01, 0.43±0.01 for L1, L2 and L3, p ≤ 0.001; V: 0.68±0.04, 0.72±0.04, 0.77±0.04 for L1, L2 and L3, p ≤ 0.001) and in the vertical direction at the pelvis (0.55±0.04, 0.58±0.04, 0.62±0.03 for L1, L2 and L3, p ≤ 0.001). Conversely, ML and AP LDS increased with increasing speed at the trunk (ML: 0.48±0.02, 0.44±0.02, 0.41±0.02 for S1, S2 and S3, p < 0.001; AP: 0.43±0.01, 0.41±0.01, 0.39±0.02, p < 0.001 for S1 vs S2 and S1 vs S3) and pelvis (ML: 0.32±0.02, 0.30±0.01, 0.01 for S1 vs S2, S2 vs S3; AP: 0.42±0.02, 0.37±0.03, 0.36±0.02, p < 0.001 for S1 vs S2 and S1 vs S3). However, vertical LDS decreased with increasing speed at the trunk (0.71±0.04, 0.71±0.05, 0.75±0.04, p ≤ 0.012 for S1 vs S2 and S2 vs S3) and pelvis (0.57±0.04, 0.57±0.05, 0.61±0.02, p ≤ 0.006 for S1 vs S2 and S1 vs S3).

CONCLUSIONS: Preliminary results suggest that increasing speed with a heavier load increases stability. However, the decrease in vertical LDS with increased speed indicates that more energy may be required to control the vertical motion of the trunk and pelvis, and may lead to earlier fatigue. Inclusion of more participants may reveal interaction effects of load and speed not yet detected. Funding: BU’s Dudley Allen Sargent Research Fund and the DoD SMART.

Total hip arthroplasty (THA) is an effective treatment for patients suffering from end-stage primary hip osteoarthritis. The most common reported outcomes of THA relate to restoration of mobility and decrease of pain. Gait velocity and the Timed Up and Go (TUG) provide functional metrics to quantify improvements during rehabilitation.

PURPOSE: The purpose of this study was to examine differences in gait velocity and TUG measures in direct anterior approach THA patients during recovery compared to healthy controls.

METHODS: Eight unilateral THA patients and 11 healthy controls were recruited for participation. Data collection occurred pre-operatively and at 6 time-points up to 2 years post-operatively. Participants performed 6 walking trials over a 4-m walkway to determine self-selected velocity and 3 TUG trials. A 2×7 repeated measures ANOVA assessed differences in mean gait velocity and TUG (α=0.05).

RESULTS: A significant interaction was found for both velocity (p = 0.002) and TUG (p < 0.01). Post-hoc analysis identified a significant time effect in the THA group for velocity (p < 0.01) and TUG (p = 0.01). Post-hoc independent t-tests identified that THA velocity was less than controls at three-weeks post-operatively; there was a significant effect of time in the THA group (Figure 1a). There were no significant group differences in TUG at any time point, but there was an effect of time in THA group TUG measures (Figure 1b).

CONCLUSIONS: Improvements in gait velocity and TUG measures within in THA group supports THA as a successful treatment. However, changes in velocity over time may suggest functional degradation at the 2 year time-point. While there are no differences between 1 and 2 year velocities, we observed THA patients exhibiting a faster velocity at 1 year than six-weeks post-operatively. Yet at 2 years, velocity was no longer faster. This suggests that long-term maintenance of functional measures should remain a clinical consideration for THA patients.
observed a priori at alpha = 0.05. RESULTS: There were no significant differences between the gait application and video for gait speed (1.694 ± 0.352 vs. 1.693 ± 0.347 m/s, respectively) or turn duration (4.165 ± 0.761 vs. 4.171 ± 0.762 s, respectively). There was, however, a small but significant difference between the gait application and video for cadence (129.9 ± 14.0 vs. 129.1 ± 13.6 steps/min, respectively).

CONCLUSION: For middle aged adults across a broad spectrum of gait speeds, the gait application is a valid method to evaluate steady-state gait speed and turn duration of a 400 m walk test. Although there was a significant difference between the gait application and video for cadence, the one step per minute difference is not likely to be clinically meaningful.

### 3302 Board #171 June 2 9:30 AM - 11:00 AM

**The Effect Of Soccer History On Tibial Strain During Load Carriage**

Henry Wang, D. Clark Dickin, Julie Hughes, Jiahao Pan, Ball State University, Muncie, IN. US Army Research Institute of Environmental Medicine, Natick, MA.

(No relevant relationships reported)

**Purpose:** To examine the effects of a soccer history and incremented load carriage on tibial bone strain.

**Methods:** 20 female soccer players (20±1 yr) and 20 mass- and height-matched healthy women (21±1 yr) participated in this study. They completed four walking tasks with 0kg, 10kg, 20kg, and 30kg loads on a force instrumented treadmill at 1.67 m/s. Participants’ tibia CT models were combined with subject-specific musculoskeletal models for forward-dynamic computer simulations and finite element analyses. Strains from the middle third of the bone shaft were analyzed. One-way ANOVA’s were performed. α = 0.05. Results: Significant differences in strains were found among walking conditions and between the two groups (All p<0.0001). The mean ± SE strains during load carriage (6kg, 10kg, 20kg, and 30kg) were 562±3 µs, 634±3 µs, 736±7 µs, and 825±7 µs, respectively, and 684±3 µs, 791±3 µs, 1152±7 µs, and 1015±4 µs, for controls, respectively, resulting in an 18-36% difference in strains during load carriage. Compressive strains were 849±4 µs, 960±4 µs, 1092±10 µs, and 1180±7 µs in soccer players and 1039±4 µs, 1179±7 µs, 1749±11 µs, and 1552±7 µs in controls showing similar percent differences as tensile strains (18-38%). Conclusion: Participants with a soccer history demonstrated significantly lower strains than healthy controls during incremental load carriage. Lower tibial strains during load carriage may be protective from TFIs in those with a history of soccer, although this has yet to be demonstrated experimentally. These findings suggest that physical training involving MDL may be an ideal exercise modality for preconditioning prior to BCT for female recruits. US ARMY #W81XWH-15-1-0006.

### 3303 Board #172 June 2 9:30 AM - 11:00 AM

**Older Adults That Choose To Not Report Their Falls**

Eryn N. Murphy, David W. Keeley, Robert H. Wood. New Mexico State University, Las Cruces, NM.

(No relevant relationships reported)

**Purpose:** This study aimed to better understand the gait biomechanics of individuals that voluntarily choose to not report their history of falling, or lack thereof, against older adults who self-reported a history of falling or not falling. Methods: The sample included 1390 people over the age of 60 years (failed to report = 182, fallers = 605, non-fallers = 603). Participants were recruited from multiple testing sites across the Southwest United States. Multiple analysis of variance was conducted to test for differences between individuals that failed to report (FTR), fallers (F), and non-fallers (NF), as well as group differences within variables of the pace factor, including cadence, gait velocity and stride length. For the multivariate analysis, alpha was set at α = 0.15 with follow-up analysis alpha corrected using the Bonferroni technique and set at α = 0.05. Results: MANOVA analysis for differences on the set of pace factor variables revealed that there is a significant difference between groups (p<0.001) on the set of variables inclusive of cadence, gait velocity and stride length. Follow-up univariate analysis revealed significant differences in each of the pace factor variables (p<0.05). Pairwise comparisons indicated the position of these differences. Specifically, with regard to cadence, there was no difference between FTR and F, however there was a significant difference between FTR and NF, as well as group differences within variables of the pace factor, including cadence, gait velocity and stride length. For the multivariate analysis, alpha was set at α = 0.15 with follow-up analysis alpha corrected using the Bonferroni technique and set at α = 0.05. Conclusion: Participants with a soccer history benefited from significantly lower strains than healthy controls during incremental load carriage. Lower tibial strains during load carriage may be protective from TFIs in those with a history of soccer, although this has yet to be demonstrated experimentally. These findings suggest that physical training involving MDL may be an ideal exercise modality for preconditioning prior to BCT for female recruits. US ARMY #W81XWH-15-1-0006.
screensings, individuals are asked to self-report a history of falling. Based on these results, clinicians should understand that across pace factor variables established to be predictive of falls risk, individuals that choose not to self-report their history of falling appear to present with biomechanical measures that more closely resemble fallers.

**G-43 Free Communication/Poster - Macronutrient and Exercise Metabolism**

**Room: CC-Hall B**

**3304 Board #173**

**June 2 9:30 AM - 11:00 AM**

**Influence Of Short, Disrupted Sleep And High-intensity Interval Exercise On Fasting And Post-prandial Blood Lipid And Lipid-related Antioxidant Responses In Healthy Men**

Matthew N. Peterson1, Zachariahs Papadakis2, Jeffrey S. Forssé1, Fernando Gutierrez3, J. Kyle Taylor1, Li Qian2, Omar Brito-Estrada2, Kathryn Dugan1, Peter W. Grandjean, FACSM3,4,5:

1Baylor University, Waco, TX, 2Montgomery, AL, 3Georgia Institute of Technology, 4Baylor University, Montgomery, Montgomery, AL. (Sponsor: Peter W. Grandjean, FACSM)

(No relevant relationships reported)

Exercise is known to impart transient blood lipid responses that appear consistent with reduced cardiovascular disease risk; yet, it is unclear how short, disrupted sleep (SDS) modifies post-exercise fasting and postprandial lipid and lipid-related antioxidant responses to a single episode of exercise. PURPOSE: To determine the influence of a single night of SDS on fasting and postprandial lipid and lipid-related antioxidant responses after HIIE. METHODS: Fifteen male participants (age 31.1 ± 5.3 yr; weight 83.5 ± 11.4 kg; BMI 25.5 ± 2.7 kg/m²; VO2 max 49.1 ± 8.5 ml/kg/min) completed a non-exercise control trial after 9 to 9.5 hours of reference sleep (REF), HIIE by consuming a high-carbohydrate diet and spending 3-4 hr resting. Blood samples were obtained by the same technician under standardized conditions just before, immediately after (IPE), 1 hr after exercise (1 HR) and just before a high-fat meal - 1240 kcal (56 g fat; 145 g carbohydrate; 38 g protein) and again 2, 4, and 8hrs after meal ingestion and at equal intervals during REF. Total, high-density and low-density lipoprotein cholesterol (HDLc and LDLc) and paraoxonase-1 concentration were measured up to 1 hr post-exercise. Post-prandial triglyceride was measured and area under the curves - total (AUCt) and incremental (AUCi) were calculated. Lipid and lipid-related antioxidant responses were analyzed using 3 (condition) by (sample point) repeated measures ANOVAs. AUCt and AUCi were measured using one-way, 3 (condition) repeated measures ANOVAs. RESULTS: HDLc (+6.3%, p = 0.0023) and paraoxonase-1 (+10.8%, p < 0.0001) increased and triglyceride (-18.5%, p < 0.0001) decreased after REF+EX and SDS+EX, TAUC and SDS+EX remained refractory to exercise and short, disrupted sleep. SUMMARY: Exercise transiently increased fasting HDLc, cholestrol and related antioxidant concentrations and reduced triglyceride levels, but did not modify total or incremental triglyceride AUC in response to a post-exercise high-fat meal. Short, disrupted sleep did not influence these responses.

**3305 Board #174**

**June 2 9:30 AM - 11:00 AM**

**Effects Of Pre-exercise Sucrose Ingestion On Thermoregulatory Responses To 5-km Running**

Patrick Wilson. Old Dominion University, Norfolk, VA.

(No relevant relationships reported)

PURPOSE: Carbohydrate feeding, in particular fructose, is associated with increased dietary thermogenesis and body temperature at rest. Whether these effects influence the thermoregulatory responses to heavy exercise remains uncertain. METHODS: A total of 28 runners (26 men, 2 women; 35.2 ± 9.6 years) with the ability to finish a 5-km in 16 to 23 minutes completed this randomized, double-blind, placebo-controlled trial. Runners were pair-matched based on their self-reported maximal 5-km running speed (max 49.1 ± 4.5 km/h; average 38.7 ± 4.0 km/h) and placebo (38.6 ± 0.4 km/h) groups by the end of the

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**3306 Board #175**

**June 2 9:30 AM - 11:00 AM**

**Blood Glucose Control Following Single-leg And Double-leg Cycling**

Shane Draper, John McDaniel. Kent State University, Kent, OH.

(No relevant relationships reported)

When exercise is confined to a small muscle mass, greater blood flow to that muscle allows for greater muscle specific intensity compared to whole body exercise. The greater muscle specific intensity results in greater glucose oxidation for any given VO2, which may optimize exogenous blood glucose uptake following the exercise. PURPOSE: Thus, the purpose of this study was to determine the influence of reduced muscle mass exercise (single leg cycling) on post exercise blood glucose control. METHODS: Seven healthy college age students completed the study in which they arrived fasted and were administered an oral glucose tolerance test (OGTT) following 4 conditions: no exercise, following 30 minutes of single leg cycling, following 30 minutes of double leg cycling matched for VO2, and following 30 minutes of double leg cycling matched for power. VO2, RER, and carbohydrate oxidation were recorded throughout the exercise. Two 4 x 2 repeated measures ANOVAs were performed on condition (single leg, double leg VO2, and double leg power) and time (baseline and average blood utilization as well as peak and baseline blood glucose). RESULTS: Despite the fact that carbohydrate oxidation was greater during the single leg cycling ((1.4 ± 0.45 grams) of carbohydrate utilized per minute during single leg compared to (1.0 ± 0.49 g/min) during double leg matched for VO2, and (0.87 ± 0.43 g/min) during double leg cycling matched for power), there was no difference (p > 0.05) in average blood glucose uptake between single leg cycling (126 ± 8 mg/dL) and double leg cycling when matching for VO2 (121 ± 10 mg/dL) and power (125 ± 10 mg/dL) compared to baseline (124 ± 13 mg/dL). Additionaly, there was no difference in peak blood glucose between single leg cycling (160 ± 17 mg/dL) and double leg cycling when matching for VO2 (154 ± 20 mg/dL) and power (155 ± 19 mg/dL) compared to baseline (159 ± 18 mg/dL). CONCLUSION: We conclude that the greater glucose utilization during single leg cycling had no effect on blood glucose uptake following an OGTT. This study was partially supported by the Kent State University School of Health Sciences Small Grant.
exercise in promoting acutely enhanced glycemic control. Future investigations into post-exercise glycemic control should be expanded to include a larger sample size and varied resistance exercises.

### 3308 Board #177
June 2 9:30 AM - 11:00 AM
**Accuracy, Precision And Comfort Of A Microdialysis Device For Continuous Real-time Blood Lactate Monitoring**

Ben J. Lee, Juliianne Doherty, Ania M. Hiles, Daniel Carney, Mark C. O’Connell, University of Chichester, Chichester, United Kingdom; 2Probe Scientific, Thurliegh, United Kingdom.

**Reported Relationships:** B.J. Lee: Contracted Research - Including Principle Investigator; Probe Scientific.

**BACKGROUND:** In critically ill patients blood lactate is measured as a marker of tissue perfusion, with increasing lactate being associated with insufficient perfusion and poorer prognosis. Serial monitoring of blood lactate is a valuable tool in predicting in-hospital mortality, with a better prognosis observed when blood lactate concentrations are decreasing. A device that allows for automated, continuous monitoring of blood lactate removes the need for a practitioner to draw samples, and could provide more effective patient monitoring. **PURPOSE:** Evaluate the performance of a peripheral intravascular microdialysis device and online in-vitro diagnostic lactate biosensor system for continuous automated blood lactate monitoring.

**METHODS:** Twenty volunteers (age 27 ± 8 years; stature 175 ± 10 cm; mass 76.5 ± 13.8 kg) completed one experimental visit. An 18-gauge catheter was inserted into an antecubital vein and a microdialysis device (MicroEye® PM10612, Probe Scientific, UK) inserted into the catheter. The MicroEye® was perfused at 1 mL/hour with 0.9% sodium chloride containing antiocoagulant (Fondaparinux). The outlet of the MicroEye® was connected to the inlet of a lactate flow cell (ContinaMon®, Probe Scientific, UK) for continuous lactate monitoring. A second catheter was introduced into a peripheral vein in the contralateral forearm for reference blood sampling. Venous blood was sampled at 10-minute intervals throughout 30 minutes of rest, and at the end of five 3-minute incremental exercise stages, beginning at 70 watts and increasing by 35 Watts per stage. Comfort for each arm was assessed using a 9-point scale ranging from unnoticeable (0) to painful (9). The relationship and agreement between reference and MicroEye® values assessed via least mean square and Bland-Altman analysis.

**RESULTS:** Paired samples falling within the clinical range (0-4 mM; n = 152) gave an R² of 0.93 (y = 1.002), a mean bias of 0.027 mM, and an upper and lower limit of agreement of 0.54 and -0.49 mM respectively. Subjective comfort was not different between the MicroEye® (7 ± 1) or reference arm (7 ± 1) at any point in the trial.

**CONCLUSION:** The MicroEye® microdialysis catheter and ContinuaMon® continuous lactate monitoring system exhibits good agreement when following exercise induced blood lactate changes in the clinical range.

### 3309 Board #178
June 2 9:30 AM - 11:00 AM
**Influence Of Muscle Action On Energy Expenditure: Concentric Vs. Eccentric Vs. Both**


**PURPOSE:** Previous studies have found the energy cost of eccentric exercise to be approximately 1/7 to 1/4 that of concentric exercise, but no study has directly compared concentric--and eccentric--only resistance exercise. Therefore, we compared energy expenditure between squats performed with concentric or eccentric muscle actions.

**METHODS:** 12 healthy men (20.9±1.1yrs) with a BMI-26 performed three exercise protocols once weekly designed to compare energy expenditure between different muscle actions: concentric (CON), eccentric (ECC), and a trial incorporating both concentric and eccentric actions. Subject’s 1RM was determined using a plate-loaded squad machine. Each protocol was randomly assigned in a counterbalanced order and required subjects to perform 4 sets of 10 reps with 50% of 1RM. Repetition speed (2sec), ROM, and rest intervals were identical across protocols.Expired air was collected continuously before (15min), during (12min), and after (30min) each exercise protocol using a metabolic cart. Data were analyzed using a two-way repeated measures ANOVA, with Fisher’s least significant difference (LSD) post hoc analyses wherever appropriate.

**RESULTS:** Rates of energy expenditure (kcal·min⁻¹) were significantly greater (p<0.05) during sets 1 through 4 of CON and BOTH compared to ECC (see Table). CON was also greater than BOTH for sets 2 and 4. After exercise, CON > ECC at +5 and +10min, and BOTH > ECC at +5min. Significant differences (p<0.05) in total energy expenditure (kcal) included CON (58.1±6.27) > BOTH (50.7±5.92) > ECC (49.0±3.33).

**CONCLUSION:** When squats were performed with 2sec CON or ECC muscle actions and 50% of 1RM, the energy cost of ECC was 2/3 to 3/4 that of CON exercise, whereas previous studies have reported about 1/4 of CON. A possible explanation may be that slower muscle actions used in our study resulted in elevated energy cost of eccentric muscle actions due to increased time under tension.

### 3310 Board #179
June 2 9:30 AM - 11:00 AM
**The Effects Of Exercise To Bmp-4-mediated Browning On White Adipose Tissue In Obese Rats**

Liang Chunyu, Yan Yi. Beijing Sport University, Beijing, China.

**PURPOSE:** Bone morphogenetic protein-4(BMP-4) play a key role in regulating adipocyte differentiation and browning. The aim of this study is to observe the effect of treadmill running on the protein expression of BMP-4 and UCP-1 which is a marker protein associated with thermogenesis to discuss the effect of exercise on adipogenesis and browning in adipose tissue roundly.

**METHODS:** Before the formal experiment, we established a rat model of obesity with 8-week high-fat diet. The 20 11-week obese rats were obtained, and randomly divided into sedentary high-fat-diet group(SHD) and exercise high-fat-diet group(EHD). Other 20 11-week chow-diet rats were randomly divided into sedentary chow-diet group(SCD) and exercise chow-diet (ECD) groups. Rats in the ECD and EHD had 8 weeks training (60%-70% VO2 max, 50 minutes/day, 5 days/week). The white adipose of inguinal subcutaneous tissue (SAT). Peripectidymal white adipose tissue (PAT) were collected.

**RESULTS:** 1) In SAT, obesity has a very little effect in promoting protein expression of BMP-4 and UCP-1. Exercise significantly increased the protein expression of BMP-4 and UCP-1 on obese rats , but had little effect on chow diet rats. 2) In PAT, obesity can decrease the expression of BMP-4 protein, but little effect on UCP-1. Exercise significantly increased the protein expression of BMP-4 and UCP-1 on chow diet rats, but had little effect on obese rats. (The data are shown in table)

**CONCLUSIONS:** The effect of high-fat diet on adipocyte differentiation and browning is different in different tissues in obese rats, and exercise can exaggerate this differences.

### 3311 Board #180
June 2 9:30 AM - 11:00 AM
**Acute Exposure to a High-Fat High-Sugar Diet Alters Wheel Running Activity**

Katherina A. Stiegel, Ayland C. Letsinger, Jorge Z. Granados, Cedric Cerda, J. Timothy Lightfoot, FACSM, Texas A&M University, College Station, TX. (Sponsor: J. Timothy Lightfoot, FACSM)

**No relevant relationships reported**

**BACKGROUND:** Literature shows that chronic exposure to a high-fat-high-sugar (HFHS) Western diet decreases voluntary physical activity, mainly through decreased duration of activity. **PURPOSE:** To determine if acute exposures to standard chow and a HFHS diet affect voluntary activity levels in male mice. **METHODS:** Eight-week-old male C57BL/6J male mice (n=20) were singly housed and provided with running wheels. Wheel running activity was measured daily via mounted odometers. Distance (km) and duration (min) were used to calculate average speed (m/min). Mice were randomly assigned to two experimental groups that alternated between the HFHS diet (20% protein, 33% carbohydrate, 45% fat, with 20% fructose water) and a standard chow diet (24.3% protein, 40.2% CHO, 4.7% fat) in three 5-day cycles followed by two 8-day cycles. At study initiation, Group 1 began with the HFHS diet and Group 2 began with standard chow. At the end of each cycle period, both groups switched to the opposing diet. Data were analyzed using a repeated measures model.
Previous research has found that early life undernutrition increases the risk of cardiovascular disease later in life. It is hypothesized that exercise training could mitigate the cardiovascular impairments of early life undernutrition. PURPOSE: To evaluate the effects of early life undernutrition on changes in exercise capacity after 8 weeks of treadmill (TM) training in a mouse model. METHODS: Using a cross-fostering model, pups were undernourished during gestation (GUN), lactation (PUN), or both (GUN+PUN) by feeding FVB mouse dams a low protein (8%) diet. The control (CON) group was fed an isocaloric diet (20% protein) during all windows of development. At PN21 (21 days post-natal), all mice were weaned and fed the control diet. Thus, all physiological effects of undernutrition were isolated to early life. To evaluate exercise capacity, maximal work on a TM was performed at PN39 (baseline), PN67 (midpoint), and PN95 (post). Starting at PN41, 28 mice were trained on the TM 5 days/week with alternating 8 mins at 85% and 2 mins at 55% of their max workload for 1 hour. The sedentary group of 30 mice ran on the TM 3 days/week for 15 mins at 10/μm/s. Data were analyzed using a repeated measures ANCOVA to detect change in exercise capacity over time and an ANOVA with Tukey post-hoc test (alpha level p<0.05) to detect differences in exercise capacity between groups. RESULTS: After 4 weeks of TM training, there was a significant difference in exercise capacity change over time between the TM trained (F(5,3.9) = 3.9 [F(1,16)] and sedentary groups (-2.5±0.1) (p<0.03). Differences in exercise capacity change over the first 4 weeks were trending toward significance between groups (GUN: 2.8±1.4J, PUN: 1.7±1.2J, PUN+GUN: 6.0±1.2J, CON: 4.6±1.4J) (p<0.057). No significant changes were observed from weeks 4 to 8 between or within groups. CONCLUSION: Results indicate that 4 weeks of exercise training can improve exercise capacity in mice who were undernourished during gestation and gestation plus lactation, but not undernutrition during lactation only. PN-21 is associated with cardiac growth and the nutrient restriction could potentially limit cardiac growth factors preventing stroke volume adaptations with training.

High-fat-low carbohydrate (HFLC) diets are increasingly considered by endurance athletes to enhance their performances and overall health. Total macronutrient contents in plasma may be affected by diets and exercise. PURPOSE: To examine the effects of HFLC diet and an acute bout of exercise on total plasma macronutrient contents in trained males. METHODS: Eight trained distance runners (age = 39.5 ± 9.9 years and VO\textsubscript{max} = 47.9 ± 7.6 ml/kg/min) that were on high-carbohydrate (HC) diets adopted the HFLC diet for 3 weeks, which consisted of 70% of overall caloric intake from fats and no more than 50g of carbohydrates. At the end of each diet trial, participants performed an indoor treadmill exercise for 50 minutes at varying race pace followed by an outdoor 5km time trial. Fasting blood samples were collected at pre- (baseline) and post-exercise (24-hours) to analyze changes in total plasma lipids, proteins, and carbohydrates using attenuated total reflectance Fourier-transform infrared spectroscopy (ATR FT-IR). The O-H stretch vibrational band of infrared samples was used to analyze the IR spectra and the protein content was quantified using the amide I peak intensity at 1600 - 1700 cm\textsuperscript{-1}. To quantify the lipids and carbohydrates, the samples were lyophilized and measured by the intensities at 2800 - 3000 cm\textsuperscript{-1} and 800 - 1200 cm\textsuperscript{-1}, respectively. RESULTS: The ATR FT-IR analysis showed that total plasma proteins remained unchanged (HC baseline = 135.20±4.20 and HFLC baseline = 135.24±3.91AU). However, the HC diet at baseline showed a significant accumulation of lipids (30.06±7.75 AU, 95% CI = 6.93) and carbohydrates (42.92±11.62 AU, 95% CI = 10.39). Additionally, total lipids in the HC diet significantly increased at 24-hours post-exercise (from 30.06±7.75 to 28.51±1.91 AU, p=0.016). Conclusion: A short-term high-fat diet does not significantly alter any macronutrient contents in plasma, whereas a high-carbohydrate diet increases an accumulation of lipids and carbohydrates. Elevated plasma lipids and carbohydrates with a high-carbohydrate diet may be due to decreased insulin sensitivity, which consequently leads to increased plasma lipid contents. Notably, decreased total plasma lipid content following an acute bout of exercise suggests that lipids were the primary energy substrate.

Physical activity can influence absorption and excretion of fluoride (F). However, the evidence is still limited and often contradictory; studies in rats showed a significant reduction in plasma F concentration at light F exposure and no change while a study with healthy human adults had an increase in plasma concentration and a decline in renal clearance rate of F, with increasing exercise intensity. PURPOSE: To investigate recruitment and acceptance of an experimental protocol (phase I) and the development of methodological procedures (phase II). METHODS: Parents of children (5 to 8 years) were recruited from schools in Brazil. In phase I, parents were asked to complete socio-economic, physical activity (Netherlands Physical Activity Questionnaire) and feasibility questionnaire. The latter explored parents’ willingness for their child to participate and reasons for refusing consent. In phase II, children participated in two test conditions: high intensity exercise and resting with blood samples collected in urine and saliva samples collected before and after the exercise trial. RESULTS: Only 77 out of 350 parents approached agreed to participate. The majority (54.6%) of the families were from middle socio-economic class. Seventy percent of the children were considered predominately inactive according to an established cut-off point. Fifty-five percent of the parents who responded, would consent their child to participate in the study. The main reason for refusal of consent was collection of blood samples from children (62% and 69% said “no” for finger prick and vein blood collection respectively). In phase II, four children were recruited and one provided blood collection. F concentration of parotid saliva from this participant was 0.01 µg/ml, both at rest and after exercise. Blood lactate concentration and mean F concentration increased from before (Pre) to after (Post) exercise (Lactate Pre: 4.3 mmol/l vs. Post: 14.4 mmol/l; Mean F concentration urine Pre: 0.58 µg/ml vs. Post: 0.63 µg/ml). CONCLUSIONS: Some of the questions related to recruitment rate and acceptability of measurements were answered in this study. However, participants’ willingness to be randomized and their acceptance of and compliance with a high intensity exercise protocol still needs to be explored in a randomized feasibility trial.
output than the PWC \(_{\text{FT}}\) (153 ± 33 W), GET (155 ± 33 W), and VT (177 ± 27 W). In addition, the VT occurred at a higher output than the LT, PWC \(_{\text{FT}}\), and GET, whereas there was no difference in power outputs between the PWC \(_{\text{T2}}\) and GET. Furthermore, there were no significant inter-correlations among any of the fatigue thresholds (r = -0.03 ± 0.35), except between the GET and VT (r = 0.70). CONCLUSIONS: Based on the significant mean differences in power outputs and non-significant correlations, the findings of the present study indicated there were no relationships among indicators of fatigue identified through changes in muscle activation (PWC \(_{\text{T2}}\)), blood lactate (LT), and measurements of gas exchange (VT and GET). These findings suggested there is a dissociation among the exercise intensities associated with the PWC \(_{\text{T1}}\), LT, VT, and GET, and thus, each originate from separate physiological mechanisms.

Despite a paucity of information regarding the hemodynamic changes associated with moderate fluid ingestion, the popular, unsubstantiated recommendation for most adults to drink 8 ounces of water daily (1800 ml) remains prevalent. PURPOSE: The purpose of this study was to determine the hemodynamic and body fluid changes associated with consuming water at temperatures of 4º C & 37º C and two volumes of 7.2 and 21 mL/kg. METHODS: 10 subjects (age 22.3 ± 1.3 yr, ht. 1.74 ± 0.15 m, body mass (bm), 75.1 ± 18.5 kg, 4♂, 6♀) refilled a lab in a euhydrated state and refrained from ingestion of food and beverage (except water) for 10 hrs and no water 2 hours pre-trial. 30 minutes of rest preceded venipuncture for hematocrit (H), plasma protein (PP), plasma density (PD) analyzed by digital refractometry. Hemodynamic values of heart rate (HR), stroke volume (SV) and cardiac output (CO) were obtained by a non-invasive impedance cardiography system. All measurements were obtained pre-water ingestion (PRE) and at 20 minute intervals following water ingestion (T1, T2, & T3). Immediately following the PRE, subjects ingested C2, C21, H7 or H21 with the volume calculated from individual bm at a mean of 526 and 1577 mL for 7 and 21 trials, respectively. Subjects served as their own control in the randomized assignment of trials. RESULTS: Statistical analysis by ANOVA was applied to these data and revealed NSD (p>0.05) among all trials. Mean values for all four trials are depicted in the following table:

<table>
<thead>
<tr>
<th>PRE</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>H (%)</td>
<td>46.2 ± 4.4</td>
<td>47.2 ± 6.8</td>
<td>46.1 ± 6.5</td>
</tr>
<tr>
<td>PSV (gm/cm²)</td>
<td>1.053 ± 0.02</td>
<td>1.031 ± 0.02</td>
<td>1.026 ± 0.01</td>
</tr>
<tr>
<td>PD (gm/mL)</td>
<td>1.025 ± 0.01</td>
<td>1.024 ± 0.01</td>
<td>1.024 ± 0.01</td>
</tr>
<tr>
<td>HR (b/min)</td>
<td>62 ± 7</td>
<td>60 ± 7</td>
<td>59 ± 7</td>
</tr>
<tr>
<td>SV (mL/b)</td>
<td>90.3 ± 14.5</td>
<td>93.8 ± 18.2</td>
<td>95.9 ± 15.8</td>
</tr>
<tr>
<td>Q (L/min)</td>
<td>5.60 ± 0.80</td>
<td>5.60 ± 0.83</td>
<td>5.62 ± 0.79</td>
</tr>
</tbody>
</table>

CONCLUSION: The ingestion of water in volumes and temperatures mimicking current practices among many adults results in minimal expansion of blood volume or changes in hemodynamic function. Apparently, consuming considerable water without excessive loss of fluid from either environmental conditions or exercise induced temperature regulation, is safe with no adverse impact on non-exercising individuals.

The adiopose tissue infiltrated within the muscle is known as intramuscular adipose tissue (IntraMAT). Using Two-point Dixon Imaging With Two Segmentation Techniques Based On T1-weighted Imaging

Madjaka Ogawa, Noriko Tanaka, Akito Yoshiko, Hiroshi Akima. Nagoya University, Aichi, Japan. (Sponsor: Katsumi Asano, FACSM)

The adiopose tissue infiltrated within the muscle is known as intramuscular adipose tissue (IntraMAT) and measuring of IntraMAT have a potential risk of insulin resistance. T1-weighted (T1W) imaging is one of the basic pulse sequences to measure IntraMAT using a histogram-based thresholding technique based on signal intensity. The Otsu and the Midpoint methods based on T1W imaging have been used to measure IntraMAT in the literature. Now two-point Dixon is recognized as the gold standard for determining adipose tissue content. However, it is unknown that relationship between adipose tissue content determined by Dixon imaging and that determined by T1W imaging. PURPOSE: The purpose of this study was to compare IntraMAT content determined by Dixon imaging with T1W imaging which was calculated by two different thresholding techniques, i.e. Otsu and Midpoint methods. METHODS: Subjects were 13 older (72 ± 6 years) and 19 young (26 ± 5 years) men. Axial images of a spoiled-echo Dixon sequence used to generate T1-weighted (T1W) images. Furthermore, there were no significant inter-correlations among any of the fatigue thresholds (r = -0.03 ± 0.35), except between the GET and VT (r = 0.70). CONCLUSIONS: Based on the significant mean differences in power outputs and non-significant correlations, the findings of the present study indicated there were no relationships among indicators of fatigue identified through changes in muscle activation (PWC \(_{\text{FT}}\)), blood lactate (LT), and measurements of gas exchange (VT and GET). These findings suggested there is a dissociation among the exercise intensities associated with the PWC \(_{\text{T1}}\), LT, VT, and GET, and thus, each originate from separate physiological mechanisms.
entire exercise period, maximal fat oxidation (AMFO), and where MFO occurred along the exercise intensity spectrum (AFatmax) were analysed via whole-body indirect calorimetry.

RESULTS
No statistical differences in fat utilization during CO exercise when compared to TN as indicated by ARER (0.05 ± 0.02 vs. 0.05 ± 0.02; p = 0.584), AMFO (0.21 ± 0.18 vs. 0.16 ± 0.13 pmol/min; p = 0.133) and AFatmax (13.3 ± 19.0 vs. 0.6 ± 21.3 %VO2max; p = 0.035) in SIT and TN, respectively.

CONCLUSION
A cold environment increases lipid contribution as metabolic fuel during exercise, and may be considered in training and health-intervention strategies. In the present study, an acute glucose ingestion causing a shift in carbohydrate utilization, was similar in both the cold and thermoneutral environment, indicating that exercising in a cold environment does not compromise metabolic flexibility. Future exercise studies should investigate the metabolic influences of high-fat diets and acute lipid overload in cold and warm environments.

S320 Board #189
June 2 9:30 AM - 11:00 AM
Attenuated Fat Oxidation Rates in ME/CFS Patients
Jeff Cournoyer, Graham Salmin. Nova Southeastern University, Miami, FL.
(No relevant relationships reported)

Chronic Fatigue Syndrome (CFS) is a condition characterized in part by inexplicable severe fatigue, and post-exertional malaise (PEM), which is defined by crippling fatigue, and post-exertional malaise (PEM), which is defined by crippling

PURPOSE
The purpose of our study is to identify changes in fat oxidation patterns during increasing exercise intensities as a result of the CFS disease state. METHODS Twenty male patients (39.6 ± 12.4 yrs) were divided into two groups: CFS (N=14) and HC (N=6).

Participants were asked to perform a maximal exercise test on a cycle ergometer, with an initial resistance of 60 Watts and increasing by 30 Watts until volitional fatigue was reached or a pedalling cadence of 55-65 RPM was no longer maintained. VO2 Max, time to exhaustion (TE), Maximal Fat Oxidation (MFO) and Total Fat Oxidation (TFO) were recorded for all participants and 2-tailed T-tests were used to determine significant differences between the two groups. RESULTS MFO (HC mean: 617 g/day; CFS mean: 339.5 g/day; p=0.05) and TFO (HC mean: 10 kcal; CFS mean: 2.8 kcal; p=0.05) were lower in CFS patients, but no significant difference was observed in TE (HC mean: 11.2 minutes; CFS mean: 8.1 minutes; p=0.05), VO2 Max (HC: 27.9 ml/kg/min; CFS mean: 26.3 ml/kg/min; p=0.06) or FatMAX (CFS: 41.2% of VO2 Max; HC: 48.9% of VO2 Max; p=0.05). CONCLUSION Patients diagnosed with CFS displayed significantly lower capacity for fat oxidation than HC, though their TE was not significantly less. This might indicate a propensity for CFS patients to spend more time in an anaerobic state.

S322 Board #191
June 2 9:30 AM - 11:00 AM
L-glutamine and L-alanine improve energy status and skeletal muscle cytoprotection in rats submitted to heavy resistance exercise
Julio - Tirapegui, Raquel Raizel, Audrey Coqueiro, Andrea Bonvini, Thais Hypolito, Amanda Garcia, Rafael Lara. University of São Paulo, São Paulo, Brazil.
(No relevant relationships reported)

Strenuous exercise results in muscle damage and low cellular energy levels, which activates the AMP-activated protein kinase (AMPK), a sensor of energy status, as well as induces the expression of forkhead box O1 (FOXO1), linked to delayed skeletal muscle regeneration. Glutamine and alanine are the most important gluconeogenic and cytoprotection-related amino acids, and have been demonstrated to attenuate exercise-induced muscle damage and inflammation. However, whether these amino acids have a role in regulating energy status and muscle damage during heavy resistance exercise (HRE) remain largely unknown. PURPOSE To evaluate the effects of chronic oral supplementation with L-glutamine and L-alanine in their free form (GLN+ALA, ALA) or as the dipeptide L-alanyl-L-glutamine (DIP) on energy status, muscle damage and cytoprotection markers in skeletal muscle of rats submitted to heavy resistance exercise (HRE). METHODS: Forty adult male Wistar rats (n=8/group) were submitted to 8-week HRE, which consisted of climbing a ladder with progressive loads (25 to 100% of body weight), and to supplementation delivered in a 4% solution in drinking water, in the last 21 days of HRE. Phosphorylation of AMPK and FOXO1, as well as cytochrome c (Cyt-c), mitochondrial membrane potential (ΔΨm), cytochrome c oxidase (COX), as well as the expression of cytochrome c oxidase (COX), as well as the expression of ATP synthase β subunit (ATP5B) and superoxide dismutase (SOD), were measured in soleus muscle of the rats. RESULTS: After 8 weeks of HRE, a decrease in phosphorylation of AMPK and FOXO1, and an increase in COX activity were observed in soleus muscle of rats submitted to acute protocol HRE. CONCLUSION: Chronic oral supplementation with L-glutamine and L-alanine (GLN+ALA) or DIP improved skeletal muscle energy status during heavy resistance exercise, suggesting that these amino acids have a role in regulating energy status and muscle damage during heavy resistance exercise (HRE).
were higher, whereas, satiety and fullness were lower after CHO (p < 0.05) compared to LWP, HWP and HSP but not compared to LSP. There were no significant differences (p > 0.05) observed in postprandial leptin or insulin responses between meals, however, a significant change over time was observed for insulin (p = 0.02) but not leptin (p > 0.05). Insulin increased by 293 ± 89 ng/ml at 30 min and decreased by -291 ± 92 ng/ml at 180 min post meal, whereas, leptin decreased by -37 ± 29 ng/ml and -10 ± 5 ng/ml at 30 and 180 min, respectively.

CONCLUSIONS: Liquid, breakfast meals with higher doses of whey and soy protein reduced subsequent energy intake at lunch and were rated as more satiating compared to an isonenergetic CHO meal. In addition, postprandial levels of leptin and insulin did not differ between meals suggesting that acute changes in energy intake and satiety perception may not be influenced by circulating leptin levels.

Skeletal muscle mass loss is a common feature in patients with renal failure receiving maintenance hemodialysis (MHD) therapy. Dietary protein (amino acids) is one of the main anabolic stimuli to skeletal muscle tissue in humans, and impairments to anabolic stimuli over time may lead to muscle mass loss. However, there are major gaps in our knowledge of how muscle mass is regulated by protein intake in MHD patients.

PURPOSE: To compare dietary protein digestion and absorption kinetics and phosphorylation of anabolic signaling proteins after mixed meal ingestion in MHD patients and age- and BMI-matched controls.

METHODS: 8 MHD patients (age: 56±5 y; BMI: 32±2 kg/m²) and 8 controls (age: 50±2 y; BMI: 31±1 kg/m²) received primed continuous infusions of L-[1-13C]leucine and ingested a mixed meal (546 kcal, 20 g protein, 59 g carbohydrate, 26 g fat) with protein provided as intrinsically labeled [5,5,5-2H₃]leucine labeled. Breath, blood, and muscle biopsies were collected to determine amino acid concentrations, leucine enrichments, and phosphorylation of mTORC1 on Ser2448 during a 5 postprandial period. RESULTS: Postprandial release of dietary leucine into circulation over 5 h was reduced in MHD patients (41±5%) vs. controls (61±4%; p<0.03). The feeding-mediated increase in mTORC1 phosphorylation was blunted in MHD patients (0.6-fold above basal) vs. controls (1.1-fold above basal; P=0.006) at 5 h of the postprandial period. CONCLUSION: Our data demonstrated impaired kinetics of digestion/absorption of dietary proteins and reduced postprandial plasma amino acid availability in circulation after mixed meal ingestion in MHD patients when compared to age- and BMI-matched controls. This diminished dietary amino acid availability may have partly contributed to the blunted anabolic signaling mechanisms in MHD patients.

Supported by the Egg Nutrition Center (ENC)

G-44 Free Communication/Poster - Behavioral Aspects and Correlates of Concussions
Saturday, June 2, 2018, 7:30 AM - 11:00 AM
Room: CC-Hall B

3324 Board #193 June 2 9:30 AM - 11:00 AM
Dietary Amino Acid Availability and Anabolic Signaling Molecule Phosphorylation is Blunted in Maintenance Hemodialysis Patients
Nicholas A. Burt, Stephan van Vliet, Sarah K. Skinner, Joseph W. Marks, Hsin-Yu Fang, Alexander V. Ulatov, Scott A. Paluska, FACS, Kenneth R. Wilund, University of Illinois at Urbana-Champaign, Urbana, IL. (Sponsor: Scott A. Paluska, FACS)

Purpose: To compare dietary protein digestion and absorption kinetics and phosphorylation of anabolic signaling proteins after mixed meal ingestion in MHD patients and age- and BMI-matched controls.

Methods: 8 MHD patients (age: 56±5 y; BMI: 32±2 kg/m²) and 8 controls (age: 50±2 y; BMI: 31±1 kg/m²) received primed continuous infusions of L-[1-13C]leucine and ingested a mixed meal (546 kcal, 20 g protein, 59 g carbohydrate, 26 g fat) with protein provided as intrinsically labeled [5,5,5-2H₃]leucine labeled. Breath, blood, and muscle biopsies were collected to determine amino acid concentrations, leucine enrichments, and phosphorylation of mTORC1 on Ser2448 during a 5 postprandial period. Results: Postprandial release of dietary leucine into circulation over 5 h was reduced in MHD patients (41±5%) vs. controls (61±4%; p<0.03). The feeding-mediated increase in mTORC1 phosphorylation was blunted in MHD patients (0.6-fold above basal) vs. controls (1.1-fold above basal; P=0.006) at 5 h of the postprandial period. Conclusion: Our data demonstrated impaired kinetics of digestion/absorption of dietary proteins and reduced postprandial plasma amino acid availability in circulation after mixed meal ingestion in MHD patients when compared to age- and BMI-matched controls. This diminished dietary amino acid availability may have partly contributed to the blunted anabolic signaling mechanisms in MHD patients.

Supported by the Egg Nutrition Center (ENC)

3326 Board #195 June 2 9:30 AM - 11:00 AM
Concussion History Predicts Reduced Cortical Thickness in Special Operations Forces Personnel

Purpose: To compare cortical morphology, symptom scores, and neurocognition in SOF personnel with and without concussion history. Methods: SOF personnel completed an assessment battery including 3T high-resolution MRI and the Immediate Postconcussion Assessment and Cognitive Test (ImpACT). We examined symptom reporting and the ImpACT composite scores for verbal and visual memory, visual-motor processing speed, reaction time, and impulse control. The SOF personnel were categorized by self-reported concussion history (no history vs. 1+ concussions). We used FreeSurfer (v6) to reconstruct and segment the cerebral cortex. Cortical thickness was regressed on concussion history controlling for estimated total intracranial volume. The symptom reporting and ImpACT composite scores were regressed on concussion history. Results: We imaged 166 SOF personnel (160 males; 65 self-reported concussion history) using MRI. Of these, 155 completed the ImpACT during a healthy baseline testing session. Two brain regions had reduced cortical thickness associated with concussion history, controlling for the total intracranial volume: left pericalcarine (t₀=-2.00, p=0.04), and left parahippocampal (t₀=-2.81, p=0.006). One region had larger cortical thickness in those with a concussion history: right transverse temporal (t₀=-2.35, p=0.02). Concussion history did not predict symptom or ImpACT composite scores (p>0.05). Conclusions: Concussion history predicted cortical thickness in brain regions associated with vision and memory, which may have cognitive functions affected following concussion injury. The ImpACT composites were not sensitive to concussion history.

Supported by the United States Army Special Operations Command (USASOC)

Abstracts were prepared by the authors and printed as submitted.
Concussion is one of the most common sports-related injuries in the United States and is especially prevalent in youth sports such as football, ice hockey, and soccer. While all stakeholders are concerned about head trauma in youth sports, parents have an especially strong influence on their children's participation in organized sports. However, few studies have analyzed how parents' knowledge of concussion in sport may affect their decisions regarding youth sport participation.

**PURPOSE:** To explore parental perceptions regarding concussion risk in football and how these perceptions influence subsequent advice offered to other parents regarding their child's participation in football.

**METHODS:** A mixed-methods approach was employed using an online questionnaire distributed to 100 parents of current NCAA Division II football players at a small Midwestern university. The questionnaire included items related to their son's football participation and concussion history as well as their own awareness and perception of concussion risk. Several items included open-ended follow-up questions to allow for qualitative responses, which were coded through inductive analysis and grouped into thematic categories. **RESULTS:** Thirty-four parents of collegiate football players completed the questionnaire (34% response rate). Thirteen (38%) respondents believed their son had experienced a concussion and nine (26%) reported their son had been diagnosed with at least one concussion while playing football. Fourteen (41%) reported the benefits of football participation outweighed the risks and would allow their child to continue in football athletics.**CONCLUSIONS:** Parents of collegiate football players believe the benefits of football participation outweigh the risks and generally would not discourage other parents from allowing their children to participate in football.

**3329 Board #198 June 2 9:30 AM - 11:00 AM**

**Adolescent and Collegiate Knowledge and Behavior Regarding Concussion**

Brent Harper, Adrian Aron, Alex Sivuyf. Radford University, Roanoke, VA. (Sponsor: A. Lynn Millar, FACSM)

(No relevant relationships reported)

**PURPOSE:** To compare adolescent concussion knowledge and behaviors regarding concussion to that of collegiate students using a modified Rosenbaum Concussion Knowledge and Attitudes Survey (RoCKAS) questionnaire.

**METHODS:** Two groups (n=222) completed the questionnaire. Group 1 (HS) included female and male 9th and 10th grade high school students (n=190) with a mean age of 15.1 ± 0.8 years (64.7% female; 35.3% male) and group 2 (CS) included female and male collegiate students (n=32) with a mean age of 19.1 ± 1.1 years (78.1% female; 21.9% male). Of HS, 59.4% reported belonging to a competitive sports team and 87.5% of CS (p=0.007). A sampling of questions from the RoCKAS questionnaire was used to assess groups for: (1) general concussion knowledge and (2) the demonstration of safe behaviors in situational decision making (“safe” or “unsafe”).

**RESULTS:** Sample survey questions evaluated if the participants were actually reading and answering the questions thoughtfully. Scores were high in both groups with no statistically significant difference (HHS 88.5%; CS 93%; p=0.13). General concussion knowledge was correctly answered by 83.8% of the HSS compared to 93% of the CS (p=0.007). HSS not participating in athletics were less knowledgeable than those participating in sports (20.1% compared to 13.5%, p=0.01). HSS males not participating in sports answered incorrectly 23.4% of the time compared with HSS males in sports (12.2%, p=0.03). No statistical significance comparing HSS females in relation to sports participation. Responses to the four situational questions analyzed indicated that 63% of the HSS answered incorrectly by 83.8% of the HSS correctly answering 93% of the questions. **CONCLUSIONS:** HSS and CS are knowledgeable about concussion. Age is positively associated with increased knowledge. HSS participating on sports teams are more knowledgeable, especially males. HS students make more unsafe situational decisions compared to their collegiate counterparts and female CS demonstrate the safest behavior.
culturally relevant concussion-related interventions in high risk populations.

**PURPOSE:** The purpose of this study was to examine factors influencing intention to disclose (ID) concussion symptoms among first-year service academy cadets.

**METHODS:** First-year service academy cadets at the United States Military Academy completed a validated cross-sectional survey based on the Theory of Planned Behavior, including: demographics, medical history, concussion-related knowledge (scale=0–39), attitudes (scale=6–42), subjective norms (scale=7–49), perceived control (scale=1–7), and ID (scale=1–7). All scales had a Cronbach’s alpha >0.75. Multiple linear regression predicted mean differences (MD) in ID. Independent variables included: gender (female vs. male), race (non-Caucasian vs. Caucasian), ethnicity (non-Hispanic vs. Hispanic), prior concussion history (no vs. yes), previous concussion education (no vs. yes), socioeconomic proxy (parent without college education vs. with), concussion-related knowledge, attitudes, perceived social pressures, and perceived control over disclosure. Alpha level was set to 0.05. **RESULTS:** A total of 972 first-year cadets (201 Females; 281 Division 1 student-athletes) completed the survey (85% response rate). Average ID was 5.9±1.2 (IQR: 4.0, 7.0). In the multivariable model, stronger ID was associated with: being non-Hispanic (MD=0.22; p=0.048); no previous concussion education (MD=0.20; p=0.005); more favorable attitudes (MD=0.19; p<0.001) and perceived social pressures (MD=0.55; p<0.001), and more perceived control over concussion disclosure (MD=0.17; p<0.001). **CONCLUSIONS:** Our data suggest perceived social pressures strongly influence ID. Clinicians and health educators should consider culturally and organizationally appropriate intervention strategies among service academy cadets and their key social referents including classmates, cadre, and commanding officers. In context with other factors, ethnicity and concussion education may also influence ID. Supported in part by a grant from the NCAA-DOD Mind Matters Research Challenge.

**G-45 Free Communication/Poster - Exercise Psychology- Pedagogy**

**3332 Board #201 June 2 9:30 AM - 11:00 AM**

**Innovative Curricula Technology in the Exercise Science Classroom: Perceptions of Faculty and Students**

Katherine E. Clark1, Judith A. Juvancic-Heltzel2, Laura A. Richardson1.
1University of Mount Union, Alliance, OH.
2University of Akron, Akron, OH.

(No relevant relationships reported)

**BACKGROUND:** Selecting appropriate pedagogies for meaningful engagement of today’s college students can be challenging. Adequate preparation to meet the advances and challenges in our rapidly evolving profession requires mutual collaboration and open-mindedness by both faculty and students alike. **PURPOSE:** The purpose of this study was to examine perceptions of faculty and students on the use of technology-based pedagogies in Exercise Science curricula. **METHODS:** A survey exploring perceptions of the integration and utilization of technology-based tools in the classroom was administered to participants (N = 51). Survey data was also collected regarding the types of technologies integrated into their respective classrooms. **RESULTS:** Respondent demographics included 43% faculty (N = 22) and 57% students (N = 29). Results revealed 72.5% of respondents prefer enrolling in courses which utilize technology; 72.5% believe technology helps with retention of information; 43% find it frustrating to learn new technologies; and 35% find technology to be a distraction from the intended content. Results also revealed 82% of respondents have used a recorded lecture technology; 41% have used a synchronous web-based lecture tool; and 23.5% have used an in-class app. **CONCLUSIONS:** As the student profile continually changes with our rapidly evolving technological society, it is paramount that educators keep abreast and adapt curricula by implementing innovative pedagogies. Understanding students’ perceptions of classroom tools provides tangible evidence that educators must not remain stagnant with teaching styles. Additionally, understanding perceptions of faculty is equally imperative in context with other factors, ethnicity and concussion education may also influence ID. Supported in part by a grant from the NCAA-DOD Mind Matters Research Challenge.

**3333 Board #202 June 2 9:30 AM - 11:00 AM**

**The Automated Wrist Blood Pressure Cuff as Teaching Tool**

Marvin O. Boluyt, Carly Jones, Shannon Porterfield, Brad Spencer, Ann Brennan. Washkewicz Community College, Ann Arbor, MI.

(No relevant relationships reported)

**PURPOSE:** The teaching and learning potential of the wrist blood pressure cuff were explored. The hypothesis that physics (acceleration due to gravity) would explain the variance in blood pressure readings when the wrist was placed in different positions was tested.

**METHODS:** Subjects (n=27) were recruited from the student, staff, and faculty populations at Washkewicz Community College. In a seated position, systolic and diastolic blood pressures (BP) were obtained with a wrist cuff (Omron BP629) while the wrist was held in three different positions: above the heart (ear level) at the heart (chest level) below the heart (thigh level). The differences in BP from chest level were plotted against the distance (cm) above or below the heart for each individual and compared to the theoretical slope calculated for the acceleration due to gravity. **RESULTS:** While it was clear that gravity was the predominant factor involved in the changes in BP, the slope of the observed line was consistently less steep than that predicted. To explore potential physiological influences on the changes in blood pressure, heart rate (HR) and oxygen consumption (VO2) were measured in separate sets of experiments on 5 subjects each. Both HR and VO2 were significantly elevated when one or both arms were elevated (p < 0.05). **CONCLUSIONS:** It was concluded that gravitational acceleration explains most, but not all of the variance in BP readings when the wrist is above or below the heart, and that physiological adjustments make a small but significant impact. The wrist BP cuff may provide opportunities for teachers and learners to experimentally explore physical and physiological factors that influence BP readings.

**3334 Board #203 June 2 9:30 AM - 11:00 AM**

**Effects of Situated Learning with Cooperative Learning Strategies for Older Adults on Functional Fitness**

Chin-Yun Huang1, Hui-Chuan Wei1, Lan-Yi Chang2, Li Lan Cheng1. 1Nanhua University, Chia-Yi, Taiwan. 2National Chung Cheng University, Chia-Yi, Taiwan. 3Transworld University, Yun-Lin, Taiwan.

(No relevant relationships reported)

Situated learning emphasizes that learning is an important social situation that occurs within everyday functional fitness and social interaction. Such learning interaction originates from social relations, cultural history, specific commodities, real life situations, and physical activity learning environment. Although cooperative learning strategies were found to improve positive effects of interactive learning, there is a lack of research on the impacts of their use in situated cognition teaching design on fitness and cognitive function improvement in older adults. **PURPOSE:** To examine the effects of situated learning and cooperative learning strategies for older adults on functional fitness. **METHODS:** A 2x3 factorial design for experimental study. 120 older adults aged > 65 years from purposive sampling classified as high and high, high and low, and low and low. Participants were randomly assigned to ability treatment. Participants were classified as high or low-ability according to performance on the pretest of pre-existing functional fitness. For the purpose of creating heterogeneous group of older adults for situated learning with cooperative strategies, high and low ability participants were combined into the group. The instructional module utilized a macro context design. After participants completed 18 weeks of functional fitness program, a post-test was delivered. Results: On instructional factor, older adults working situated learning group with cooperative learning significantly outscored those older adults on traditional learning environment. On ability factor, older adults working group with high and high, high and low pair significantly outscored those older adults on low and low pair. However, the group with high and high comparing to high and low pair was not significantly different condition. On Interaction, one of crucial findings to emerge from the study was older adults in the low ability /situated learning with cooperative group outscored those older adults in the low ability /traditional learning group. **CONCLUSIONS:** The structuring situations cooperatively may result in older adults processing functional fitness more effective learning than traditional instructional model.
Exercising women with menstrual disturbances, independent t-tests were used to compare differences between groups. Two-sided significance was determined by SHBG, total T, and calculated free T; hyperandrogenism was defined as decreased concentrations of total triiodothyronine (TT$ _3$) and decreasing anxiety even if there are no changes in weight or body fat percentage.

Exercise associated menstrual disturbances (EAMD) are often attributed to hypothalamic inhibition of the reproductive axis secondary to energy deficiency. However, some exercising women with menstrual disturbances do not present with the traditional metabolic profile of suppressed resting energy expenditure (REE), decreased concentrations of total triiodothyronine (TT$ _3$) and leptin, and elevated ghrelin concentration typical of energy deficiency. Hyperandrogenism may be an alternative or coexisting mechanism underlying menstrual dysfunction in a subset of exercising women. Purpose: To determine if there are differences between the metabolic profiles of exercising women with menstrual disturbances and with and without hyperandrogenism (EAMD-HA, n=30; EAMD-NA, n=67).

The complexity of GH release from the anterior pituitary has increased with the discovery of two somatotrophs: band I molecular weight isoforms (<30 kD) called immunoreactive GH (IGH) and band II large molecular weight isoforms (>60 kD) called bioactive GH (BGH). PURPOSE: To determine the differences between untrained women with low and high body fat percentages.

METHODS: Seventy-five females (mean ± SD; Age: 20.8 ± 3.6 y; Height: 164.7 ± 10.0 cm; Weight: 68.5 ± 16.3 kg; Body fat percentage [BF%]; 27.3 ± 8.7 %) enrolled in college PE courses of Kickingbox (n=14), Beginning jogging (n=9), Intermediate Jogging (n=22), Strength Training (n=14), and Conditioning (n=15) volunteered to participate in this study. Each course met 3 times a week for 50 minutes each class period during the 8-week long course. At the start and completion of each course, participants completed the Body Shape Questionnaire, Exercise Self-Efficacy (ESE), and Social Physique Scale, and height, weight, and BF%, measured by bioelectrical impedance analysis, were recorded.

RESULTS: There were no significant differences pre- to post-testing in weight or activity levels outside of PE in any of the 5 courses (p>0.05). BF% significantly decreased pre- to post-testing in Intermediate Jogging (p<0.05), but not in the other courses. Social physique anxiety decreased in Beginning Jogging (p=0.024) and Strength Training (p<0.05), but not in the other courses. All courses had a significant improvement in body image (p<0.05) and ESE (p<0.05). BF% had a significant negative correlation with body image (R = 0.43, p<0.05) and ESE (R = 0.47, p<0.02), and a positive correlation with anxiety (R = 0.35, p<0.05). Individual heath rating had a significant positive correlation with body image (R = 0.47, p<0.05) and ESE (R = 0.44, p<0.05), and a negative correlation with BF% (R = 0.26, p<0.05) and anxiety (R = 0.42, p<0.05). ESE had a significant positive correlation with body image (R = 0.40, p<0.003) and anxiety (R = 0.32, p=0.033).

CONCLUSIONS: Lower BF% was associated with better body image, exercise self-efficacy, and lower anxiety. However, these results indicate regular exercise through 8-week PE college courses may aid in improving body image and exercise self-efficacy and decreasing anxiety even if there are no changes in weight or body fat percentage.

Exercise has been identified as a potential tool to mediate anxiety and improve self-efficacy and body image, however, the effectiveness of college physical education (PE) courses on psychological health needs further evaluation. PURPOSE: To examine the effects of 8-week PE courses on body image, anxiety, and exercise self-efficacy.

Exercise: (LF: 4 ± 3.1 to 18 ± 3.6 µg·L$ ^{-1}$·min$ ^{-1}$, HF: 1900 ± 433 to 2200 ± 323 µg·L$ ^{-1}$·min$ ^{-1}$; p<0.05). Physical activity level of IGH to resistance exercise, even when BGH responses remain unchanged acutely. Significant differences were observed in the 1 RM squat. All exercise tests were performed between 0630 and 1100 after an 8- to 12-h fast. Pre-exercise samples were obtained during the early follicular phase 15 min before test via standard venipuncture and a post-exercise sample was obtained immediately after the test. Plasma was collected and assayed for IGH using a monoclonal assay. Total BGH was determined using the pituitary cell line bioassay. A two-way analysis of variance (2 X 2) for group and time were used to analyze the data. A p ≤ 0.05 was used to define significance.

RESULTS: No differences were observed between the groups for 1 RM strength in the squat. Both groups significantly increased their IGH concentrations pre to post-exercise: (LF: 4 ± 3.1 to 18 ± 3.6 µg·L$ ^{-1}$·min$ ^{-1}$, HF: 4900 ± 433 to 5200 ± 393 µg·L$ ^{-1}$·min$ ^{-1}$, HF: 1900 ± 433 to 2200 ± 323 µg·L$ ^{-1}$·min$ ^{-1}$). Both BGH did not increase pre to post-exercise, but both IGH and BGH values were significantly higher in the LF group than the HF group. Pre to post-exercise responses were: LF (4900 ± 433 to 5200 ± 393 µg·L$ ^{-1}$·min$ ^{-1}$, HF (1900 ± 433 to 2200 ± 323 µg·L$ ^{-1}$·min$ ^{-1}$). BGH was significantly higher than IGH values at all time points.

CONCLUSION: As previously observed in young men, body fat impacts the response of IGH to resistance exercise, even when BGH responses remain unchanged acutely. BGH in women with lower % body fat do not see the suppression that occurs in women with higher % body fat, which may be linked to GH binding protein activity.

Adipose tissue was considered a passive reservoir for energy storage, but now is viewed as an active endocrine organ secreting adipokines such as resistin and adiponectin. Resistin is viewed as an active endocrine organ secreting adipokines such as resistin and adiponectin. Resistin tends to be inflammatory in nature, while adiponectin tends to be anti-inflammatory, with both being related to insulin resistance. Few researchers have examined the impact of age and physical activity level on serum resistin and adiponectin within the same study. The PURPOSE of this study was to assess the relationships among age, physical activity level, and serum resistin and adiponectin levels in healthy young and older adults. METHODS: A convenience sample was used consisting of 20 young (10 M/10 F; ± 1 age: 21 ± 1.2 y; BMI: 24.3 ± 4.5 kg·m$ ^{-2}$) and 20 older (6 M/14 F; Age: 68.4 ± 4.0 y; BMI: 25.5 ± 3.1 kg·m$ ^{-2}$) adults. Physical activity frequency and intensity were determined in young and older subjects using the International Physical Activity Questionnaire (IPAQ) and the Community Healthy Activities Modeling Project for Seniors (CHAMPS), respectively. Enzyme-linked immunosorbent assay were used for the detection and quantification of serum resistin and adiponectin. RESULTS: Young and older subjects had average resistin levels of 3.49 ± 0.97 ng·mL$ ^{-1}$ and 2.97 ± 0.69 ng·mL$ ^{-1}$; and adiponectin levels of 101.40 ± 33.35 ng·mL$ ^{-1}$ and 165.1 ± 59.39 ng·mL$ ^{-1}$, respectively. Physical activity level

G-46 Free Communication/Poster - Endocrinology/Immunology II Saturday, June 2, 2018, 7:30 AM - 11:00 AM Room: CC-Hall B

3335 Board #204 June 2 9:30 AM - 11:00 AM Effects of 8-week Physical Education Courses On Body Image, Anxiety, And Exercise Self-efficacy Erica J. Roelofs, Sarah R. Du Bose. Meredith College, Raleigh, NC.

(No relevant relationships reported)
was not correlated with either resistin or adiponectin. Resistin tended to be lower in older compared to young subjects (p = 0.056). There was no significant difference in adiponectin levels between young and old subjects (p = 0.57). Adiponectin was correlated with BMI within both groups (old: r = -0.45, p = 0.034; young: r = -0.46, p = 0.043) and when old and young subject data were combined (r = -0.45, p = 0.004).

**CONCLUSIONS:** Body composition appears to be more predictive of serum levels of the anti-inflammatory adipokine, adiponectin, than either age or physical activity level. Surprisingly, resistin, a pro-inflammatory adipokine, was lower in older compared to young adults. Future studies with larger sample sizes and objective measures of physical activity level are warranted to better understand the relationships among age, physical activity level, and the expression of these adipokines.

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### Osteoporosis and Exercise in Female Athletes

**PURPOSE:** To investigate the association between bone mineral density (BMD) and VDR gene polymorphisms in female athletes.

**METHODS:** One hundred and eighty seven female athletes (age: 20.3±1.2 years, height: 161.6±6.3 cm, body weight: 58.3±9.8 kg, percent body fat: 24.8±3.7%) participated in the present study. BMD of the whole-body, lumbar spine (L2–L4), and femoral neck was measured using dual-energy X-ray absorptiometry. Analyses of VDR genes Fok1, Apa1, and Taq1 polymorphisms were performed using TaqMan Genotyping Assay.

**RESULTS:** The genotype frequencies of VDR genes Fok1, Apa1, and Taq1 polymorphisms were in Hardy-Weinberg equilibrium. The VDR genotype for Fok1, FF was found in 44.9%, FF in 41.7%, and FF in 13.4% of the subjects (p = 0.31). For Apa1, AA was found in 12.3%, AA in 45.2%, and AA in 24% (p = 0.05). For Taq1, TT was found in 72%, TT in 26.4%, and TT in 1.6% (p = 0.054). There was no significant difference in physical characteristics among the VDR Fok1, Apa1, and Taq1 genotypes. No significant difference was observed between whole bone BMD, lumbar spine (L2–L4) BMD, and femoral neck BMD in association with the VDR gene Fok1, Apa1, and Taq1 polymorphisms. However, the genotype of the VDR Apa1 T/T polymorphism was significantly associated with lower whole-body BMD than the AA genotype (p = 0.05).

**CONCLUSIONS:** An association with the VDR gene Apa1 polymorphism was observed in this study only for whole-body BMD. In conclusion, the VDR gene Apa1 polymorphism as genotype is associated with decreased whole-body BMD in female athletes.

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### Exercise-Induced Muscle Damage and Inflammation

**PURPOSE:** To determine effect of wearing lower-body compression garment (CG) during prolonged running on tissue vibration and exercise-induced muscle damage and inflammatory responses.

**METHODS:** Ten male subjects (170.5 ± 4.0 cm, 62.6 ± 0.7 kg, VO2 max: 50.6 ± 0.7 mL/kg/min) performed 2 exercise trials in a random order. The exercise consisted of 120 min of uphill running (7% gradient) at 92.4 ± 8.6 % VO2 max. The exercise trials included 1) wearing lower-body CG with exercising 15 mmHg to thigh and calf [CG]; and 2) wearing lower-body garment with exercising below 5 mmHg to thigh and calf [CON]. During exercise, heart rate (HR), rating of perceived exertion (RPE), stride parameters (length and frequency) and tissue vibrations (3-axis acceleration of vastus lateralis, biceps femoris, tibia and gastrocnemius muscles) were evaluated. Jump performances and maximal voluntary contraction for knee extension (MVC) were evaluated before and immediately after, 60 min and 180 min after exercise. Blood variables were collected to determine blood glucose and lactate, serum myoglobin, and plasma IL-6, IL-1α, IL-10, TNF-α and MCP-1 concentrations.

**RESULTS:** Average HR during 120 min of exercise was significantly lower in the CG trial than in the CON trial (163 ± 14 bpm vs. 167 ± 11 bpm, P = 0.042). Although stride parameters during exercise did not significantly differ between two trials, CG trials showed significantly lower tissue vibrations compared with the CON trial (P < 0.05). Jump performances and MVC were significantly decreased after exercise in both trials, whereas the CG trial showed significantly higher value of MVC at 180 min after exercise (92.4 ± 8.6 % vs. 85.0 ± 11.4 %, P = 0.044). There were significant increases in all plasma cytokine concentrations after exercise in both trials (P < 0.05). Area under the curve (AUC) for IL-6 concentration during exercise and post-exercise period was significantly lower in the CG trial than in the CON trial (2,560 ± 1,686 pg/mL vs. 4,021 ± 3,234 pg/mL, P = 0.04). Furthermore, AUCCs for plasma IL-1α and IL-10 concentrations during post-exercise period tended to be lower in the CG trial.

**CONCLUSION:** Wearing lower-body CG during 120 min of uphill running caused significantly lower exercise-induced increase in HR, tissue vibration, inflammation and faster recovery of muscular strength.

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### Running Mitigated Tissue Vibration, Exercise-Induced Muscle Damage and Inflammation

**PURPOSE:** To determine effect of wearing lower-body compression garment (CG) during prolonged running on tissue vibration and exercise-induced muscle damage and inflammatory responses.

**METHODS:** Ten male subjects (170.5 ± 4.0 cm, 62.6 ± 0.7 kg, VO2 max: 50.6 ± 0.7 mL/kg/min) performed 2 exercise trials in a random order. The exercise consisted of 120 min of uphill running (7% gradient) at 92.4 ± 8.6 % VO2 max. The exercise trials included 1) wearing lower-body CG with exercising 15 mmHg to thigh and calf [CG]; and 2) wearing lower-body garment with exercising below 5 mmHg to thigh and calf [CON]. During exercise, heart rate (HR), rating of perceived exertion (RPE), stride parameters (length and frequency) and tissue vibrations (3-axis acceleration of vastus lateralis, biceps femoris, tibia and gastrocnemius muscles) were evaluated. Jump performances and maximal voluntary contraction for knee extension (MVC) were evaluated before and immediately after, 60 min and 180 min after exercise. Blood variables were collected to determine blood glucose and lactate, serum myoglobin, and plasma IL-6, IL-1α, IL-10, TNF-α and MCP-1 concentrations.

**RESULTS:** Average HR during 120 min of exercise was significantly lower in the CG trial than in the CON trial (163 ± 14 bpm vs. 167 ± 11 bpm, P = 0.042). Although stride parameters during exercise did not significantly differ between two trials, CG trials showed significantly lower tissue vibrations compared with the CON trial (P < 0.05). Jump performances and MVC were significantly decreased after exercise in both trials, whereas the CG trial showed significantly higher value of MVC at 180 min after exercise (92.4 ± 8.6 % vs. 85.0 ± 11.4 %, P = 0.044). There were significant increases in all plasma cytokine concentrations after exercise in both trials (P < 0.05). Area under the curve (AUC) for IL-6 concentration during exercise and post-exercise period was significantly lower in the CG trial than in the CON trial (2,560 ± 1,686 pg/mL vs. 4,021 ± 3,234 pg/mL, P = 0.04). Furthermore, AUCCs for plasma IL-1α and IL-10 concentrations during post-exercise period tended to be lower in the CG trial.

**CONCLUSION:** Wearing lower-body CG during 120 min of uphill running caused significantly lower exercise-induced increase in HR, tissue vibration, inflammation and faster recovery of muscular strength.
Rehabilitation following knee surgery (e.g., ACL reconstruction) is prolonged and many individuals do not completely regain their quadriceps size and strength. These persistent impairments give rise to limb asymmetry which increases risks for re-injury and osteoarthritis. PURPOSE: To establish exercise with blood flow restriction (BFR) as a home-based program to overcome persistent quadriceps size and strength impairments and restore limb symmetry long after knee surgery. METHODS: Five adults with an ACL reconstruction and/or meniscus repair (4.4 ± 2.5 years post-surgery) volunteered. Participants had at least 10% asymmetry in quadriceps size and/or strength. Participants exercised at home 4x/week for 4 weeks. Exercises included body weight squats, single-leg knee extension with resistance bands, and walking. Blood flow to the affected limb was restricted using a 15cm pressurized cuff inflated to 50% of limb occlusion pressure. Vastus lateralis and rectus femoris thickness along with knee extensor strength were measured before and after training. Percent difference between affected and contralateral limbs was used as an index of limb asymmetry. Post-training asymmetry indices were compared to healthy uninjured controls (n = 5). RESULTS: Following training, asymmetry in muscle thickness decreased for the vastus lateralis (9.7 ± 2.9 vs. 2.0 ± 4.0%, p = 0.04) and rectus femoris (11.9 ± 7.8 vs. 2.6 ± 3.5%, p = 0.03). Knee extension strength asymmetry decreased from 10.9 ± 2.6% to 2.6 ± 2.7% (p = 0.02). Post-training quadriceps size and strength asymmetry indices were not different from controls (<5%, all p > 0.05). CONCLUSION: These results extend upon early post-operative application of exercise with BFR and demonstrate that this modality can also be used to overcome persistent quadriceps impairments long after knee surgery. Exercise with BFR could serve as a cost-effective home option for improving function after supervised rehabilitation ends. Supported by Blue Cross Blue Shield of Michigan Foundation.

Effects of whole body vibration on neuromuscular performance in patients with osteoarthrosis of the knee

Abstract

Background: The effect of whole body vibration on strength, power and force differences (asymmetries) during the sit to stand (STS) test and isometric strength test assessed with uniaxial force platforms in patients with osteoarthritis of the knee.

Objective: To evaluate the effects of whole body vibration on neuromuscular performance and asymmetries in lower limbs in patients with or at risk of knee osteoarthritis.

Methods: Randomized-Controlled trial with 60 subjects (mean age of 48 years ± 14.2) with diagnosis or at risk of knee osteoarthritis (OA) but physically active, were randomly assigned to training program for 12 weeks: with vibration (WBV) and without vibration (CON). The force platforms was used for the strength measurements (Paso square = 500Hz).

Results: The data was analyzed with the software ForceDecks. Statistically significant differences were found for the CON group between Peak Vertical Force (PVF) pre-training: 655N and POST training: 837N (p = 0.00); the rate of force development (RFD) PRE: 935Ns, POST: 1634Ns (p = 0.05), while in the WBV group there was a non-significant increase: PVF (pre-training: 628N and POST training: 685N) (p = 0.08); the RFD (pre-training: 1280Ns and POST training: 1354Ns) (p = 0.57). In the WBV group there was a significant decrease of pain according to the Visual Analog Scale (VAS). Significant differences were found between the groups being much greater in the group CON, in the isometric leg press test in RFD-200ms (p = 0.03) and relative peak force (Preliminary results).

Conclusion: In individuals with knee OA 12 weeks of strength training performed with whole body vibration led to lower neuromuscular performance gains than the same training performed without vibration, however pain intensity decreases at knee, hip and lower back level according to the VAS.

Key words: Resistance training, acceleration training, Osteoarthrosis knee, Reflex starle, Muscle strength.

Does Blood Flow Restricted Training Improve Quadriceps Strength Following an ACL Injury?

Kathryn Lucas, Darren L. Johnson, Mary L. Ireland, FACSM, Brian Noehren, FACSM, University of Kentucky, Lexington, KY. (Sponsor: Brian Noehren, FACSM)

PURPOSE: Anterior cruciate ligament (ACL) injuries result in significant quadriceps weakness, causing pain and compensation in gait. High resistance strengthening is often not well tolerated after an ACL injury. Blood flow restricted training (BFRT), which uses partial occlusion of blood flow through applied cuffs, may be an effective technique to maximize strength at low intensities. While BFRT has been well...
studied in healthy populations, its effectiveness in an injured population has not been established. We hypothesized that a 4-week blood flow restricted quadriceps strengthening protocol will significantly improve quadriceps strength and the limb symmetry index of the quadriceps.

METHODS: Nine subjects status-post ACL injury participated in this study. After determining the subjects’ preoperative isometric quadriceps strength on a Biodex and their 1 repetition maximum on each piece of exercise equipment, they then performed a 4-week BFRT protocol. Training was performed for 30% of the subject’s 1 rep maximum with BFRT optimal pressure determined per manufacturer instructions. Four quadriceps strengthening exercises were performed at each session. Three sets of 10-30 repetitions were performed for each exercise. At the end of 4 weeks, quadriceps strength was reassessed. A paired t-test was used to compare pre and post intervention quadriceps strength normalized to body weight, and limb symmetry indexes were calculated.

RESULTS: Quadriceps strength of the involved side significantly increased (p<0.001) from 2.2±0.67 Nm/kg to 2.8±0.71 Nm/kg. The limb symmetry index improved from 0.70 pre-BFRT to 0.88 post-BFRT.

CONCLUSIONS: A four-week blood flow restricted training protocol significantly increases quadriceps strength in a preoperative ACL reconstruction population. By training at 30% of the individual’s IRM, the risk of further injury or pain is minimized. Restoring quadriceps strength before surgery may result in a faster recovery and better long term outcomes. Further research should investigate if blood flow restrictive training is appropriate for other injured populations and for postoperative care of patients who have had an ACL reconstruction.

Electromechanical delay (EMD) is a key to evaluate the ability of neuromuscular transmission, and fatigue is believed to be associated with altered neuromuscular transmission of hamstrings, which may increase the risk of non-contact anterior cruciate ligament (ACL) injury. However, experiment evidence supporting this relationship is insufficient.

PURPOSE: The purpose of this study is to investigate the effect of fatigue on electromechanical delay times of hamstrings during eccentric muscle action.

METHODS: Twenty female (20±2 yrs) volunteers participated in the study and EMD of semitendinosum (ST), semimembranosum (SM) and biceps femoris (BF) were determined before and after fatigue during eccentric muscle action at 120° and 240°/s. All subjects followed an isokinetic fatigue protocol until flexion torque fell below 50% of initial torque for three consecutive repetitions. A 2*2*3 ANOVA was used to calculate the effect of fatigue, movement velocity, type of muscle and their interaction on EMD. RESULTS: There was no significant difference in the EMD of the 3 muscles examined (BF: 119.0±25.3ms vs. SM: 119.0±24.0ms vs. ST: 120.3±24.9ms, P>0.05), irrespective of fatigue status or movement velocity. Fatigue caused a significant increase on EMD of muscles examined (non-fatigue: 98.4±11.5ms vs. fatigue: 140±13.8ms, P<0.001). Irrespective of fatigue, EMD of the 3 muscles significantly increased with increasing movement velocity (low angular velocity: 107.8±20.9ms to 140±13.8ms, P<0.001). Irrespective of fatigue status or movement velocity, EMD of the 3 muscles significantly increased with increasing movement velocity (low angular velocity: 107.8±20.9ms vs. high angular velocity: 131.0±22.5ms, P<0.001). CONCLUSIONS: Our findings suggest that fatigue decrease the ability of neuromuscular transmission of hamstrings during eccentric muscle action, irrespective of movement velocity. This would suggest that improving resistance to fatigue of hamstrings may be an effective prevention tool of non-contact ACL injury.

Physiological impairments in incomplete spinal cord injury (iSCI) can include muscle weakness and altered skeletal muscle activation. Reduced voluntary muscle activation in iSCI can cause inadequate fibre recruitment and in turn the muscle may undergo adverse morphological adaptations.

PURPOSE: The study aimed to characterize, the level of lower limb muscle activation using surface electromyography (EMG) during 6 minutes of treadmill walking in iSCI following 12 weeks of a novel overground locomotor training (OLT) program.

METHODS: A convenience sample of 3 individuals with iSCI (Age: 39±15.5 years, AIS C or D, >6months post-SCI) completed 12 weeks of OLT, which consisted of two 90-minute sessions per week. The principles of OLT included the motor learning concepts of task specificity, practice variability and progressive overload. Sessions were broken down into 5 segments: joint mobilization, muscle activation, task isolation, task integration and task rehearsal. Each session catered to a specific component of the gait cycle. Pre- and post-assessment included 6 minutes of treadmill walking, performed at participant’s self-selected speed (0.5-1.4mph). Two sets of bipolar electrodes were placed on the muscle belly of the left lateral gastrocnemius (GA), left tibialis anterior (TA) and left biceps femoris (BF). EMG data was continuously collected over the 6 minutes. The root mean square (RMS) and peak activation of EMG during the last 10 seconds of minute 1, 3 and 6 was calculated using Matlab programming code. The values for each minute were normalized to the RMS

Abstracts were prepared by the authors and printed as submitted.
and peak value of the first 10 seconds of the walking bout. Cohen’s d was calculated to determine effect size (ES) of EMG signal pre- and post-OLT, as well as comparing minute 1 to minute 6 of walking.

**RESULTS**

Following OLT the RMS during minute 6 of the GA and BF increased, difference of 37.52mV with strong ES >0.8. Comparing pre-OLT minute 1 to minute 6 shows a trend of reduced activity in the GA, TA and BF (A-29.11mV, A-8.71mV, A-28.7mV; ES>0.63, ES>0.68 ES>0.75), yet post-OLT the trend is positive (A=48.73mV, 71±±2,163.3 years old, ES>0.74 -0.8). Overall, ES>0.44.

**CONCLUSIONS:** Higher RMS of the EMG during minute 6 of the walking trail could indicate greater activation of measured muscles in SCI following OLT.

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### MEDICINE & SCIENCE IN SPORTS & EXERCISE

Regular exercise is an important strategy to prevent the development of several chronic non-communicable diseases (NCDs), including metabolic inflexibility and diabetes. Skeletal muscle increases glucose uptake through two distinct pathways: Insulin receptor sensitivity pathway and the exercise induced AMPK pathway. Because people with paralysis are unable to move, they never reap the benefits of muscle exercise/activity following a meal. **Purpose:** To determine if electrically induced exercise regulates the glycemic response after an oral glucose load in people with and without a SCI. **Methods:** 8 and 14 people with and without a SCI participated in this study. Participants completed 2 sessions of a 2 hour oral glucose tolerance test at least 7 days apart. 15 minutes after ingesting 75g glucose beverage, participants sat passively (control) or were given a dose of electrically induced muscle stimulation delivered at a 3Hz frequency for 1-hour, then rested for the next hour. Glucose and insulin were measured from venous blood draws at baseline and 120 minutes. Capillary glucose measurements were performed at baseline, 30, 60, 90, and 120 minutes. A mixed design analysis of variance was used for all comparisons with pairwise comparisons where appropriate. **Results:** At baseline, neither glucose (85.5±9.4 and 93.1±6.8 mg/dL, p=0.62) or insulin (13.2±8.8 and 7.8±1.4 μIU/mL, p=0.84) was significantly higher for people with a SCI compared to those without. During the oral glucose tolerance test, there was a significant decrease in the glucose AUC during the electrically induced exercise session for people with a SCI (7,763±3,670 (STIM) and 8,904±4,039 (CTRL) p<0.003), but no difference for people without a SCI (5,205±2,487 (STIM) and 5,500±2,355 (CTRL) p=0.58). Significantly less insulin was needed during the exercise as compared to the control session (124.1±34.8 and 190.2±40.8, p<0.013).

**Conclusions:** A dose of low frequency electrically induced muscle exercise attenuated the severe glycemic response in people with SCI after a meal. These findings offer a unique strategy for people who are paralyzed to improve their glucose tolerance after a meal. Supported by NIH Grants R01HD084645 and R01HD082109.

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### Low Frequency Electrically Induced Muscle Exercise Modulates Glucose Tolerance In People With SCI

**3353 Board #222**

**June 2 9:30 AM - 11:00 AM**

**Low Frequency Electrically Induced Muscle Exercise Modulates Glucose Tolerance In People With SCI**

**Richard K. Shields, Michael A. Petrue, Jinbyun Lee, Jessica R. Woelfel. The University of Iowa, Iowa City, IA.**

(No relevant relationships reported)

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### Relationships Between Quadriceps Femoris Quality And Locomotor Functions In Disabled Patients

**3351 Board #220**

**June 2 9:30 AM - 11:00 AM**

**Relationships Between Quadriceps Femoris Quality And Locomotor Functions In Disabled Patients**

Hishishi Maeda1, Ken Imada2, Koji Ishida1, Hiroshi Akima1, Nagoya University, Nagoya, Japan. "Kinkai Rehabilitation Hospital, Tottori, Japan. (Sponsor: Katsumi Asano, FACSM)

(No relevant relationships reported)

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### Long-term Electrically Induced Muscle Exercise Duration Modulates Distinct Gene Signaling Pathways In People With Spinal Cord Injury

**3352 Board #221**

**June 2 9:30 AM - 11:00 AM**

**Long-term Electrically Induced Muscle Exercise Duration Modulates Distinct Gene Signaling Pathways In People With Spinal Cord Injury**

Michael A. Petrue, Manish Sunjeh, Richard K. Shields. The University of Iowa, Iowa City, IA.

(No relevant relationships reported)

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### Measuring Activity-related Energy Expenditure

**3354 Board #223**

**June 2 9:30 AM - 11:00 AM**

**Measuring Activity-related Energy Expenditure following Exercise Training**

Stephen J. Carter1, Laura Q. Rogers, FACSM1, Heather R. Bowles2, Gary R. Hunter, FACSM1. University of Alabama at Birmingham, Birmingham, AL. National Cancer Institute, Bethesda, MD. (Sponsor: Gary R. Hunter, FACSM)

(No relevant relationships reported)

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### Muscle-tendon Elasticity: Friend or Foe When Measuring Activity-related Energy Expenditure

**3350 Board #222**

**June 2 9:30 AM - 11:00 AM**

**Muscle-tendon Elasticity: Friend or Foe When Measuring Activity-related Energy Expenditure following Exercise Training**

Stephen J. Carter1, Laura Q. Rogers, FACSM1, Heather R. Bowles2, Gary R. Hunter, FACSM1. University of Alabama at Birmingham, Birmingham, AL. National Cancer Institute, Bethesda, MD. (Sponsor: Gary R. Hunter, FACSM)

(No relevant relationships reported)
increase in vertical accelerations. The divergence between actual EE and accelerometer based estimates of EE may contribute to erroneous inferences concerning free-living physical activity.

3355 Board #224 June 2 9:30 AM - 11:00 AM The Test-retest Reliability And Exercise-driven Changes Of UCH-L1 In Healthy, Recreational Active College Students

Grant H. Cabell1, Elizabeth F. Teel2, Erik D. Hanson1, Jason P. Mihalik1, Kevin M. Guskiewicz, FACSM1. 1University of North Carolina at Chapel Hill, Chapel Hill, NC; 2McGill University, Montreal, QC, Canada.

(No relevant relationships reported)

Concussions are common in sports, yet remain difficult to diagnose since truly objective assessments are lacking. Validating the acute exercise effect on UCH-L1 may provide a potential solution to this problem. A biomarker must be sensitive and specific to head injury before it can be further studied as a clinically useful diagnostic for sport-related concussion (SRC). It must be stable over time, and remain unchanged by other factors including acute exercise.

PURPOSE: To investigate the test-retest reliability and acute exercise effect on a novel head injury biomarker, Ubiquitin C-Terminal Hydrolase-L1 (UCH-L1) in healthy subjects such that findings could assist with interpretation of findings in acutely injured athletes. METHODS: Recreationally active (>30 min activity 3 days/week) college students (n=27, males=14, age=21± 2.3 yrs) completed a maximal cycle ergometer exercise trial during two assessment sessions 10-14 days apart. Blood samples were collected within 10 minutes before and after each test. UCH-L1 values were determined through sandwich enzyme linked immunosorbent assays (ELISA) run in triplicate. Intraclass correlation coefficients (ICC) and 80% reliable change indices (RCI) examined the test-retest reliability of UCH-L1. A 2 (sex) x 2 (pre/post) mixed model ANOVA analyzed the acute exercise effect on UCH-L1 levels.

RESULTS: UCH-L1 was moderately reliable in the entire cohort (ICC=0.505, 80% RCI=107.0 pg/ml). Males had excellent reliability (ICC=0.895, 80% RCI=44.4 pg/ml), while females had poor reliability (ICC=0.094, 80% RCI=138.8 pg/ml). No significant effects of acute exercise (F(1, 26)=0.002, p=0.966), sex (F(1, 26)=0.981, p=0.357), or sex by exercise interaction (F(1, 26)=1.108, p=0.303) on UCH-L1 values were found. CONCLUSIONS: UCH-L1 may have potential to be clinically useful in males. The high reliability and negligible effect of exercise suggest the biomarker remains stable in healthy males and is unaffected by acute exercise. Thus, changes may be attributed to external factors known to affect the biomarker such as head trauma. Conversely, the low reliability and wide RCI suggests UCH-L1 feasibility and methods of sideline biomarker analysis are needed in hopes of improving SRC detection and identification.

3356 Board #225 June 2 9:30 AM - 11:00 AM Effects of Body Position and Electrode Type on the Reliability of Bioimpedance Spectroscopy

Michael Lane1, Lee A. Doernte1, April M. Sears1, Ryan M. Beant1, Jordan R. Moon1, Eastern Kentucky University, Richmond, KY; Impedimed, Inc., Carlsbad, CA.

Reported Relationships: M. Lane: Consulting, Consultancy (No relevant relationships reported)

PURPOSE: To compare multiple BIS measurements taken using the traditional approach (gel-backed wet electrodes and subject supine) to BIS measurements taken when subjects are standing or seated using fixed metal electrodes and determine if reliability and measurement error of BIS is affected by these factors. METHODS: To compare multiple BIS measurements taken using the traditional approach (gel-backed wet electrodes and subject supine) to BIS measurements taken when subjects are standing or seated using fixed metal electrodes and determine if reliability and measurement error of BIS is affected by these factors. RELIABILITY: Data was analyzed comparing the two back-to-back measurements both before and after repositioning as well as measurements taken before repositioning to measurements taken after repositioning (pre-to-post).

RESULTS: Both back-to-back and pre-to-post analysis revealed all methods to be highly reliable (ICC > 0.98, %CV < 2.32). Back-to-back measurements resulted in more reliable R0 and Rinf data compared to pre-to-post repositioning data for SIM, SIM, and SoG (ICC > 0.985, %CV < 0.87, SIM < 0.627 Ohms), compared to pre-to-post data for SIM, SIM, and SoG (ICC > 0.987, %CV < 2.32, SIM < 13.33 Ohms). SoG produced the most reliable back-to-back measurements (SoG: ICC =1.00, %CV < 0.34, SIM < 1.48 Ohms, SIM: ICC > 0.995, %CV < 0.97, SIM < 0.72 Ohms) but had the largest reliability errors from pre-to-post compared to SIM and SIM and SoG (ICC > 0.996, %CV < 2.32, SIM < 13.33 Ohms, SIM:ICC > 0.991, %CV < 1.51, SIM < 0.10 Ohms). Similar results were observed when comparing SIM to SIM for both back-to-back and pre-to-post measurements. CONCLUSIONS: Sitting with metal electrodes, standing with metal electrodes, and lying supine with gel-backed electrodes all appear to produce reliable and repeatable BIS measurements (R0 and Rinf). Gel-backed electrodes appear to produce greater variability when measurements are taken after re-applying the electrodes compared to repositioning metal electrodes. Yet, back-to-back measurements have slightly greater variability with metal electrodes compared to gel-backed electrodes. BIS measurements that require tracking of changes over time appear to be more reliable when using metal electrodes over gel-backed electrodes.

3357 Board #226 June 2 9:30 AM - 11:00 AM Pulmonary Testing and Exercise-induced Bronchocoonstriction in Collegiate Baseball Players

Matthew J. Garver1, Molly A. Jennings1, Dustin W. Davis1, Brian J. Hughes1, Steve Burns1, Taylor K. Duyer1, Alex Rickard1, Justin L. Colf1, Jenna L. Cardacci1, Anna L. Blazer1, Laura A. Wilson1, Dave M. Burnett1. 1University of Central Missouri, Warrensburg, MO; 2University of Kentucky, Lexington, KY; 3University of Kansas Medical Center, Kansas City, KS.

(No relevant relationships reported)

Testing for pulmonary conditions such as asthma and exercise-induced bronchoconstriction (EIB) is often overlooked in collegiate athletes, despite the fact that they may have profound effects on performance and health. Asthma is a chronic condition, while EIB is a transient narrowing of the airways activated by strenuous exercise. PURPOSE: The purpose of this analysis was to investigate the prevalence of asthma, undiagnosed asthma, and EIB in collegiate baseball players. METHODS: Participants with asthma were noted and removed from the EIB provocation protocol. The protocol commenced with maximal forced spirometry. Participants were encouraged to achieve a six-second plateau, and spirometry values were collected in duplicate. Participants failing to achieve a baseline forced expiratory volume (FEV1) of at least 70% of the predicted value were removed from ongoing testing. Those passing the baseline spirometry screening proceeded to a single bout of exercise on a treadmill. In stepped fashion, participants progressed to an intensity matching 80-90% of age-predicted maximal heart rate. Exercise intensity was confirmed with ventilation (35*FEV1*10.5 and 35*FEV1*0.6). Participants maintained target intensity for four minutes. Immediately post-exercise, participants resumed a seated position. Maximal forced spirometry efforts were repeated at 2, 5, 10, 15, and 20-min time points. A fall in FEV1 >10% from baseline was considered positive for EIB. RESULTS: Thirty athletes (age: 20.3±1.9 yr, height: 184.2±6.4 cm, and weight 86.5±8.8 kg) volunteered for testing. One (3.3%) had been previously diagnosed with asthma. At baseline, two participants (6.7%) failed to obtain 70% of predicted FEV1 values (labeled as potentially undiagnosed asthma and removed from ongoing testing). A total of 27 participants completed the EIB provocation protocol. Five (16.7% of cohort) failed to obtain 90% of their pre-exercise FEV1 value (an indication of EIB) at one of the post-test time points. The mean drop among those failing was 30.5% with all values being reviewed by a registered respiratory therapist. CONCLUSIONS: The prevalence of pulmonary conditions in athletes may be masked by a lack of testing. It would seem prudent to test athletes for these conditions and create treatment plans.

3358 Board #227 June 2 9:30 AM - 11:00 AM Decreased Aerobic Efficiency in Pediatric and Young Patients with Sickle Cell Disease : Race Comparison

Sandra K. Knecht, Wayne A. Mays, Mallorcé C. Rice, Andrea L. Grzeszczak, Adam W. Powell, Clifford Chin, Punam Malik, Tarek Alsaied. Cincinnati Children’s Hospital, Cincinnati, OH.

(No relevant relationships reported)

PURPOSE: To compare the differences in aerobic efficiency between pediatric and young Sickle Cell patients (SS) and African American (NAA) and Caucasian (NC) controls. METHODS: We evaluated 14 SS patients, NAA and NC age, gender, and body size matched using a Ramp Cycle Ergometry protocol. Oxygen consumption (absolute and indexed), carbon dioxide production, expiratory minute volume (VE), respiratory exchange ratio (RER), systolic blood pressure (SBP) and heart rate (HR) were obtained at all stages. The VE/VO2 (VO2eq) and VE/VCO2 (VCO2eq) equivalents, oxygen consumption uptake efficiency slope (OUES), VE/VCO2 slope (Slope) and oxygen pulse (O2Pulse) were calculated at anaerobic threshold (AT) and maximal exercise (Max). RESULTS: There was no difference in SBP between SS, NAA and NC groups. Max RER was significantly elevated in SS. Indexed Max oxygen consumption (IMVO2) was significantly decreased in SS. O2Pulse and OUES were significantly decreased in SS at AT and Max. Slope, VO2eq and VCO2eq at Max were significantly elevated in SS. The HR at AT was significantly elevated in NAA compared to SS at AT.
We measure peak oxygen consumption (VO₂peak) in children with severe burns via indirect calorimetry. When we can’t measure VO₂peak, we estimate it using the Cooper equation (CEq). In addition, a pharmacological agent sometimes used in burns is propranolol. It is unknown how propranolol affects the prediction of VO₂peak using CEq. Therefore, we compare predictive and measured VO₂peak and metabolic equivalents (METs) in children with severe burns.

METHODS: Children with severe burns were randomly assigned to receive propranolol or no drug during their hospital stay. At discharge, patients underwent a treadmill exercise test using the Bruce protocol. We measured VO₂peak (ml/min/kg), peak heart rate (bpm), and the Cooper equation (CEq). In addition, a pharmacological agent sometimes used in burns is propranolol. It is unknown how propranolol affects the prediction of VO₂peak using CEq. Therefore, we compare predictive and measured VO₂peak and metabolic equivalents (METs) in children with severe burns.

RESULTS: VO₂peak was 25.1 ± 5.6 ml/min/kg vs. 22.1 ± 4.9 ml/min/kg, p = 0.005. VO₂peak was significantly higher in the propranolol group. However, no study has yet evaluated the effects of exercise therapy in children with non-CF bronchiectasis. PURPOSE: To evaluate the effect of a 7-week movement program on fundamental movement skill (FMS) proficiency, cardiorespiratory fitness, perceived movement competence, and health-related quality of life (HR-QoL) in children with non-CF bronchiectasis. METHODS: Children (n = 21) investigated, mean age 7.1 ± 2.3 years with non-CF bronchiectasis were randomly allocated to an exercise or control group. The program consisted of 7 weekly sessions plus home exercises. Each 60-minute session consisted of 6 different developmentally appropriate games, each targeting a specific FMS. The TUGMD 2 was used to assess FMS; cardiovascular fitness was assessed using a continuous exercise test in exercising heart rate (HR), perceived competence was evaluated by the athletic competence subscale from Harter’s Self-Perception Profile for children. HR-QoL was assessed with the PedsQL and parental cough-specific quality of life (PCQOL). A two-way ANOVA was used to assess the effects of the program. Data were analysed according to the intention to treat principle. RESULTS: Average HR during sessions was 137 ± 12 bpm. There was a significant group x time interaction for both FMS subgroups, locomotor (F(3,36) = 7.6, p = 0.01) and object control skills (F(1,18) = 8.3, p = 0.01). The exercise group exhibited improvements in both locomotor (pre 29 ± 2.0,
7-week movement program increases FMS proficiency in children with non-CF bronchiectasis and has a moderate positive effect on cardiovascular fitness.

PURPOSE: To determine the proportion of patients that achieve favorable changes in body composition in the absence of improvements in body mass index. METHODS: Data from 52 months of clinical visits to a pediatric weight management program were extracted from electronic medical records. Body mass index (BMI) and body composition measurements were collected during clinical care. Height and weight were used to calculate BMI. BMI percentile (BMI<sub>p</sub>) for age and gender was determined. Bioelectrical impedance analyzers were used to measure body fat percentage (BF<sub>p</sub>). Data were analyzed to determine what proportion of patients had a favorable decrease in PBF despite an unchanged or increased BMI. RESULTS: Data were obtained for 1741 patients (943 females, 798 males), ages 4-21 years old, with at least two clinical visits. Initial age (±SD) was 12.2 ± 3.1 years. Initial BMI was 23.8 ± 7.0 kg/m<sup>2</sup>. Initial BMI<sub>p</sub> was 98.6 ± 1.7. Initial PBF was 44.0 ± 6.4%. At follow-up, BMI increased or remained unchanged in 1148 patients (66%). PBF decreased in 928 patients (53%). There was an overall increase in BMI (1.2 ± 3.0 kg/m<sup>2</sup>, p<0.0001). However, BMI<sub>p</sub> and PBF decreased (-0.31 ± 1.73, p<0.0001 and -0.66 ± 3.94%, p<0.0001). In patients whose BMI increased or remained unchanged, overall BMI<sub>p</sub> and PBF increased (0.15 ± 0.89, p<0.0001 and 0.53 ± 3.15%, p<0.0001). In males, the increase in PBF was small (1.99 ± 0.66, p=0.07). Of the 779 patients whose BMI increased by 1.0 kg/m<sup>2</sup> or more, 239 (30.1%) had a decrease in PBF. CONCLUSION: Results suggest that including body fat percentage as a measure of success may be beneficial in a pediatric clinical weight management program. While patients with stable or increasing BMIs did not improve body composition overall, males demonstrated stabilized body fat percentages. In addition, of those patients whose BMI increased by 1.0 kg/m<sup>2</sup> or more, 30% still demonstrated an improvement in body composition. While this may not be clinically significant for the patient population as a whole, it is a measure of success for a specific subset of patients who otherwise may believe they had done poorly. This may act as a motivator for patients to continue with healthier lifestyle changes. Future research in this area may include examining age cut-offs and gender differences for the usefulness of body composition assessment.

Alcohol-induced oxidative stress is involved in the development and progression of various pathological conditions and diseases whereas exercise training has been shown to improve redox status, thus attenuating oxidative stress-associated disease processes. PURPOSE: to evaluate the effect of an exercise training program on blood redox status in heavy drinkers. METHODS: Eleven sedentary, heavy drinking men participated in an intervention where they completed an 8-week supervised aerobic training program of moderate intensity. Blood samples were collected before, during (week 4) and after intervention and analyzed for total antioxidant capacity (TAC), thiobarbituric acid reactive substances (TBARS), uric acid (UA), bilirubin, reduced glutathione (GSH) and catalase activity. RESULTS: Catalase activity increased (p<0.05) after 8 weeks (340.7±13.3 U mg/Hb) of intervention compared to week 4 (299.5±18.7 U mg/Hb). GSH increased (p<0.05) after 8 weeks of intervention (1.22±0.16 μmol/g Hb) compared to the control condition (1.11±0.15 μmol/g Hb) and to week 4 (1.11±0.15 μmol/g Hb). TAC, UA, bilirubin, TBARS and catalase activity increased (p<0.05) after 8 weeks of intervention. CONCLUSION: An 8-week aerobic
training program enhanced erythrocyte antioxidant status in heavy drinkers, indicating that aerobic training may attenuate pathological processes caused by alcohol-induced oxidative stress.

**G-48b Free Communication/Poster - Late-Breaking Abstracts**

**June 2 9:30 AM - 11:00 AM**

**Room:** CC-Hall B

3367 Board #: 235

**June 2 9:30 AM - 11:00 AM**

**Does Habitation To High Protein Intake Affect Amino Acid Handling?**

Grith Hajfeldt¹, Jacob Bülöw¹, Lena Rendam², Peter Schjerling¹, Jens Bülöw², Gerrit van Hall³, Lars Holm³. ¹Institute of Sports Medicine, Bispebjerg Hospital, Copenhagen, Denmark. ²Department of Clinical Physiology and Nuclear Medicine, Frederiksberg Hospital and Bispebjerg Hospital, Copenhagen, Denmark. ³Clinical Metabolomics Core Facility, Clinical Biochemistry, Rigshospitalet and Department of Biomedical Sciences, University of Copenhagen, Copenhagen, Denmark. ⁴School of Sport, Exercise and Rehabilitation Sciences, University of Birmingham, Birmingham, United Kingdom.

(No relevant relationships reported)

**Background:** An age related loss of muscle mass is frequent among older adults, a phenomenon termed sarcopenia. In order to circumvent this age related phenomenon, nutritional strategies of increased protein intake has been proposed, however studies investigating the effect of long-term habituation to divergent protein intakes are scarce.

In this study we wish to examine if divergent levels of protein intake, is reflected in postprandial whole body protein kinetics in older male subjects.

**Method:** 12 male subjects ages 65-70 were included in a double blinded cross-over study, where each intervention consisted of a 21-day habituation period to either low or high protein intake (0-6.8 g/kg body weight (BW) or above 1.5 g/kg BW, respectively) interspersed by at least 60 days. At the end of each habituation period, subjects met in to an experimental trial with a primed, constant infusion of $^{13}$C-PHE. A baseline blood sample was taken 90 min after infusion start. Hereafter, intrinsically labeled milk proteins, $^{15}$N-phenylalanine (PHE) caseinate and D$_2$PHE whey were ingested in a breakfast meal. In the postprandial period blood samples were taken at 30, 60, 90, 120, 150, 180 and 240 min. All blood samples were analyzed for amino acid concentrations and PHE tracer enrichments on LCMSMS system. The gastro-intestinal (GI) absorption rate of the milk-protein derived amino acids was estimated from the appearance rate of the milk protein bound PHE tracers. The whole body protein degradation rate was calculated by subtracting the exogenous PHE appearance from the total PHE rate of appearance.

**Results:** The absorption rate of PHE from casein protein was elevated in the late postprandial period after being habituated to low protein intake (interaction: P=0.01, N=6). The absorption rate of whey protein and the endogenous rate of PHE appearance (whole body degradation rate) were not affected in the postprandial period by the habituated level of protein intake.

**Conclusion:** When habituated to a low protein diet preliminary results reveal that the absorption rate of slow digestible dietary protein is enhanced while the whole body protein degradation is not affected in the postprandial phase.

**Funding:** Supported by the Danish Dairy Research Foundation and the University of Copenhagen Excellence Programme 2016 (the CALM project).

(No relevant relationships reported)

3368 Board #: 237

**June 2 9:30 AM - 11:00 AM**

**The Effects of Protein Type and Added Leucine on Myofibrillar Protein Synthesis Following Concurrent Exercise**

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**Reported Relationships:** T.A. Churchward-Venne: Contracted Research - Including Principle Investigator; This study was externally funded by GSSI, a division of PepsiCo Inc. Any opinions or specific interpretations expressed in this manuscript are those of the author and do not necessarily reflect the, position or policy of PepsiCo Inc.

Protein ingestion increases skeletal muscle protein synthesis (MPS) rates. The effect of protein on MPS rates is enhanced by prior exercise. However, the effect of different types of protein on MPS is unclear and has not been evaluated following concurrent exercise. **PURPOSE:** The objective of this study was to determine the capacity of total milk protein (MILK), whey (WHEY), micellar casein (CASEIN), and soy protein, without (SOY) and with additional leucine (SOY+LEU) to support postprandial myofibrillar protein synthesis (MysPs) following concurrent exercise. **METHODS:** 72 young recreationally active males participated in this parallel group, double-blind, randomized controlled trial consisting of two arms. In arm #1, 48 subjects (23±0.3 y) ingested 45 g of carbohydrate with either 0 g protein (CHO), or 20 g MILK, WHEY, or CASEIN protein. In arm #2, 36 subjects (23±0.5 y) ingested 45 g of carbohydrate with 20 g WHEY, SOY, or SOY+LEU. A primed continuous infusion of L-[ring-$^{13}$C]phenylalanine with blood and muscle biopsies was applied to evaluate postprandial MysPs over 360 minutes after exercise. **RESULTS:** In arm #1, MysPs did not differ between treatments (P=0.12) during the postprandial period after exercise (FSR: CHO=0.051±0.003; MILK=0.061±0.003; WHEY=0.056±0.002; CASEIN=0.062±0.005 %/h). When MILK, WHEY, and CASEIN were collapsed into a single group (PROTEIN), protein-carbohydrate co-ingestion resulted in greater MysPs rates than carbohydrate alone (FSR: PROTEIN=0.060±0.002; CHO=0.051±0.003 %/h; P=0.042). In arm #2 MyPs did not differ between treatments (P=0.85) after exercise (FSR: WHEY=0.056±0.002; SOY=0.056±0.004; SOY+LEU=0.058±0.004 %/h). **CONCLUSION:** Total milk protein, whey, and micellar casein (arm #1) do not differ in their capacity to support postprandial MysPs rates when co-ingested with carbohydrate following concurrent exercise in young males. Similarly, whey and soy protein, irrespective of leucine enrichment of soy (arm #2), do not differ in their capacity to support postprandial MysPs after concurrent exercise. Co-ingestion of protein with carbohydrate results in greater postprandial MysPs rates than carbohydrate alone, and may therefore represent a nutritional strategy to support skeletal muscle remodeling following concurrent exercise.

**Funding:** Innovation Foundation Denmark

3369 Board #: 238

**June 2 9:30 AM - 11:00 AM**

**The Effect of Whey Protein Supplementation on the Recovery of Contractile Function following Resistance Training**

Robert W. Davies¹, Joseph J. Bass¹, Brian P. Carson¹, Catherine Norton¹, Marta Kozior², Matthew S. Brook², Daniel J. Atkinson², Philip J. Atherton², Philip M. Jakeman². ¹University of Limerick, Limerick, Ireland. ²University of Nottingham, Nottingham, United Kingdom.

**Reported Relationships:** R.W. Davies: Contracted Research - Including Principle Investigator; Food for Health Ireland. Prof. Philip Jakeman.

**PURPOSE:** This study investigated the effect of supplemental whey protein (WP) on acute measures of muscle protein synthesis (MPS) and the recovery of skeletal muscle contractile function during repeated bouts of resistance training (RT).

**METHODS:** Sixteen resistance-trained men (80 [13] kg body mass; 23 [4] y; 2.6 [1.2] y RT experience; mean [SD]) completed the 7-day dietary supplement
Oleocanthal (Oleo) and Oleacein (Olea) are natural phenolic compounds found in extra-virgin olive oil (EVOO), exerting anti-inflammatory and antioxidant effects. Active therapeutics, led by arterial plaque deposition, in turn increased chronic inflammation and oxidative stress. PURPOSE: The purpose of the study is to evaluate the immunomodulatory and anti-inflammatory effects of Oleo/Olea supplementation and exercise training in the athlosclerotic rats. METHODS: Female Sprague-Dawley rats (age 4-week, n=48) were randomly divided into 4 groups fed an athloric diet (C) with added cholesterol (1.25%) and cholic acid (0.5%) for 12 wks. Half of the rats were supplemented with high Oleo/Olea (1000 mg/kg, HO, n=24); the other half with low Oleo/Olea (100 mg/kg, LO, n=24). In each dietary group, half was trained (T) on a treadmill for 20 mins (25/min, 10% grade for 60 min/day, 5 days/wk), while the other half remained sedentary (S). Two separate groups of rats were fed a chow diet (n=6) and athloric diet (n=12), respectively, without EVOO or T. Total leukocytes and differential were measured using flow cytometry. Total nitrate/nitrite (NOx) contents were determined by colorimetric assay kit. Data were shown as mean ± SEM and analyzed using two-way ANOVA. RESULTS: Leukocytes percentage was higher in HO vs. LO rats (P<0.05), but lowered 32% by T (P<0.05). LO and HO rats showed higher granulocytes percentage than C rats (P<0.05), whereas T suppressed granulocytes in HO by 27% (P<0.05). Neutrophils percentage was increased in HO vs. C and LO rats (P<0.05), but declined by 41% with T (P<0.01). Lymphocytes percentage was decreased in LO and HO rats (P<0.05) and elevated in HO→T by 23% (P<0.05). In addition, T tended to increase monocytes levels in LO rats (P<0.05). Total NOx levels in EVOO-fed rats were decreased compared to C rats (P<0.05), whereas it was higher in HO-fed vs. LO-fed rats (P<0.05). T tended to decrease NOx in LO but increase NOx in HO rats (P=0.052, interaction effect). CONCLUSION: High Oleo/Olea diet increased leukocytes, granulocytes and neutrophils percentage but decreased lymphocytes in sedentary rats, whereas exercise training significantly reversed these trends of immune markers.

Exercise-induced hyperpermeability of the gastrointestinal (GI) tract contributes to abdominal pain, bloating, and fatigue; symptoms commonly expressed in Inflammatory Bowel Disease, Celiac’s Disease, and Type 1 Diabetes. Therapies that can ameliorate the symptoms and conditions are lacking. PURPOSE: To assess the efficacy and feasibility of Lactobacillus Salivarius (UCC118) supplementation on GI permeability in healthy humans. Methods: In a randomized, double blind crossover study, 7 highly-trained endurance athletes (31 ± 6.1 y, VO2max 57.3 ± 9.3 ml/kg/min) received 4 weeks of daily probiotic or placebo supplementation. The initial 4 week period was followed by a 4 week washout, followed by an additional 4 weeks of placebo or probiotic supplementation. GI permeability, blood chemistry, and fecal microbiota were assessed before and after each 4 week intervention period. GI permeability was challenged using 2 hours of continuous treadmill running at 60% VO2max After 20 minutes of running, subjects ingested 5 grams of L-tryptophan, sucrose, and lactulose. Urine was collected before, immediately after, and every hour for 5 hours after exercise. GI permeability was measured as sugar recovered in urine as determined by LC-MS/MS. Metagenomic sequencing was performed on fecal samples with Illumina HiSeq 4000 utilizing a 2 x 150 configuration for an average of 120-130M paired end reads per sample. Beta diversity was estimated using Bray-Curtis method to reveal the microbial diversity between pre and post intervention samples. Results: Compared to placebo, UCC118 treatment increased microbial diversity under the curve for urine (N=5) sucrose (P=0.081) and thiamine recovery (P=0.100). Gut taxonomy sequencing revealed significant changes in 60 bacterial species (P<0.05) after UCC118 supplementation. Additionally, there was an increase in microbial diversity after probiotic use. Conclusion: The results described herein provide proof of principle that 4 weeks of UCC118 supplementation attenuates exercise-induced intestinal hyperpermeability. Molecular processes are ill-defined, so further investigation is needed to determine associated pathways, protein interactions, and impact of specific bacterial taxa. Study supported by external sponsor.

Epidemiological investigations have supported the healthy benefits of subsistence foods. Surprisingly, the health benefits derived from the nomadic nature of humans during the Paleolithic era have been understudied. Hunting and gathering activity that occurs far from the conveniences of civilization on public land most likely represent...
the closest example of this ancient lifestyle that thrived for thousands of years.

PURPOSE: To determine the energy demands, and changes in body composition and metabolic factors in humans during a 12-day wilderness hunting immersion.

METHODS: Four healthy men (age: 42 ± 1 yr, BMI: 27 ± 2 kg/m²) without any known cardiovascular, neurological, pulmonary or metabolic pathology were recruited for participation in the study. Total energy expenditure (TEE) was measured using the doubly labeled water method and a written food diary was utilized to estimate total energy intake (TEI). Body composition was measured using dual energy x-ray absorptiometry; cross sectional area of the upper thigh (XT) and intracellular lipid (IHL) was measured using magnetic resonance imaging/spectroscopy. Fasted blood samples were collected for the measurement of total cholesterol (TC), high (HDL) and low-density lipoproteins (LDL). Results were analyzed using paired t-tests, presented as meansSEM and considered significant at P<0.05.

RESULTS: TEE and TEI were 4226 ± 219 kcal/day and 2499 ± 422 kcal/day, respectively, and resulted in a caloric deficit of 1726 kcal/day. There was a decrease in body weight (3.3 ± 0.2 kg), total fat mass (-3.1 ± 1.0 kg) and visceral fat volume (-261 ± 47 cm³). In contrast, total, leg and arm lean tissue mass and XT were preserved. There was a decrease in IHL (-0.5 ± 0.1 %) with peak fasting insulin levels noted in blood lipids, but two of the four participants did not have their blood samples collected due to conflicts with weather and bush flight schedules. CONCLUSION: In the context of a chronic caloric deficit, adipose tissue and IHL decreased without any reduction in lean tissue mass or muscle mass. These alterations may reflect the interactive influence of movement constancy and caloric deficit on the health benefits of the hunter-gatherer lifestyle. Supported by NIH grant UL1GM181891, T3LGM118992, or R55GM118890 and by a grant from the University of Montana.

3374 Board #: 243
June 2 9:30 AM - 11:00 AM
The Effects Of Acute Exercise On Npy/AgRP And POMC Neuron Activity In The Mouse Hypothalamus
Wyatt P. Bunner, Brenton T. Laing, Hu Huang. East Carolina University, Greenville, NC.

(No relevant relationships reported)

NeuroPeptide Y/Agouti-related peptide (NPY/AgRP) and pro-opiomelanocortin (POMC) neurons are key components of the neuronal circuits that respond to various physiological condition to regulate food intake and energy homeostasis. However, far less is known about how these neurons respond to acute exercise. PURPOSE: To determine effects of acute exercise on the activity of AgRP/NPY and POMC neurons in the mouse hypothalamus. Methods: NPY-GFP reporter mice were utilized in 3 separate experiments. We randomly assigned cohort 1 (N=6) mice to a treadmill exercise with a speed of 13 M/min and an 8.75% grade for a duration of an hour group or a sedentary group, blood glucose was measured immediately post-exercise. Mice were then intracardially perfused, and their brains were isolated to examine the colocalization of the neuronal activation marker c-FOS and the signaling marker for phosphorylation of extracellular signal-regulated kinases (p-ERK) in NPY-GFP and POMC neurons. In cohort 2 (N=7) food intake was assessed following the same treadmill conditions over a 24-hour period. In the final cohort, (N=5) patch-clamp electrophysiological recordings were used to quantify changes in NPY-GFP neuron firing rate induced by exercise. Results: Despite normal glucose levels and food intake after the acute treadmill exercise, c-FOS and p-ERK in NPY/AgRP neurons are significantly increased (p<.05) in the exercised mice compared to the control mice. This result was further confirmed by electrophysiological recording shows that the firing rate was increased in the NPY/AgRP neurons of exercised mice. In contrast, exercise induced c-FOS expression was decreased in the POMC neurons of exercised mice. Conclusion: Acute treadmill exercise increases NPY/AgRP neuron activation, whereas POMC neuron activation is decreased. The responsiveness of these neurons to acute exercise is independent from food intake and glucose regulation but might associate with exercise-induced phosphorylation of ERK in the mouse hypothalamus. Supported by East Carolina University start-up fund.

3375 Board #: 244
June 2 9:30 AM - 11:00 AM
Markers of Non-Functional Overreaching Syndrome During the Race Across America (RAAM): A Case Study
Edward K. Merritt, Toone Barnett, Edward K. Merritt, Kathryn Cardwell, Scott O. Burkhart, Erik A. Willis, Phillip R. Worts, Arnoud Groen, 7 Phillip R. Worts, 1 Scott O. Burkhart, 2, Daniel Petty 3, Lynn B. Panton, FACSM, 4 Michael J. Ormsbee, FACSM, 5 Cathy W. Levenson, FACSM, 1, Jeong-Su Kim, FACSM, 4 Florida State University, Tallahassee, FL. 1Children’s Health Andrews Institute, Plano, TX. 2Centre Pointe Health and Rehabilitation, Tallahassee, FL.

(No relevant relationships reported)

Previous research suggests that strict rest for 5 days following a concussion may prolong symptom presentation. Sub-maximal aerobic exercise is an efficacious treatment for post-concussion syndrome but therapeutic aerobic exercise is not well described in sub-acutely concussed patients. PURPOSE: To determine if sub-maximal aerobic exercise could be safely performed in the context of sport-related concussion. METHODS: Fifteen participants (16 ± 1.5 years; 9 males; 6 females) were assigned using a randomized block design to a 40% Age-Predicted heart rate (HR)MAX (40HR), 60% Age-Predicted HRMAX (60HR), or seated rest control (CON) group. Participants exercised after their initial evaluation between Day 3 and Day 7 (4 ± 1.2 days) following their concussion. Participants’ HR and symptoms were monitored during the treatment. Descriptive statistics and a two-way mixed ANOVA were performed using SPSS 22. RESULTS: Fourteen (93%) participants were able to complete the treatment session. There was a significant interaction between group and time on heart rate (F3,690, 20.297) = 5.163, P = 0.006, partial η2= 0.484. HR was significantly higher in the 60HR group on day 3 of recovery. The 5 blood proteins from the DBS samples that increased the most during RAAM included complement component C7 (35%), complement C4-B (23%), serum amyloid A-4 protein (21%), inter-alpha-trypsin inhibitor heavy chain H4 (19%), and alpha-1-antitrypsin (18%). CONCLUSION: This case study of an ultra-endurance athlete competing in the 2017 RAAM event (4th overall) showed the typical decrease in maximal exercise performance associated with non-functional overreaching. Targeted proteomics procedures from DBS samples showed that the largest increases were measured for immune-related proteins that are involved with complement activation and the acute phase response.

3376 Board #: 245
June 2 9:30 AM - 11:00 AM
Safety Of Sub-maximal Aerobic Exercise During The Sub-acute Phase Of Recovery Following Sport-related Concussion
Phillip R. Worts,1 Scott O. Burkhart,2, Daniel Petty3, Lynn B. Panton, FACSM,1 Michael J. Ormsbee, FACSM,1 Cathy W. Levenson, FACSM,1 Jeong-Su Kim, FACSM,4 Florida State University, Tallahassee, FL. 1Children’s Health Andrews Institute, Plano, TX. 2Centre Pointe Health and Rehabilitation, Tallahassee, FL.

(No relevant relationships reported)

An athlete competing in RAAM. METHODS: The 40-y-old male athlete underwent fitness testing 4-wks pre-RAAM and 4-d post-RAAM to determine body composition and aerobic cycling capacity. During RAAM training distress score (TDS) and body mass were measured one and 2 times per day. Power output and heart rate (HR) were continuously measured during cycling. Fingerstick samples for dried blood spot samples (DBS) were obtained 4 wks, 24-h, and 2-h before the start of the race, twice per day of the race (morning/evening), and after 1 and 4 d recovery. Proteins were resolved from the DBS with trypsin based on specific measurements (Multiple Reaction Monitoring) on an Agilent 6400 QqQ LC-MS/MS. Data was processed and analysed using Skyline. RESULTS: The athlete completed the 4941-km race in 10.1 d at an average moving speed of 24.5 km/h. He cycled for 20.0 h/d, with 20 h sleep for the duration of the race. Power output was 102.6 ± 8.9 watts with the highest 24-h power in the first and last 24 h (108 vs. 120 watts). TDS was 1 before the start and increased to 30 by the end of the race. Pre-Race body capacity was 63% lower (61 vs. 57.5 mL.kg⁻¹.min⁻¹), and maximal HR declined 5.7% (192 vs. 181 beats/min). No changes in body mass or composition occurred. The % change in blood proteins was calculated using the average of the 2 pre-race samples and 5 samples collected on days 8, 9, and the first day of recovery. The 5 blood proteins from the DBS samples that increased the most during RAAM included complement component C7 (35%), complement C4-B (23%), serum amyloid A-4 protein (21%), inter-alpha-trypsin inhibitor heavy chain H4 (19%), and alpha-1-antitrypsin (18%). CONCLUSION: This case study of an ultra-endurance athlete competing in the 2017 RAAM event (4th overall) showed the typical decrease in maximal exercise performance associated with non-functional overreaching. Targeted proteomics procedures from DBS samples showed that the largest increases were measured for immune-related proteins that are involved with complement activation and the acute phase response.

3377 Board #: 246
June 2 9:30 AM - 11:00 AM
Erik A. Williss,1 Pedro F. Saint-Maurice,1 Herman Ponzettii,2 Charles E. Matthews, FACSM,1. National Cancer Institute, Bethesda, MD. 1Hunter College, New York, NY.

(No relevant relationships reported)

PURPOSE: Strategies for the prevention and treatment of obesity require a better understanding of the association between physical activity (PA) and total energy expenditure (TEE). Current strategies are based on an additive model, where TEE and PA increase in a dose-dependent manner. However, recent evidence suggests a constrained TEE model, where increases in PA increases in TEE plateaus at higher levels of PA as the body adjusts to maintain an equilibrium of TEE through metabolic adaptations. Our aims were to examine the shape of the relationship between PA and TEE and to...
assess the role of energy balance status (negative, stable, positive) in this association. METHODS: Participants were 642 older adults (50-74 yrs.) participating in the Interactive Diet and Activity Tracking in AARP study. TEE was assessed by doubly labeled water, PA, assessed by accelerometer, was estimated using three methods to calculate total PA: Vertical Axis counts per minute (CPM), Vector Magnitude CPM, and MET-hrs./d (using a machine learning algorithm [Sojourner-3x]). TEE for each subject was adjusted for anthropometric and demographic factors using linear regression. The relationship between PA and TEE was assessed using linear (i.e., correlations) and non-linear parameters (e.g., nonparametric LOESS regression curves). Percent weight change over a six month period of assessment was calculated as a proxy measurement of energy balance status. RESULTS: The difference in TEE between the top and bottom deciles of PA was 3760 (SD=341) kcal/d in the total sample, +499 (SD=347) kcal/d in men, and -229 (SD=318.4) kcal/d in women. TEE was positively associated with PA levels estimated by Vertical Axis (r= 0.36; <0.0001), Vector Magnitude (r= 0.39; <0.0001), and MET-hrs./d (r= 0.40; <0.0001). There was no evidence of a plateau in TEE as demonstrated by the LOESS curves or the change in median TEE over PA deciles. Individuals who lost >3% of their body weight showed evidence of a plateau in TEE at higher levels of PA. CONCLUSIONS: Overall, PA was associated with TEE in a linear dose-dependent manner. For individual who lost weight, TEE was positively correlated with physical activity, but the relationship was stronger over the longer ranges of TEE. This study provides evidence to adopt a dynamic model for estimating energy expenditure as it pertains to obesity.

3378 Board #: 247 June 2 9:30 AM - 11:00 AM Associations Of Skeletal Muscle And Appendicular Lean Body Mass With Blood Pressure And Hypertension Sunyye Ye, Chaonan Zhu, Chen Wei, Da Gan, Shankuan Zhu, Zhejiang University, Hangzhou, China. (No relevant relationships reported)

PURPOSE: Previous studies have shown the negative effects of body fat on blood pressure (BP). However, the associations between skeletal muscle and BP remain unclear. The present study was aimed to investigate the associations of total skeletal muscle (TSM) and appendicular lean body mass (LBM) including leg and arm, with BP and hypertension. METHODS: Data from 3,130 participants aged 18 to 80 years old were analyzed. Appendicular LBM including leg and arm were obtained from dual-energy X-ray absorptiometry. TSM was calculated based on the total LBM. LBM/weight, LBM/height, and LBM/height^2 indices included TSM, and appendicular, leg and arm LBM divided either by weight, or by squared height. Adjusted multivariable linear or logistic regression models were used to analyze the associations of TSM and appendicular, leg, and arm LBM with BP or hypertension, respectively. To further investigate the associations of regional LBM with BP, arm and leg LBM were put in the linear regression models together, and the Wald test was used to compare the standardized parameter coefficients of arm and leg LBM.

RESULTS: TSM, and appendicular, leg and arm LBM indices were all positively associated with elevated systolic or diastolic BP after controlling for potential confounders including body fat percent and android to gynoid fat ratio, except for appendicular and leg LBM/weight. In addition, higher odds of hypertension were observed in all TSM appendicular and leg LBM indices, except for leg LBM/weight. The standardized beta coefficients of arm LBM indices on systolic and diastolic BP were significantly higher than relevant indices of leg LBM, except for arm LBM/height^2 and arm LBM/height.

CONCLUSIONS: Total skeletal muscle and appendicular LBM especially in arms were positively associated with elevated blood pressure and hypertension, after controlling of potential confounding factors including body fat and fat distribution. Our results suggested that excess skeletal muscle especially in upper extremities may have a negative impact on BP and hypertension. Future longitudinal studies are warranted to confirm our findings.

3379 Board #: 248 June 2 9:30 AM - 11:00 AM Optimal Level of Objectively Measured Physical Activity for Long-Term Weight Loss Danielle M. Ostendorf1, Janet K. Snell-Bergeon1, Jan P. Lande1, Anna E. Baron1, Angela D. Bryant2, Sarah J. Schmiege1, Dawn Comstock1, Edward L. Melanson, FACSM1, Victoria A. Catenacci1, University of Colorado Anschutz Medical Campus, Aurora, CO; University of Colorado Boulder, Boulder, CO. (No relevant relationships reported)

Purpose: Existing physical activity (PA) guidelines for weight management have relied heavily on self-reported PA measures, which are typically overestimated. Our purpose was to determine the optimal level of objectively measured PA for sustaining long-term weight loss. Methods: We conducted a secondary analysis of an 18 month behavioral weight loss trial, which included an exercise prescription of 300 min/wk of moderate-intensity PA. Participants received 6 months of supervised exercise during either months 0-6 or 7-12, followed by 6 months of unsupervised exercise during either months 7-12 or 12-18. PA was objectively measured with the SenseWear arm band. Participants with valid wear time ≥17 h/week were included (≥1 h/wk on ≥15 weekdays and ≥1 weekend day) upon completing unsupervised exercise were included in analyses. Sustained bouts (≥10 min) of activity ≥3 METS were converted to moderate-to-vigorous intensity PA (MPVA). Receiver operating characteristic curve analyses determined the optimal duration of bout MPVA to achieve ≥5% or ≥10% weight loss at 18 months. To identify the optimal cutoff, the Youden index (sensitivity + specificity - 1) and 95% bootstrap percentile confidence intervals were calculated using RStudio (pROC package). A linear mixed effects model examined the association between bout MPVA and weight loss.

Results: Participants included 143 adults (age 39.6±9.4 yrs. BMI 34.2±4.0 kg/m², 87% female). 102 provided an 18-month weight and of these, 82 had valid SenseWear data after completion of unsupervised exercise. The optimal level of bout MPVA upon completion of unsupervised exercise was median (95% bootstrap CI) 209 (144-301) min/wk to achieve ≥5% weight loss at 18 months or 267 (108-449) min/ wk to achieve ≥10% weight loss at 18 months. There was a dose response relationship between bout MPVA and weight loss. Participants who met 5.9-9.9% or ≥10% weight loss at 18 months were at mean±SD: 270±143 or 316±256 min/wk of bout MPVA upon completion of unsupervised exercise.

Conclusions: Results confirm the importance of high PA levels for sustaining clinically meaningful weight loss. These data validate existing guidelines with objective PA measures and suggest that ≥200-300 min/wk of bout MPVA is the optimal duration of PA required to achieve successful long-term weight loss (≥5-10% weight loss 18 months).

3380 Board #: 249 June 2 9:30 AM - 11:00 AM Prevalence Of Rash Suspicious For Tinea Among Minnesota High School Wrestlers -2017-18 Season Mark A. Berg, William O. Roberts, FACSM, University of Minnesota, St. Paul, MN. (No relevant relationships reported)

PURPOSE: Transmitable skin infections in sport are a concern, especially for wrestlers. We followed a geographically defined group of Minnesota high school wrestlers over the 12-week 2017-18 season to determine the prevalence of rash suspicious for tinea (RST). METHODS: Nineteen high school wrestling programs in the St Paul area were contacted, 17 agreed to participate. Wrestlers undergo skin inspections prior to each competition throughout the season. Wrestlers identified during skin checks with an RST (raised, red, <5mm diameter, and with dry flaky scale) were recruited.

RESULTS: 39 of 510 wrestlers (7%) developed RST. 34 wrestlers consented to enter the study and had a total of 38 RST’s meeting inclusion criteria (2 wrestlers developed 2 separate RST and 1 wrestler developed 3 RST). RST occurred throughout the season, with slightly more at the beginning and near the end. Slightly more RST occurred in middle competition weight categories. The most common site for RST was on the extremities(23 RST), followed by trunk(10), neck(2), face(1), and scalp(1). Empiric topical antifungal treatment had been started by 47% of the wrestlers.

CONCLUSIONS: RST prevalence of 7% was less frequent than found in previously reported wrestling populations. This may be the result of routine skin inspections prior to competition. Empiric topical antifungal treatment is commonly employed. Empiric antifungal treatment may be a prevention strategy that deserves further study.

3381 Board #: 250 June 2 9:30 AM - 11:00 AM Current Practices of Concussion Management in Primary Care: A Survey William L. Patterson Jr1, Kristine Karlson2, William Dexter, FACSM1, Deborah Johnson1, Christina Holt, Ardis Olson1, Amy Haskins1, Maine Medical Center, Portland, ME; Dartmouth Hitchcock, Lebanon, NH. (No relevant relationships reported)

Purpose: Best practices for sports-related concussions (SRC) are evolving rapidly. We aim to describe the knowledge of standardized diagnostic tools and the current practices in SRC management by primary care providers (PCPs) in Northern New England.

Methods: We designed an ‘action’ survey, using REDCap, to query current SRC management by pediatric and family physicians in ME, NH, and VT branches of the Academy of Pediatrics (AP) and Academy of Family Physicians (AFP). An email was sent to providers with a link to a deidentified survey which included questions about demographics and clinical practices. The questions covered: frequency of routine skin inspections prior to competition; frequency of routine skin inspections prior to competition. The respondents could view their responses compared with others, and were sent links to evidence models.

Results: Initial response rate is 16% (primary) (111 responses of 688 MEAFP and MEAP members surveyed). Demographics: 43 male, 68 female; mean age: 49.2 years; mean years in practice: 18.7. 90% (100/111) have seen a patient with SRC in the past 2 years; however, 79% (88/111) see ≤1 per month. 56% work with ATCs to

Abstracts were prepared by the authors and printed as submitted.
manage SRC. 61% report moderate or extreme comfort managing SRC. 91% (101/111) are aware at least 1 guideline for SRC, but only 18% (20/111) are aware of the 6 Berlin consensus statement [2]. Our findings are consistent with previous findings that the majority of clinicians are not familiar with SRC terminology or guidelines. A potential explanation for this is that many clinicians may not have had sufficient training on how to identify and manage SRC. This highlights the need for ongoing education and awareness programs to improve the management of SRC in clinical settings. METHODS: Fourteen focus groups (n=105) were conducted in five Canadian provinces. Participants were recruited through email listservs and social media. Focus groups were audio-recorded and transcribed. Data were analyzed using thematic analysis. RESULTS: Our findings indicate that clinicians are often not aware of the presence of SRC in their patients. Many clinicians reported feeling unprepared to manage SRC, with some feeling overwhelmed by the complexity of the condition. Furthermore, there was a notable lack of resources available to clinicians for managing SRC. CONCLUSIONS: The findings from this study highlight the need for improved education and resources for clinicians managing SRC. The development of comprehensive guidelines and training programs is necessary to improve the management of SRC in clinical settings.

**3384 Board #: 253 June 2 9:30 AM - 11:00 AM Nurse Amie (Addressing Metastatic Individuals Everyday)**

Erika Schleicher¹, Leah Cream², Renä Kass¹, Michelle Farnan¹, Xiaochen Zhang¹, Katlynn Mathis¹, Jessica Moyer¹, Kathryn Schmitz, FACSM. ¹Pennsylvania State University, Hershey, PA. ²Ohio State University, Columbus, OH. (No relevant relationships reported)

**PURPOSE:** To investigate the feasibility and acceptance of a symptom assessment and management platform for metastatic breast cancer (MBCa) patients, including exercise.

**METHODS:** Our team developed an interactive symptom assessment and management platform, Nurse AMIE. Patients were provided with a tablet, pedometer, and resistance bands. Nurse AMIE asked a question about sleep, fatigue, pain, or diarrhea. Data from the pedometer and daily symptom questions were applied to an algorithm that resulted in a self-management intervention. Interventions included guided relaxation, social support forum, exercise, and music. Systematic symptom assessment and self-management interventions, along with weekly supportive phone calls determined whether self-management could continue or if there was a need to schedule an appointment with the clinician.

**RESULTS:** 31 MBCa patients had been consented to use Nurse AMIE. The initial patient adherence rate was 76%. Qualitatively, patient interviews suggest that Nurse AMIE is ‘surprisingly easy to use’ and the most valued interventions have been the social support forum, exercises, and music. Additionally, patients noted an improvement in fatigue while using the walking intervention. One patient who was only able to ambulate painfully with a walker at baseline now walks over 10,000 steps a day. Thus far, all initial patients have been able to self-manage with no interval visits with clinicians while using Nurse AMIE.

**Conclusion:** Nurse AMIE is an interactive platform that allows MBCa patients to successfully self-manage symptoms while providing critical feedback. Overall, the physical activity component of this intervention is particularly well received. Qualitative feedback suggests that clinicians and patients are pleased by this comprehensive and standardized approach to assessing and managing symptoms. Further evaluation will allow us to better understand symptom assessment and management.

**3385 Board #: 254 June 2 9:30 AM - 11:00 AM Interindividual Variability and Adverse Responses to Body Composition with Exercise Training in Adolescents with Obesity**

Jeremy J. Walsh¹, Gary Goldfield¹, Glen Kenny³, Ronald Sigal¹, Steven Doucette¹, Brendon J. Gurd¹. ¹Children’s Hospital of Eastern Ontario, Ottawa, ON, Canada. ²University of Ottawa, Ottawa, ON, Canada. ³University of Calgary, Calgary, AB, Canada. ⁴Nova Scotia Health Authority, Halifax, NS, Canada. ⁵Queen’s University, Kingston, ON, Canada. (No relevant relationships reported)

**PURPOSE:** To examine if exercise training increases IV in the observed response of BC, and to quantify adverse response rates to training compared to diet-only control in adolescents with obesity.

**METHODS:** Twenty-four male Sprague-Dawley rats were randomly assigned into a control group (C, n=12), and a sustained aerobic exercise group (E, n=12). Groups C received conventional feeding for four weeks, and group E received feeding and swimming training for four weeks, 60 min/day, 6 days/week. Firstly, we would analysis the effect of sustained aerobic exercise on spatial learning and memory ability of aged rats, by increasing mitophagy in rats’ loubus fromatis. Mitophagy is playing a very important role in brain aging of aged rats.

**RESULTS:** Firstly, sustained aerobic exercise could alleviate rats’ brain aging in spatial learning and memory ability. Mitophagy was significantly increasing in loubus fromatis detected by transmission electron microscope and immunofluorescence. According to the western blotting test, Beclin1 (C:0.08, P62 and LC3-II, HSP60 and LAMP1;at last, index related to the mitophagy were detected by western blotting. The experimental data were reported as means±SE, and P values<0.05 was also significantly increased. These indicators that mitophagy was increasing after sustained aerobic exercise.

**CONCLUSIONS:** Results from this study suggest that four weeks of sustained aerobic exercise can improve spatial learning and memory ability of aged rats, by increasing mitophagy in rats’ loubus fromatis. Mitophagy is playing a very important role in brain aging of aged rats.
outcomes were body fat % and lean body mass (LBMc) measured via MRI, and waist circumference (WC). IVC was assessed using the standard deviation of the observed change from baseline between fasted and pooled exercise groups (SDx). A positive SDx indicates increased IVC with training. An effect size (ES) was used when the SDx was positive to characterize the magnitude of effect. Adverse responses were evaluated using a measure of typical error to establish response thresholds and expressed as an aggregated score for all BC outcomes.

Results: All exercise groups displayed a significant increase in IVC following training for body fat % (SDx = 1.77, ES = 0.32 [0.06, 0.89]), but not for LBMc or WC (SDx = no effect). Exercise significantly decreased the rate of adverse responses for aggregated measures of BC relative to control (7.4% vs. 20.4%, p<0.05), regardless of training modality.

Conclusion: Regardless of modality, exercise training does not systematically increase IVC across most BC measures in previously sedentary adolescents with obesity. Rather, exercise creates a positive, uniform shift in BC outcomes, thereby decreasing the rate of adverse responses and increasing positive responses.

Doxorubicin (DOX) is a potent chemotherapy drug used to treat numerous cancers, but its use is limited due to its toxicities. DOX treatment may lead to skeletal muscle dysfunction which compromises quality of life for cancer patients. It is suggested that DOX inhibits creatine transporter (CreaT) and creatine kinase (CK) expression in cardiac muscle, but little is known as to how it affects CreaT and CK expression in skeletal muscle. Additionally, resistance training has been shown to alleviate DOX-induced skeletal muscle dysfunction (weakness and fatigue), but the effects of resistance training on CreaT and CK expression in DOX-treated skeletal muscle is currently unknown. Purpose: To investigate the effects of resistance training prior to and during DOX treatment on CreaT and CK expression in the primarily type II, or fast, extensor digitorum longus (EDL) muscle. METHODS: Thirty-six male, Sprague-Dawley rats were randomly assigned to one of four groups: sedentary+saline (SSS), sedentary+DOX (SSD), resistance training+saline (RRS), and resistance training+DOX (RRD). The resistance training protocol incorporated a raised cage model where food and water were elevated progressively which provided hindlimb loading 10 weeks prior to DOX injection and during the course of DOX treatment.

Animals receiving DOX received 3 mg/kg DOX administered i.p. weekly for 4 weeks and 3 mg/kg DOX in 4 divided doses daily for 5 days weekly for 10 weeks. Isokinetic muscle function test and Wingate test were conducted to assess their muscle function before and 72 hours after the last session. A biopsy of quadriceps femoris was performed to determine changes in muscle cross-sectional area (CSA), satellite cell activation and mitochondrial metabolism.

Results: After 10 weeks of exercise training, 30FAIL and 30SFAIL showed an increase in peak torque, CSA, and satellite cell activation (p<0.05). In terms of endurance strength, 30FAIL was the only group that presented a significant increase after the training (p<0.001). Furthermore, 30FAIL recorded a significant rise in expression of mitochondrial biosynthesis indicators of COXIV and cytochrome c, fusion proteins (Mfn2, Opa1), CIDEA and PPAR-γ in white adipose tissue (WAT) in sub-elite endurance athletes. According to previous findings, it is suggested that life-long endurance exercise can increase muscle mass effectivley, and can also contribute by facilitating mitochondrial metabolism or an adaptive phenomenon of endurance exercise.

Purpose: We aimed to investigate skeletal muscle functions, hypertrophy, and mitochondrial metabolism according to load and total work volume of exercise training based on molecular biology and physiological factors.

Methods: We recruited 21 men in their 20s and divided them into three groups, 80FAIL (80%RM set to failure, n=7), 30WM (30%RM and work matched to 80FAIL), and 30FAIL (30%RM set to failure), to perform resistance exercise three times a week for 10 weeks. Isokinetic muscle function test and Wingate test were used to assess their muscle function before and 72 hours after the last session. A biopsy of quadriceps femoris was performed to determine changes in muscle cross-sectional area (CSA), satellite cell activation and mitochondrial metabolism.

Results: After 10 weeks of exercise training, 30FAIL and 30SFAIL showed an increase in peak torque, CSA, and satellite cell activation (p<0.05). In terms of endurance strength, 30FAIL was the only group that presented a significant increase after the training (p<0.001). Furthermore, 30FAIL recorded a significant rise in expression of mitochondrial biosynthesis indicators of COXIV and cytochrome c, fusion proteins (Mfn2, Opa1), fusion proteins (Dnp1, Fasl), and mitophagy factors (PINK1, Parkin) after the exercise training (p<0.05). Overall, 10 weeks of low-load resistance exercise training (set to failure) can activate skeletal muscle cells, thereby contributing to increase in CSA and improvement of muscle function.

Conclusion: Low-load high-repetition exercise training can be suggested as an effective method of exercise muscle training to enhance skeletal muscle function and aerobic metabolism at the same time by facilitating mitochondrial metabolism of the skeletal muscle.

Purpose: Despite exercise recommendations for cancer patients, exercise counseling is not standard of care in cancer centers across the U.S. Challenges in the field of exercise oncology persist and require strategic approaches to ensure that exercise programming is approached in a manner that is widely acceptable to patients and their clinicians. Therefore, we have conducted an implementation study to assess feasibility, adherence to exercise during chemotherapy, and logistics of operating an exercise intervention program in the infusion suite of a cancer institute.

Methods: The Exercise Medicine Unit at the Penn State Cancer Institute (PSCI) is located in the infusion suite of the PSCI and was opened in the Fall of 2017. Staff screened all patient visits to the PSCI infusion suite for study eligibility criteria: ECOG ≤ 2, absence of absolute contraindications for exercise, solid tumor malignancy, and scheduled to receive chemotherapy. Participants completed surveys (physical activity, barriers to exercise, nutrition, work impairment, and quality of life) and physical function testing at baseline and follow up. An ACSM certified cancer exercise trainer prescribed a personalized exercise program that has 5 components: aerobic, strength, balance, stretching, and relaxation.

Results: Of 217 patients across all variable across cancer type, 62% were eligible (135), and 104 consented (77%) to the EnACT study. Characteristics of the study population include an average age of 59 years, 62% female, and 40% with metastatic disease. The top 3 cancer sites in the study were the breast (23%), colorectal (17%), and pancreatic (16%). Adherence to prescribed exercise programming was 82%, n=39 completers. Overall, barriers to being active were decreased, with fewer participants reporting lack of willpower to exercise (42%, baseline; 19% follow up; p=0.02), and fewer citing influence from others as a barrier to exercise (19%, baseline; 3% follow up; p=0.06).

Conclusion: We report our mid-point analysis of the EnACT study. Thus far, the study is clinically feasible with 77% of eligible participants providing consent and an 82% adherence rate. Qualitative assessment with participants and health care professionals are ongoing. Collectively this will aid in moving evidence based exercise oncology practice into routine clinical usage.

Abstracts were prepared by the authors and printed as submitted.
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was statistically analyzed by Student’s-test. Results: UCP-1 gene expression was significantly higher in trained women compared with the control group (p = 0.046). No significant difference was found when men were compared -1 expression (p = 0.257). Expression of CIDEA was, again, significantly higher compared with controls (p = 0.049), but also in men (p = 0.024). Finally, expression of PPAR-γ was significantly higher in trained women (p = 0.005). Again no differences were found in men (p = 0.924). Conclusion: Life-long endurance training results in a higher expression of brown adipose tissue markers in periubumal WAT in women, in men only in expression of CIDEA, a factory closely associated with metabolic health. Previous results in rodents show a higher susceptibility of females to upregulate BAT markers following β-adrenergic signalling. A similar mechanism might be possible in humans. This effect might also be caused by differences in body fat distribution and functionality, with women having a higher prevalence for BAT.

PURPOSE: Iliotibial band syndrome (ITBS) is one of the most common overuse leg injuries. Two current theories - friction and compression - attempt to correlate the cause of lateral knee pain and inflammation of the iliotibial band (ITB). Despite lack of consensus, both theories suggest that strain plays a key role in all potential mechanisms of injury. The purpose of this study is to measure strain in the ITB non-invasively over the skin, as a basis for further evaluation of ITBS as correlated to change in skin strain. METHODS: Strain was measured using a ‘strain measurement apparatus’ consisting of strain gauges in a carbon fiber casing. The strain measurement apparatus was placed on biomimetic skin overlying a tendon to obtain an estimated measure of strain upon manipulation of the cords to known forces. The output generated by the apparatus was correlated to the actual strain measured by a load cell placed directly on the tendon. The strain measurement apparatus was manipulated to maximize precision throughout the experimental process. In the second phase of the project, the ‘strain measurement apparatus’ will be used to measure strain in a porcine leg as a closer approximation of the human ITB. RESULTS: The first phase of this study demonstrated a correlation between the strain measured by the apparatus and the force applied to the biomimetic tendon, as measured by the load cell. Four trials were run, with the strongest correlations in trials 2 and 3 with correlation coefficients of 0.97 (P<0.0001) and 0.99 (P<0.0001), respectively. CONCLUSIONS: The results thus far support the hypothesis that strain can be measured in the ITB directly using strain gauges. The efficacy of the strain measurement apparatus will provide a basis for further non-invasive evaluation of the ITB as correlated to ITBS in human models.

RESULTS: Out of 144 interventional electron applications on inflammation and related pain in knees, cervical, backs, shoulder, hands and heads, the mean deviation improvement was 4.5. The Average improvement Percentage ([652.699213 (Sum total VS pain scale pre-treatment)/63.9810606 (Sum total VS pain scale post-treatment) – 10.20 (Difference in sum totals)] [100 - 10.20 – 89.80% (Average pain reduction)]) to the patient is a new accelerated assessment and treatment for rapid reduction of inflammation and related conditions. The pain reduction %’s in this large population pilot study exceed the pain reduction %’s achieved with standard conservative therapeutic options. These results warrant further study and investigation.

3392 Board #: 261 June 2 9:30 AM - 11:00 AM

Forced PGC1a1 Expression Increases Oxidative Capacity And Partially Rescues Strength Following Volumetric Muscle Loss Injury

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(No relevant relationships reported)

Volumetric muscle loss (VML) is characterized by a large volume of muscle tissue being removed from the body due to surgery or severe trauma. The remaining muscle after VML has poor function and unknown adaptive potential during physical rehabilitation. PURPOSE: To investigate the metabolic plasticity of the remaining skeletal muscle after VML injury. METHODS: VML injury was performed on the gastrocnemius muscle of 8-week old C57BL/6 mice. Study 1: Unilaterally injured VML mice performed voluntary wheel running (WR). Study 2: PGC1a1 (CMV promoter) transfection was performed on control (CON) and bilaterally injured VML mice (VML). Mice were divided into three groups: CON+PGC1a1 overexpression, VML+CMV alone, and VML+PGC1a1 overexpression. For the second phase (Wheel (Study 1) or transfecion interventions (Study 2), muscle strength and mitochondrial respiratory function (mitofx) were assessed. RESULTS: Mitofx was ~23% greater in the unjured limb of VML+WR mice compared to VML alone, but mitofx in the injured limb of VML+WR mice was not different from VML alone, suggesting VML injury prevents metabolic adaptations to exercise (ANOVA P<0.001). To determine if a faulty metabolic signaling cascade (i.e., PGC1a1) was responsible for impaired metabolic adaptation in the VML-injured muscle, direct muscle activation via sciatric nerve electrical stimulation was used to initiate oxidative gene transcription in CON and VML mice. The stimulated muscle in CON mice had ~4 fold greater PGC1a1 gene expression than the unstimulated muscle; however, there was no effect of stimulation on PGC1a1 expression in VML mice (Interaction: P<0.001) suggesting VML injury attenuates oxidative gene regulation. Endogenous PGC1a1 activation pathways were bypassed via forced expression of PGC1a1 in Study 2. Forced expression of PGC1a1 resulted in ~33% and ~31% greater mitofx in CON+PGC1a1 and VML+PGC1a1 mice, respectively, compared to VML alone (P<0.001), and VML+PGC1a1 mice had 47% greater muscle strength than VML alone (P<0.001). CONCLUSION: PGC1a1 activation is the limiting factor impairing metabolic plasticity in VML-injured muscle; and improving oxidative capacity of the remaining muscle after VML injury improves recovery of strength.

3393 Board #: 262 June 2 9:30 AM - 11:00 AM

Myonuclear Transcriptional Rate Diffs in Young vers VS Mature Mice


(No relevant relationships reported)

Skeletal muscle fiber hypertrophy occurs in mature mice (>4 months old) in response to synergist ablation overload in the absence of satellite cell-mediated myonuclear accretion, whereas young mice (2 months old) are not able to hypertrophy without satellite cells. We hypothesize that young mice have higher myonuclear transcriptional activity at rest than mature mice due to the demands of developmental muscle fiber growth. Age-related differences in transcriptional rate may in part explain why young mice cannot mount the robust myonuclear transcriptional response required for overload-induced hypertrophy without satellite cells. PURPOSE: To determine whether baseline myonuclear transcriptional differences between young (2 months) versus mature (5 months) mice. Methods: Young and mature mice (n=4 males/group), were pulsed with 5-ethyluridine (EU), a modified uridine that incorporates into nascent RNA, via intraperitoneal injection then sacrificed after 1-hour chase. Myonuclei were defined as DAPI-positive nuclei within the myofiber, delineated by dystrophin immunostaining. EU-labeled nascent RNA was detected histochemically on frozen muscle cross-sections, and myonuclear EU intensity was quantified with semi-automated thresholding software. Muscle fiber cross sectional area (CSA) was quantified via the detection of fiber borders using automated software. Results: The number of EU-labeled myonuclei per fiber were similar between young and mature mice. Myonuclear transcriptional intensity per myonucleus was 10% higher in young versus mature mice, and muscle fiber CSA was 18% smaller (P<0.05). Myonuclear transcriptional rate normalized to muscle fiber size appeared 30% higher in young versus mature mice, but did not reach statistical significance (P=0.07).

Conclusion: Likely due to lower normalized myonuclear transcription relative to young mice, mature mice may possess a transcriptional reserve that allows for hypertrophy in the absence of myonuclear accretion, as previously shown by our
Cerebral palsy (CP) is a neurological disorder caused by lesions in the brain that affect motor development. It is characterized by impaired motor function and atypical development of musculoskeletal structures and muscular weakness. Individuals with CP develop osteoporosis earlier in their age compared to the general population. Bone weakness has a detrimental effect on the muscular system, which causes the CP population to be more prone to bone fracture and further immobility. To date, it is still uncertain whether structural alterations in the skeletal system in CP population have an influence on bone mineral density (BMD) and muscular strength.

PURPOSE: To determine relationships between skeletal architecture, BMD, and muscular strength in adults with and without CP.

METHODS: We studied 13 participants with and without CP. Dual energy X-ray absorptiometry was used to measure bone mineral content (BMC) at the lumbar spine, proximal femur, and forearms. Architectural differences were measured as angles from a center line through the femoral neck to top and bottom of greater trochanter, and lesser trochanter. Leg and forearm muscular strength was measured using a handgrip dynamometer. Body mass index (BMI) was used to weight and calculate to identify the level of obesity.

RESULTS: Compared to healthy control, participants with CP had significantly lower knee extensor peak torque (11.8±2.3 CP vs. 68.0±12.5 control, foot-pounds, P<0.05) at 90 degrees/sec; (7.3±1.1 CP vs. 49.2±10.7 control, foot-pounds, P<0.05) at 210 degrees/sec, lower knee flexor peak torque (6.3±1.6 CP vs. 43.8±7.9 control, foot-pounds, P<0.05) at 90 degrees/sec; (6.00±1.13 CP vs. 35.8±6.88 control, foot-pounds, P<0.05) at 150 degrees/sec; (7.33±1.89 CP vs. 35.17±6.47 control, foot-pounds, P<0.05) at 210 degrees/sec. In control group, there were no significant differences compared with the pre-training result.

CONCLUSION: These findings suggest that CP individuals had significantly different skeletal architectural angles presented by the top and bottom of greater trochanter (e.g., top, 56.1±4 CP vs. 72.3±3 control, degrees, p<0.05). BMC, T-scores, and Z-scores were all significantly different in the left femoral neck (e.g., T-score, -2.96±0.92 CP vs. -0.89±0.49 control, p<0.05) as well as in the forearm regions (e.g., radius 33%, T-score, 0.48±0.31 CP vs. -0.30±0.18 control, p<0.05). Individuals with CP had significantly lower knee extensor peak torque (e.g., at 90 degrees/sec; 11.81±2.3 CP vs. 68.0±12.5 control, foot-pounds, p<0.05). Architectural angles of the femur were closely related to the level of BMD on femoral neck regions and leg muscular strength (p<0.05).

Conclusion: These findings suggest that femoral skeletal architecture (via reduced angles of top and bottom of greater trochanter) has an influence on BMD and muscular strength in adults who have CP.

Supported by Central RSCA and Undergraduate Research Grant, SJSU
A Novel Application of Altitude Training Masks and High-Intensity Interval Training to Improve Exercise Performance


PURPOSE: This study examines the effects of altitude training masks (ATM, also known as respiratory fitness masks) used solely during recovery periods (low-intensity intervals) during high-intensity interval training (HIIT).

METHODS: Participants underwent six weeks of HIIT (3 sessions per week) with each exercise bout consisting of eight, 60-second high-intensity intervals interspersed with eight, 90-second low-intensity recovery intervals. Workloads for the high-intensity intervals were individualized to elicit heart rates within 10 bpm of each participant’s maximal heart rate as assessed during a baseline graded exercise test. The low-intensity recovery intervals were prescribed at a fixed workload corresponding to approximately 10% of each participant’s baseline maximal oxygen consumption ($V_{O2max}$). Participants were assigned via block randomization to either a control group (CG) or a training mask group (TMG) that only wore the ATM during the low-intensity recovery intervals of the HIIT intervention. Participants performed a graded exercise test to volitional exhaustion both at baseline and following the HIIT intervention as well as a functional occlusion test to assess the tissue saturation index nadir (TSIN) of the gastrocnemius. Outcomes were $V_{O2max}$ oxygen consumption at anaerobic threshold (AT), and TSIN.

RESULTS: Twelve participants (7 women; 25.5±4.5 years; BMI: 23.6±1.5 kg/m²) have completed the study to date. $V_{O2max}$ increased significantly in the TMG group (40.5±3.6 to 44.5±5.4 ml/kg/min, p<0.03) but not in the CG. TSIN was significantly greater in the TMG group (-17.8±7.3 to -28.3±7.3% from baseline, p<0.05) with no significant change in the CG. No change in AT was observed in either group.

CONCLUSIONS: Implementing ATMs only during the low-intensity recovery intervals of HIIT training appears to improve key components of cardiorespiratory function not observed in our standard HIIT training group. These findings demonstrate a novel use of ATMs that has potential to change how ATMs are used by recreational and professional athletes. This study has also implications for the use of ATMs as potential adjunctive modalities for enhancing training effects in rehabilitative settings where improvements in short time periods are desirable.

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condition. These results contrast those reported from endurance exercise training and therefore present important insight into the specific contributions of RET to cardiac adaptation, even with stochastic training efforts. Future studies should directly compare the effects of RET and endurance exercise on the structure and function of the heart, and determine whether combined training regimes exceed a health threshold in patient populations.

Supported by NSERC grants to MZM (DG-238819-13) and SMP (RGPIN-2015-04613).

3402 Board #: 271  June 2 9:30 AM - 11:00 AM Impaired Exercise Capacity in Ctnr-tDelta160E Mice Validates Preclinical Model To Assess Exercise Interventions For HCM
Jonathan J. Herrera1, Kate Szaszsiak1, Sean Louzon1, Jaime Yol1, Jil C. Tariff1, Sharelne Day1, 1University of Michigan, Ann Arbor, MI.  2University of Arizona, Tucson, AZ.

Reduced peak VO2 in patients with hypertrophic cardiomyopathy (HCM) is a powerful predictor of adverse outcomes, including all-cause mortality and heart transplant. The risk of death or transplant is reduced by 21% for each 1mL/kg/min increase in peak VO2. A randomized clinical trial conducted by our group demonstrated 16 weeks of moderate intensity exercise training increased peak VO2 in HCM patients by 6% compared to usual activity. Whether exercise attenuates disease progression is unknown but is a critical question given the lack of disease modifying therapy. This is challenging to address in patients because disease typically progresses slowly and non-linearly over many years. Therefore, we propose a preclinical HCM model to determine the effects of exercise on phenotypic emergence and progression.

PURPOSE: To determine exercise capacity in a cardiac troponin T mutant (cTnT) mouse model of HCM through a graded exercise text (GXT) protocol.

METHODS: C57Bl/6 non-transgenic (NTG) (n=6 female, n=5 male) and ΔCtAT (n=4 female, n=8 male) mice (age 10-12 months) were subjected to a human parallel muscle GXT with stages increased in inclinaton (0°-15°) and speed (fm/min up to 30m/min). Mice were accelerated (4 days, 30 min/day) and tested on a motorized treadmill in a randomized and blinded fashion at UM Nutrition Obesity Research Center. Test was terminated when mouse remained in contact w/grid at treadmill for 5 sec. Two sample t-tests were used for data analysis.

RESULTS: Baseline and peak VO2 were significantly lower in cTnT compared to NTG mice (baseline: 83.12 mL/kg/min ± 2.07 vs 95.88 mL/kg/min ± 3.61; peak: 102.35 mL/kg/min ± 2.04 vs 119.20 mL/kg/min ± 5.57; p<0.01 in both comparisons). Compared to NTG mice, cTnT ran a shorter distance (201.33m ± 6.40 vs 253.81m ± 8.78; p<0.0001) and for less time (13.25min ± 5.57; p<0.01 in both comparisons). Compared to NTG mice, cTnT ran a shorter distance (201.33m ± 6.40 vs 253.81m ± 8.78; p<0.0001) and for less time (13.25min ± 5.57; p<0.01 in both comparisons). Compared to NTG mice, cTnT ran a shorter distance (201.33m ± 6.40 vs 253.81m ± 8.78; p<0.0001) and for less time (13.25min ± 5.57; p<0.01 in both comparisons).

CONCLUSIONS: The first report of reduced peak VO2 in a preclinical HCM model. These findings mirror reductions in peak VO2 observed in HCM patients, the magnitude of which is a strong predictor of adverse outcomes. Our observation validates the model as one in which the effects of an exercise intervention on phenotypic conversion and progression can be assessed. Support by UM.

3403 Board #: 272  June 2 9:30 AM - 11:00 AM The Influence of EMG-based Maximal Voluntary Contraction (MVCmax) Intensity on Middle Cerebral Artery Velocity
Hee-Hyuk Lee1, Seongdae Kim1, Myungjin Oh1, Ilgyu Jeong1, 1Hannam University, Daejeon, Korea, Republic of; 2Baekseok University, Cheonan, Korea, Republic of.

It has been established that cerebral blood flow velocity (CBFV) might elevate due to the increase of exercise intensity determined by %VO2 max during a cardiorespiratory exercise test. But, the response of CBV to EMG-based maximal voluntary contraction (MVCmax) during physical exercise remains unclear. To evaluate the influence and adaptability as the intensity index of MVCmax on middle cerebral artery velocity (MCA Fmax) during isometric exercise type exercise.

METHODS: Fourteen healthy male (24.1±1.1yrs) were asked to perform the 45° knee extension isometric contraction during 60 seconds. All participants performed three times in random order the isometric exercise of 100%, 80% and 60% MVC determined by root mean square (RMS) of EMG at right rectus femoris m. with a week interval. Each participant was asked to conduct and maintain the predetermined exact intensity of MVC confirming the figures on a monitor. MCA Fmax was measured at rest, during exercise, immediately after exercise, 30 seconds recovery, 60 seconds recovery and 2 minutes recovery using transcranial-Doppler sonography. All data were analyzed using two-way ANOVA (3 intensities x 6 times) with repeated measures.

RESULTS: MCA Fmax in 80% MVCmax was significantly higher than MCA Fmax in 60% MVCmax (110±19 vs. 99±19 cm/s, p<0.05) immediately after exercise. MCA Fmax in 100% MVCmax was significantly higher than MCA Fmax at 60% MVCmax in 30 second recovery (114±7 vs. 77±10 cm/s, p<0.05) and 60 seconds recovery (97±16 vs. 73±12 cm/s, p<0.05). Heart rate in 100% MVCmax was significantly higher than in 80%, 60% MVCmax at immediately after exercise (128±26 vs. 106±15, 97±10 beats/min, p<0.01) and at 30 seconds recovery (102±18 vs. 87±12, 80±9 beats/min, p<0.05).

CONCLUSIONS: These results suggest that the increase of isometric exercise intensity up to ~80% of MVCmax might induce the elevation of MCA Fmax.

3404 Board #: 273  June 2 9:30 AM - 11:00 AM Muscle Afferent Blockade Improves Endurance Exercise Performance When O2 Transport To Locomotor Muscles Is Preserved
Thomas J. Hureau1, Joshua C. Weavi1, Taylor S. Thurston1, Hsu-an Wan1, Jayson R. Gifford2, Jacob E. Jessop2, Michael J. Buys3, Russell S. Richardson4, Markus Aman2. 1University of Strasbourg, Strasbourg, France. 2University of Utah, Salt Lake City, UT.

PURPOSE: During high intensity whole body endurance exercise, feedback from group III/IV locomotor muscle afferents restricts neural drive to the legs while, simultaneously, optimizing peripheral O2 transport. We attenuated feedback from these sensory neurons to investigate their limiting effects on endurance exercise performance while controlling for locomotor muscle O2 transport.

METHODS: Eight healthy men (VO2peak: 55.6±6 mL/min/kg) performed 5 km cycling time trials (TT) under control conditions and with lumbar intrathecal fentanyl impairing neural feedback from the lower limbs. To assure similar arterial oxygenation, O2 content (CtO2) was raised by breathing 100% O2 during the control (HYP) and the fentanyl (fHYP) TT. The TT was also performed in a simulated hypoxia (HYP) protocol with a reduced 15% inspired O2 (NORM). After each TT, subjects performed a short, constant-load cycling bout at the mean power output achieved during the preceding TT while common femoral artery blood flow (QO2) was quantified using Doppler ultrasound. Leg O2 transport was calculated as the product of O2C and QO2. Using supramaximal electrical femoral nerve stimulation, peripheral and central fatigue were quantified via pre- to post-exercise changes in quadriceps twitch force (ΔQTw) and voluntary activation (AVA).

RESULTS: Both QO2 (~16 mL/min/kg) and CtO2 (~24 mL O2/dL) were similar at the mean power output achieved during HYP, and HYP, P (0.6), but significantly different from control in NORM (~4 mL/min/kg and 22 ± 1 mL O2/dL). Importantly, leg O2 transport was similar between HYP, and HYP, (~0.36 and O2/W/min, P (0.6) and significantly greater than NORM (~0.33 ± 0.05 mL O2/W/min). Although mean power output was augmented during HYP, compared to NORM (287 ± 57 W and 261 ± 38 W, P (0.05), ΔQTw was similar between trials (~40%). Interestingly, HYP further increased mean power output (309 ± 17 W) and improved trial performance (3.3 ± 0.9%) compared to HYP, (P < 0.05). This was associated with a greater ΔQTw (~54 ± 9%), but a similar ΔAVA (~4%) in HYP, compared to HYP.

CONCLUSIONS: Group III/IV muscle afferent feedback restricts endurance exercise performance and limits the development of peripheral fatigue. However, to expose the performance limiting aspect of these sensory neurons during whole body exercise, their impact on convective O2 transport needs to be controlled.

3405 Board #: 274  June 2 9:30 AM - 11:00 AM Highly Cushioned Shoes Increase Leg Stiffness And Amplify Impact Loads During Running
Juha-Pekka Kulmala1, Jukka Kosonen3, Jussi Nurminen1, Janne Avea3, 1Harvard University, Cambridge, MA.  2University of Jyväskylä, Jyväskylä, Finland.  3Helsinki University Hospital, Helsinki, Finland.

Shoe cushioning represents a standard way to manage impact loading and consequent injuries due to running. However, although modern shoes have become increasingly cushioned, running injuries have not decreased. The probable, but poorly understood explanation for this counterintuitive is that shoes with additional cushion have only limited ability to attenuate impacts during running, even though they can significantly reduce impact loads in vitro mechanical tests.

PURPOSE: The aim of this study was to investigate why shoes with additional cushion provide little or no reduction to the impact loads during running.

METHODS: Ground reaction forces (GRF) and the spring-like leg mechanics were examined among 12 healthy running individuals while running at 4.0 m/s with a rearfoot striking pattern using normal (NORM, Brooks Ghost 6) and maximalist (MAX) cushion shoes (Hoka One One). We determined and compared vertical GRF impact peak (VIP) and average vertical loading rate (AVLR), as well as leg stiffness and leg compression between shoe conditions. RESULTS: GRF parameters illustrating the hardness of the impact showed significantly greater values when running with MAX shoes, as compared to running with NORM shoes (VIP (p < 0.001) and AVLR (p < 0.038) were 10.7% and 12.3% greater in the MAX shoe, respectively). The analysis of the spring-like leg function revealed that during running with MAX shoes runner’s leg became stiffer (p < 0.012) and compresses less (p < 0.006) when compared to running with NORM.

CONCLUSIONS: The present findings suggest that increased landing stiffness may
be responsible for opposing the impact attenuation effect of extra shoe cushioning during running. In fact, highly cushioned MAX shoes can even amplify impact loading during running, which thus may increase the risk of impact-related running injuries.

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<th>NORM shoe</th>
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<td>Spring-like leg mechanics</td>
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<tr>
<td>Leg stiffness (kN/m²)</td>
<td>26.1 (7.1)</td>
<td>27.9 (8.2)</td>
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<tr>
<td>Leg compression (cm)</td>
<td>8.3 (1.3)</td>
<td>8.0 (1.4)</td>
<td>0.006**</td>
</tr>
<tr>
<td>Impact loading</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertical GRF peak impact (BW)</td>
<td>2.01 (0.32)</td>
<td>2.25 (0.32)</td>
<td>0.001***</td>
</tr>
<tr>
<td>Vertical GRF loading rate (BW/s)</td>
<td>59.0 (15.2)</td>
<td>67.3 (14.6)</td>
<td>0.038*</td>
</tr>
</tbody>
</table>

### 3406 Board #: 275 June 2 9:30 AM - 11:00 AM

**Quantifying Head Impact Dynamics In Community Level Australian Rules Football**

Alan Pearce. La Trobe University, Melbourne, Australia.

Reported Relationships: A. Pearce: Contracted Research - Including Principle Investigator; Research funded by Impact Technologies, Australia.

Research from elite contact sports is suggesting an athlete may incur hundreds of repetitive head impacts over one season. However, the majority of studies to date have focused on elite level athletes. To date, little investigation has focussed on non-elite sports, particularly in Australia where the majority of sport is played at the community level where little attention is given to those players who may experience significant head trauma. This is the first study to present head impact data in community level football. **PURPOSE:** To quantify head impact data over a season of Australian Rules football (ARF) played at the community club level. **METHODS:** Twenty-five male players (mean age 24.9 ± 5.2 years) from one ARF club participated in 20 home and away matches in the regular season. During matches, head impact data was collected using individually fitted instrumented mouth guards (Nexus A9, Impact Technologies, Australia). Data was sampled at 1000 Hz, with a 500 Hz bandwidth. If the mouthguard exceeded the pre-determined 10 g linear acceleration threshold 100 milliseconds (ms) of data (10 ms pre-trigger and 90 ms post-trigger) were recorded to the on-board memory for later downloading. Outcome measures included mean impact number, mean peak linear and peak rotational acceleration, and injury severity profiles for linear (ISP_linear) and rotational (ISP_rotational) accelerations. **RESULTS:** A total of 2810 impacts were recorded. Individual players experienced an average of 162 ± 40.5 impacts over the course of the season resulting in mean of 8 ± 11 impacts per-player per match. Linear accelerations ranged from 10 g to a peak of 176 g; with a mean, media and 95th percentile value of 33 g, 25 g, and 76 g respectively. Rotational accelerations ranged from 87 rad/s² to a peak of 19831 rad/s² with a mean, median, and 95th percentile value of 4004 rad/s², 3109 rad/s², and 9593 rad/s² respectively. The ISP_linear profiles showed 86.6% were mild severity, 12.7% were moderate severity, and 0.7% were severe. The ISP_rotational profiles showed 69%, 19.8%, and 11.2% were mild, moderate and severe respectively. **CONCLUSIONS:** This novel study provides data to better inform medical personnel in the identification and evaluation of at-risk players for concussion at non-elite community level ARF.