Low energy availability (LEA) may be prevalent in both male and female recreational athletes and can be a catalyst for negative health consequences. **Purpose:** Examine the prevalence of LEA and macronutrient intakes (protein [PRO], carbohydrate [CHO], and fats) and differences between gender in recreational athletes. **Methods:** Data from a larger cross-sectional study was used to examine recreational athletes (n=103, age: 27.9±7.1 years; males: n=59, height: 175.3±9.5 cm, weight: 77.5±13.2 kg; females: n=44, height: 167.9±8.0 cm, weight: 71.4±15.2 kg). Athletes were moderately trained (exercised a minimum of 3-4 days/week. Data collection consisted of anthropometric data, surveys (e.g., demographics, age, gender, etc.), resting metabolic rate, a 7-day online dietary to examine the proportion of participants classified as “at risk” for LEA and across sport and academic status. **Results:** Overall, 92% (n=96) of athletes demonstratedadequate nutrient intake (LEA < 30kcal/kg/FFM; EI: 1400.2±437.3 kcals, CHO: 574.4±490.8 kcals). Differences were found between LEA and PRO intake for both sport type (p<0.04) and academic status (p<0.04), with most equestrian athletes and freshman not meeting protein recommendations (<1.2 g/kg/day). Most athletes (98.7%, n=74) reported low CHO intake (< 5 g/kg/day) with 90.7% (n=68) of athletes with LEA had inadequate CHO intake. Fat intake was adequately met by 64% (n=48) of athletes, however, 26.7% (n=20) of athletes with LEA consumed fats above the recommendation. **Conclusions:** Majority of female athletes demonstrated compromised LEA and macronutrient intake (CHO and PRO). Proper nutritional education, specifically EI and macronutrient intake, is essential for adequate health status and performance in athletes. Healthcare professionals should be aware of recommendations for proper dietary intake, to be a resource for nutritional education for female athletes.
The results are shown in Table 1 below.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Sport</th>
<th>n</th>
<th>Ca (mg)</th>
<th>Mg (mg)</th>
<th>Zn (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F All</td>
<td>119</td>
<td>815.5±401.4</td>
<td>343.3±203.2</td>
<td>10.4±1.4</td>
<td></td>
</tr>
<tr>
<td>F RN</td>
<td>50</td>
<td>920±783</td>
<td>384.3±137.6</td>
<td>11.3±5.3</td>
<td></td>
</tr>
<tr>
<td>F TA</td>
<td>19</td>
<td>845.7±317.7</td>
<td>345.6±156.0</td>
<td>10.8±4.5</td>
<td></td>
</tr>
<tr>
<td>F CF</td>
<td>10</td>
<td>809.2±151.4</td>
<td>372.6±107.2</td>
<td>9.6±1.4</td>
<td></td>
</tr>
<tr>
<td>F CW</td>
<td>16</td>
<td>699.2±209.1</td>
<td>320.1±97.9</td>
<td>7.9±2.2</td>
<td></td>
</tr>
<tr>
<td>F GA</td>
<td>37</td>
<td>764.2±264.4</td>
<td>338.4±97.3</td>
<td>10.0±3.0</td>
<td></td>
</tr>
<tr>
<td>M All</td>
<td>127</td>
<td>971.9±429.3</td>
<td>405.8±173.2</td>
<td>13.4±6.0</td>
<td></td>
</tr>
<tr>
<td>M RN</td>
<td>38</td>
<td>917.5±344.0</td>
<td>338.8±151.0</td>
<td>12.5±5.0</td>
<td></td>
</tr>
<tr>
<td>M TA</td>
<td>27</td>
<td>1055±505.0</td>
<td>441.3±216.6</td>
<td>14.2±5.8</td>
<td></td>
</tr>
<tr>
<td>M CF</td>
<td>10</td>
<td>1015.5±691.6</td>
<td>336.7±124.3</td>
<td>13.5±5.9</td>
<td></td>
</tr>
<tr>
<td>M CW</td>
<td>16</td>
<td>1154.0±474.2</td>
<td>477.9±179.7</td>
<td>16.6±7.0</td>
<td></td>
</tr>
<tr>
<td>M GA</td>
<td>23</td>
<td>802.8±297.1</td>
<td>379.6±129.5</td>
<td>10.8±4.1</td>
<td></td>
</tr>
</tbody>
</table>

**CONCLUSIONS:** All female athletes combined reported Ca intakes significantly below the RDA, while Mg and Zn intakes were significantly higher than the RDA. Significantly low dietary Ca was revealed in female CF, CW, and GA. All male athletes combined reported Zn intakes significantly higher than the RDA. Male GA reported Ca intakes significantly lower than the RDA. Further research is needed to explore the effect of low Ca intake on athletic performance in female and male athletes. This study was not funded.

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

**Board #6**

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

**The Effect of Different Post-Exercise Beverages with Food on Voluntary Dietary Intake and Subsequent Performance**

Danielle McCartney1, Christopher Irwin1, Gregory R. Cox1, Ben Desbrow1, *Griffith University, Gold Coast, Australia. Bond University, Gold Coast, Australia. (Sponsor: Louise Burke, FACSM)**

*Email: danielle.mcCartney@griffithuni.edu.au (No relevant relationships reported)*

**PURPOSE:** Recent evidence suggests that different beverages promote similar fluid recovery but alter nutrient provision when consumed voluntarily with food post-exercise (Campagnolo et al., 2017; McCartney et al., In Press). However, when preparing to undertake another bout of exercise, individuals may exhibit different dietary behavior (e.g. to reduce gastrointestinal distress, optimize performance). This study investigated the effect of consuming water or a carbohydrate (CHO)-electrolyte sports beverage (‘Sports Drink’) ad libitum with food during a 4h post-exercise recovery period on fluid restoration, nutrient provision, and subsequent endurance cycling performance.

**METHODS:** On two occasions, 16 trained cyclists, 8 male (M) (age: 31±9y; VO2max: 54±6L·min−1) and 8 female (F) (age: 33±8y; VO2max: 50±7L·min−1), lost 2.3±0.3% and 1.6±0.3% of their body mass (BM) (respectively) during 1h of fixed-intensity cycling. Participants then had ad libitum access to either Water or Sports Drink (100kJ·L−1; 5.8g CHO·L−1) and food for the first 195 min of a 4h recovery period. At the end of the recovery period, participants completed a cycling performance test (45 min fixed-intensity pre-load and an incremental test to exhaustion [peak power output, PPO]). Beverage intake; water/nutrient intake; and indicators of fluid recovery (BM, urine output, plasma osmolality [P OSM]) were assessed throughout trials.

**RESULTS:** Participants returned to a similar state of positive fluid balance prior to recommencing exercise, regardless of the beverage provided (Water: +4.0±0.5 L; Sports Drink: +0.3±0.3 L, p=0.529). While Sports Drink increased post-exercise energy (M: +1.8±1.0MJ; F: +1.3±0.5MJ) and CHO (M: +114±31g; F: +84±25g) intake (p<0.001), this did not affect subsequent endurance cycling performance (Water: 337±40W [M] and 252±50W [F]; Sports Drink: 340±40W [M] and 258±47W [F], p=0.242).

**CONCLUSIONS:** Recovery beverage recommendations should consider the post-exercise environment (i.e. availability of food), an individual’s tolerance for food/fluid, the immediate requirements for refueling (e.g. CHO demands of subsequent activity) and the athlete’s overall dietary goals.

This research was funded by the MSU College of Education via a Summer Research Fellowship.

1141 Board #8 May 30 9:30 AM - 11:30 AM
The Importance of Iron Testing for D3 Cross Country Runners
Preston Kauder, Nathan Goslin-Klemme, Jake Till, Elaina Biechler, Loras College, Dubuque, IA. (Sponsor: Vincent Paolone, FACSM)
Email: pkaud24@gmail.com
(No relevant relationships reported)

PURPOSE: Iron is an important mineral carried throughout the body, which helps carry oxygen rich molecules via hemoglobin. For endurance athletes, blood iron levels may be an important predictor of performance. Previous research has shown that iron absorption rates are lower in athletes in comparison to sedentary individuals. The purpose of the current investigation was twofold: first, to measure pre-season blood iron levels in division III male and female cross country runners to determine if iron deficiency existed, and secondly, to determine if iron levels would improve with a five week nutrition intervention for subjects classified as low.

METHODS: Capillary puncture was utilized to measure blood iron levels during the week of pre-season practice in division III male (N=26) & female (N=20) cross country runners. Athletes were classified as low if the males were below 13.0mg/dL and females were below 12.0mg/dL. If subjects were classified as low, they received a nutritional pamphlet as an intervention, and were retested 6 weeks later.

RESULTS: The researchers classified 26.92% of males as iron deficient, and 5.00% of females as deficient. After retesting the deficient subjects, a paired t-test was utilized to determine if significant improvements in blood iron occurred following the five week intervention. A p-value of 0.002 (2-tail) was yielded showing a significant improvement in hemoglobin levels from preseason in comparison to 5 weeks following the intervention (12.28 +/- 1.9, 13.94 +/- 2.52 respectively).

CONCLUSIONS: After a five week intervention, iron levels in those previously deficient, were significantly improved. Iron is a significant mineral for athletes, especially runners who are greatly dependent on oxygen for their performance. Thus, making sure cross country runners are educated on good nutritional habits, and educating athletes can result in a substantial improvement in blood iron levels.

C-07 Thematic Poster - Clinical Exercise Physiology: Exercise and Type 2 Diabetes
Thursday, May 30, 2019, 9:30 AM - 11:30 AM
Room: CC-101B

1142 Chair: R. Scott Rector, FACSM. University of Missouri, Columbia, MO.
(No relevant relationships reported)

1143 Board #1 May 30 9:30 AM - 11:30 AM
Impact Of A Clinical Exercise Program On Trajectories Of Hba1c And Weight In Older Veterans
Jamie Giffuni, Rebecca Melvin, Bethany Lyons, Odessa Addison, Alyssa Stookey, Leslie Katzel. Baltimore Veterans Affairs Medical Center, Baltimore, MD.
Email: jamie.giffuni@va.gov
(No relevant relationships reported)

Purpose: Gerofit is a clinical exercise program for Veterans ≥65 years, originally developed at the Durham VA Medical Center and offered at the Baltimore VA Medical Center (BVAMC) since 2013. Veterans receive individualized exercise programs and participation in the program is voluntary. We assessed hemoglobin A1C (A1C) and weight changes in Veterans with a diagnosis of diabetes who completed one year of exercise training in Gerofit. Methods: Older Veterans with primary care at the BVAMC were referred to Gerofit. Functional assessments included measures of weight and were used in conjunction with patients’ personally identified exercise goals to develop comprehensive exercise programs including cardiorespiratory, strength, and flexibility training. Clinical chart reviews were conducted to determine A1C and weight one year prior to starting Gerofit, time of enrollment, and one year into participation. Initial program enrollment eligibility did not exclude for elevated A1C, but was later modified to include pre-program A1C ≥10%. Veterans could attend Gerofit exercise sessions up to 3 days per week. Results: Forty-four Veterans with diabetes (43 male, 73.5 ± 5.6 years, 89% African American, BMI 32.9 ± 5.0 kg/m²) completed 1 year of Gerofit. On average, both weight and A1C increased in the year prior to initiating Gerofit (A1C 7.2 ± 1.2 to 7.4 ± 1.5%, weight +1.2 lbs.). Overall A1C declined to 7 ± 0.7% (p=0.03) and weight by -0.6 ± 4.15 (p=0.73) 1 year after Gerofit. Half the group (22/44) experienced a decrease in A1C, 2/44 had no change, and 17/44 increased A1C. The group that decreased A1C at 1 year started with a significantly higher A1C at time of enrollment compared to those that increased A1C at 1 year (7.8 ± 1.6% vs. 6.8 ± 1.2%). Conclusion: Diabetic Veterans who participated in one year of Gerofit overall demonstrated a reversed trajectory of rising A1C and weight. Overall, the decline in A1C approached the clinically significant reduction of 0.5%. Those Veterans with a higher A1C at time of enrollment demonstrated a statistically and clinically significant reduction; reducing potential diabetes complications. Results demonstrate the importance of participation in a low level, multi-component exercise program for weight and diabetes management.

1144 Board #2 May 30 9:30 AM - 11:30 AM
Long-term Changes On Bdnf And Igf-1 In Patients With T2dm - Training At Different Intensities
(No relevant relationships reported)

A growing body of evidence suggests that exercise can influence the central nervous system through circadian rhythms that can cross the blood-brain barrier. Among these factors are the brain-derived neurotrophic factor (BDNF) and insulin-like growth factor-1 (IGF-1), which work simultaneously to improve brain plasticity and functioning. However, the long-term effects of different exercise intensities on BDNF and IGF-1 in patients with type 2 diabetes mellitus (T2DM) have never been examined. PURPOSE: Examine the impact of a 12-month randomized controlled trial of combined high-intensity interval training (HIIT) with resistance training (RT) vs. a combined moderate continuous training (MCT) with RT, on circulating levels of BDNF and IGF-1, in patients with T2DM. METHODS: Patients with T2DM (n=80) were randomized into three groups (Control, HIIT with RT, and MCT with RT). Exercise training was performed 3 days per week for 12 months, while supervised by exercise physiologists. Resting serum BDNF and IGF-1 levels were measured at baseline and 12-months. Within- and between-group changes in BDNF and IGF-1 were assessed using generalized estimating equations were used. RESULTS: After adjustment for sex and baseline moderate-to-vigorous physical activity, there was no significant between-group changes for both HIIT and MCT on BDNF (MCT: β=-0.05, p=0.474; HIIT β=-0.01, p=0.950) and IGF-1 (MCT: β=-1.73, p=0.358; HIIT β=-2.75, p=0.173) in the intention-to-treat analyses. With similar results, the per protocol analysis (>70% adherence to prescribed sessions) showed no significant changes for both MCT and HIIT on BDNF (MCT: β=-0.03, p=0.723; HIIT β=-0.03, p=0.602) and IGF-1 (MCT: β=-0.52, p=0.829; HIIT β=-1.84, p=0.455). CONCLUSIONS: These findings indicate that a 12-month intervention using a combination of HIIT with RT or MCT with RT had no significant impact on serum levels of both BDNF and IGF-1 in patients with T2DM. There is a heterogeneous and wide response to exercise on BDNF and IGF-1, especially when considering long-term interventions. Thus, future studies on the long-term effects of exercise are warranted to better understand the influence of these specific growth factors on brain health.

1145 Board #3 May 30 9:30 AM - 11:30 AM
Vascular Changes In Patients With T2dm Following 1-year Of Exercise, Irrespective Of Cardiorespiratory Fitness Improvement
Megan Hetherington-Rauth1, João P. Magalhães2, Pedro B. Júdice1, Xavier Melo3, Luís B. Sardinha1. 1Faculty of Human Kinetics, University of Lisbon, Lisbon, Portugal. 2Ginásio Clube Português, Lisboa, Portugal.
(No relevant relationships reported)

Micro- and macro-vascular changes occurring in patients with type 2 diabetes mellitus (T2DM) are major contributors to the development of cardiovascular disease, a leading cause of morbidity and mortality for these individuals. Increased cardiorespiratory fitness (CRF) from exercise training has been associated with improvements in metabolic and vascular health outcomes. Despite mean improvements in CRF from exercise training there remains a portion of participants having little or no improvement. PURPOSE: Our group has previously examined the impact of combined exercise interventions with T2DM, we assessed whether non-responders to CRF also failed to improve structural and functional arterial indices following a 1-year exercise intervention. METHODS: We assessed patients with T2DM (n=63) who participated in a three arm 1-year continuous training or high intensity interval training combined with resistance training (HIIT) vs. a combined moderate continuous training (MCT) with RT, on vascular changes in patients with T2DM. We assessed whether non-responders to CRF also failed to improve structural and functional arterial indices following a 1-year exercise intervention. Results demonstrated a significant reduction; reducing potential diabetes complications. Results demonstrate the importance of participation in a low level, multi-component exercise program for weight and diabetes management.
across control (n=22), exercise responders (n=15), and exercise non-responders (n=26) using generalized estimating equations. RESULTS: Compared to controls, both responders and non-responders had significant improvements in cardio-intima-media thickness (responders: β=-3.54 [CI -6.40, -0.68], non-responders: β=-5.59 [CI -9.18, -2.01]) and peripheral arterial stiffness indices, such as carotid to distal posterior tibial artery pulse wave velocity (responders: β=0.16 [CI -0.28, -0.04], non-responders: β=-0.13 [CI -0.24, -0.03]) and on the distensibility coefficient (responders: β=0.00 [CI 3.10e-5, 5.00e-6], non-responders: β=0.00 [CI 1.41e-6, 0.00]), while only responders improved central arterial stiffness (carotid pulse wave velocity, β=0.06 [CI -0.11, -0.01]). No improvements in the remaining vascular indices and hemodynamic variables were observed. CONCLUSIONS: Regardless of increasing CRF, a 1-year exercise intervention entails significant benefits for vascular function in patients with T2DM.

### RESULTS

**Aerobic fitness:** Estimated VO2max (p = 0.01) and VO2peak (p = 0.036). **Fat free mass:** [FFM (57.9±10.6 kg at baseline and 55.7±10.9 kg at follow-up, p<.001)]. Grip strength [30.1±8.1 kg at baseline and 28.0±7.3 kg at follow-up, p<.001]. **Fat mass:** [FM (48.3±18.5 kg at baseline and 38.9±12.7 kg at follow-up, p<.001)]. **Submaximal VO2max:** [20.8±6.3 ml/kg/min at baseline and 22.6±7.2 ml/kg/min at follow-up, p<.001]. 

### CONCLUSIONS

The preliminary results of this study suggest exercise with compression and cooling contributes to a reduction in biometabolic markers of diabetes. This intervention had promise in contributing to effective management of T2D with a low physical burden.

### PURPOSE

Although exercise improves glucose effectiveness (GE) in adults with type 2 diabetes, the influence of exercise on GE across the prediabetes phenotypes is unknown. Additionally, the impact of dietary intake on GE after an exercise intervention is limited. The purpose of this study was to examine the effect of short-term exercise training and habitual dietary intake on GE in adults with impaired fasting glucose (IFG) compared with IFG plus impaired glucose tolerance (IFG+IGT). METHODS: Female subjects (Age 59.4±7.2 yrs.; BMI 34.4±1.4 kg/m²) were screened for IFG (n=7, FPG: 103.9±2.3 mg/dl; 2-hr glc: 116.7±7.2 mg/dl) and IFG+IGT (n=10 FPG: 99.1±3.5 mg/dl; 2-hr glc: 152.9±11.0 mg/dl) using ADA criteria (120 min 75 g OGTT). Subjects underwent 12 bouts of exercise at ~70% of HRpeak for 60 min/d over 2-weeks. A 180 min, 75g OGTT was used to collect glucose and insulin to determine GE via a validated minimal model before and after training. VO2peak and body composition (BIA) were also tested. Energy expenditure during training was calculated using a linear regression expression based on VO2 and heart rate. Subjects were also asked to record their diet before and after the intervention using 3-d food logs. RESULTS: Exercise training reduced BMI (P<0.05), but had no effect on lean body mass (LBM) or VO2peak; and there was no difference in exercise energy expenditure in either group (all, P>0.72). However, adults with IFG+IGT increased GE post-training (within effect; P=0.02), and this rise in GE tended to be greater in IFG+IGT than IFG (0.23±0.08% vs 0.00±0.08% mg/dl per min; P=0.039). Increased GE correlated with elevated LBM (r=0.42, P=0.09), but not reduced BMI (r=-0.08, P=0.75) or increased fitness (r=0.02, P=0.95). While dietary protein intake was linked with increased GE (r=-0.49, P<0.05), no association was seen between GE and carbohydrates (r=0.24, P=0.37), fat (r=-0.17, P=0.53) or total kcal (r=-0.23, P=0.40). CONCLUSION: Independent of weight loss and fitness, short-term exercise training increased GE in adult women with IFG+IGT but not those with IFG. The results also suggest dietary protein may modulate the exercise effect on GE. Future work is needed to examine how nutrition can optimize exercise induced glucose regulation in individuals with prediabetes.

### RESULTS

Midpoint data from 16 participants at 0 and 3 months were analyzed with a two-tailed T-test, revealing significant differences in Glycohemoglobin and weight. There was an 8% average decrease in Glycohemoglobin levels (8.5±2.2 vs. 7.8±1.8 mg/dl, p = 0.002) and an average weight loss of 3.6 lbs (211±50 vs. 208±48 lbs, p = 0.032).

### CONCLUSION

The preliminary results of this study suggest exercise with compression and cooling contributes to a reduction in biometabolic markers of diabetes. This intervention had promise in contributing to effective management of T2D with a low physical burden.
In the United States, 1 in every 9 adult women and 1 in every 8 adult men have diabetes; 95% of these cases are Type 2 diabetes. The efficacy of exercise training as an intervention for treatment is likely attributed to a combination of biological and environmental factors, including age, physical fitness, and sex. Despite the large number of exercise trials observing the effects of physical activity on Type 2 diabetics, few studies compare the benefits of the intervention exclusive to the participants’ sex. PURPOSE: To evaluate sex-specific glycated hemoglobin (HbA1c) changes to structured exercise among males and females with Type 2 diabetes. METHODS: 24 males and 40 females with Type 2 diabetes were enrolled in an exercise program involving aerobic activity, resistance exercise, and flexibility training. At the initial evaluation, subjects underwent a health history exam, multiple assessments of physical fitness, cardiometabolic testing, and an assessment of HbA1c. Following 10 weeks of bi-weekly exercise sessions, participants that remained active in the program were reassessed. A repeated measures ANOVA with Greenhouse-Geisser correction compared HbA1c levels at baseline and follow-up between sexes. RESULTS: Subjects were assigned to “completers” (N=39) or “non-completers” (N=28) based on adherence to the exercise program. At baseline, HbA1c levels did not differ between completers and non-completers (p=0.234). Sex was not related to completion of the trial (p=0.660) or baseline HbA1c (p=0.117). The repeated measures ANOVA found HbA1c to improve with exercise (F=7.785, p=0.009) and an interaction effect with sex (F=6.734, p=0.014) whereby males decreased more than females (0.61 compared to 0.02). CONCLUSION: In our sample, a structured exercise program induced greater reductions in HbA1c among male participants versus female participants. These findings help illustrate clinical importance for personalizing sex-specific exercise programs for persons at risk for or diagnosed with Type 2 diabetes.

C-08 Thematic Poster - Oxygen Uptake Kinetics
Thursday, May 30, 2019, 9:30 AM - 11:30 AM
Room: CC-102A

1150 Board #8 May 30 9:30 AM - 11:30 AM
Sex-Specific HbA1c Responses to Structured Exercise Among Patients with Type 2 Diabetes
Diana Devitskaya1, Cynthia Villalobos2, J. Mark VanNess3, Paul D. Vosti2, Alexis C. King3, Courtney D. Jensen1. 1University of the Pacific, Stockton, CA. 2St. Joseph’s Medical Center, Stockton, CA. 3University of Illinois at Urbana-Champaign, Champaign, IL. (No relevant relationships reported)

Purpose
The mean response time (MRT) is defined as the mean response time (MRT). It has been shown that the MRT is best characterized by the mean response time (MRT). To characterize the relationship, RESULTS: HbA1c during CPET was strongly correlated with peak workload (0.881, p=0.0003) and VO2 peak (0.934, p=0.0001). The polynomial model explaining the relationship was significant (Adj R²=0.821, F(4,7)=7.853, p=0.009); however, the point estimates were not . The semi-linear regression model was better able to characterize the overall trend (Adj R²=0.90, p=0.0002) and the drop in ΔHHb at the higher ends of MW, and indicated that VO2 peak had a significant effect (B=-54.9, p=0.019), and interacted with sex (B=-0.157, p=0.04). CONCLUSION: These preliminary results show that the linear increase in ΔHHb with incremental workload appears to attenuate and slightly decrease at greater MW, especially for those with higher exercise capacity. Supported by NIH Grant KO1HD084860-01A1.

1151 Chair: John M. Kowalchuk, University of Western Ontario, London, ON, Canada. (No relevant relationships reported)

1152 Board #1 May 30 9:30 AM - 11:30 AM
Relationship Between Muscle Deoxygenation And Workload At Peak Exercise In Healthy Adults Using Near-infrared Spectroscopy
Ashley M. Goodwin1, Jacqueline Montes1, Ipek Ensari2, Feliz Marie Hernandez1, Kayla Coutts1, Ashwini K. Rao1, Carol Ewing Garber, FACSM. 1Columbia University Irving Medical Center, New York, NY. 2University of Arizona Data Science Institute, New York, NY. (Sponsor: Dr. Carol Ewing Garber, FACSM)
Email: amg2310@cumc.columbia.edu (No relevant relationships reported)

PURPOSE: To characterize the relationship between the change in muscle deoxygenation (ΔHHb) and maximal workload (MW) achieved during maximal cardiopulmonary exercise test (CPET).

METHODS: 6 men and 5 women (mean ± SD: 39.09 ± 17.2 years [age]) underwent CPET on a recumbent cycle ergometer. ΔHHb in the vastus lateralis muscle was measured using NIRS, and MW as recorded in Watts. A polynomial model (ΔHHb ~ MW + MW² + peak oxygen uptake; VO2 peak) was compared to a semi-linear regression model (with an added interaction term between VO2 peak and MW) to characterize the relationship. RESULTS: ΔHHb during CPET was strongly correlated with peak workload (0.881, p=0.0003) and VO2 peak (0.934, p=0.0001). The polynomial model explaining the relationship was significant (Adj R²=0.821, F(4,7)=7.853, p=0.009); however, the point estimates were not . The semi-linear regression model was better able to characterize the overall trend (Adj R²=0.90, p=0.0002) and the drop in ΔHHb at the higher ends of MW, and indicated that VO2 peak had a significant effect (B=-54.9, p=0.019), and interacted with sex (B=-0.157, p=0.04). CONCLUSION: These preliminary results show that the linear increase in ΔHHb with incremental workload appears to attenuate and slightly decrease at greater MW, especially for those with higher exercise capacity. Supported by NIH Grant KO1HD084860-01A1.

1153 Board #2 May 30 9:30 AM - 11:30 AM
The Oxygen Mean Response Time At Different Ramp-incremental Cycling Slopes.
Rafael de Almeida Azevedo1, Danilo Iannetta1, Daniel Keir2, Juan Murias1. 1University of Calgary, Calgary, AB, Canada. 2University of Health Network, Toronto, ON, Canada. (No relevant relationships reported)

During a ramp-incremental (RI) cycling exercise, the measurement of oxygen uptake (VO2) at the level of the mouth has a time delay from the onset of exercise, which is defined as the mean response time (MRT). It has been shown that the MRT is best calculated using the steady-state VO2 from a bout of moderate-intensity exercise prior to the RI test, and then matching this VO2 to the time at which this metabolic rate occurs during the RI test. Previous research has used RI slopes of 25 and 30 W min⁻¹ to measure the MRT. In this context, it is known that the VO2 to work rate relationship is affected by the slopes of the ramp, which might affect the duration of the MRT. However, there is no empirical data to support this assumption. PURPOSE: To determine the influence of different RI slopes on the MRT. METHODS: Six healthy young men (age: 28 ± 10 years; height: 179 ± 6 cm; weight: 72 ± 5 kg; VO2peak: 4.0 ± 0.3 L min⁻¹) performed six RI cycling tests with slopes of 5, 10, 15, 25, 30 and 100 W min⁻¹. The ramp-incremental test was preceded by a moderate-intensity step-transition (i.e., 6 min at 20 followed by 6 min at 100 W), from which the steady-state VO2 could be determined before the ramp VO2 vs power output relationship was established. The difference between the power output at the steady-state VO2 and the ramp-specific power output at a similar VO2 was transformed into time to calculate the MRT. RESULTS: The MRT for 5 (11 ± 6 s), 10 (16 ± 11 s), 15 (22 ± 12 s), 25 (26 ± 11 s), 30 (32 ± 13 s) and 100 (25 ± 10 s) W min⁻¹ showed a significant main effect (F = 0.001). Post-hoc comparisons showed shorter MRT for 5 compared to 30 (p = 0.025) and 30 (p = 0.001) W min⁻¹, and for 10 compared to 30 (p = 0.015) W min⁻¹. CONCLUSION: Different ramp-incremental slopes directly influences the MRT, where it appears that MRT progressively becomes greater with steeper ramp slopes, until a certain level is reached (i.e., ~25 W min⁻¹) where there was no further lengthening of the MRT. From a practical perspective, less steep RI slopes will result in smaller adjustments in power output due to the shorter MRT. Thus, in RI slopes of 5 and 100 W min⁻¹ the power output adjustment would be ~1 and ~40 W, respectively.
Obstructive sleep apnea (OSA) is associated with persistent and progressive nighttime sympathetic nervous system (SNS) arousal strain in response to both hypoxemia and apnea events. This repetitive strain of nighttime activation of the SNS may promote downstream adaptations capable of limiting muscle reactivity.

**PURPOSE:** The purpose of this study was to examine the on-kinetic profile of muscle deoxygenation during sub-maximal walking in adults with OSA.

**METHODS:** Twelve adults with OSA (age=48±10 years, BMI=29±5 kg/m², Apnea–hypopnea index (AHI)=50±24) and 12 healthy non-OSA (NO) adults (42±8 years, BMI=24±3 kg/m²) completed two 6-minute bouts of submaximal exercise on a motorized treadmill, corresponding to 85% of anaerobic threshold. Using near-infrared spectroscopy (NIRS), concentration changes in deoxygenated hemoglobin–myoglobin (Δ[Hb]) was measured continuously from the left lateral gastrocnemius muscle. The two bouts were averaged to form a single Δ[Hb] response profile per subject. Indices of Δ[Hb] on-kinetics include the time constant (τ), Δ[Hb] amplitude (Δ[Hb]amp), and mean response time (MRT=time delay+τ). In addition, the transition constant (Kₜ=Δ[Hb]amp/MRT) reflects the overall normalized rate of Δ[Hb] on-kinetics.

Data were compared using age, BMI, gender, race, total physical activity and sleep duration as covariates for ANCOVA.

**RESULTS:** Both Δ[HHb]amp and Δ[Hb]amp were lower in OSA compared to NO (Δ[HHb]: 8.7±5.3 a.u., Δ[Hb]: 28.9±7.2 a.u.; p=0.019). There were no differences in the mean response time (MRT) between OSA and NO. There was no difference in the transition constant (Kₜ) between the two groups (Kₜ: 0.101±0.07 a.u/s, NO: 0.354±0.17 a.u/s, p=0.051). The Δ[HHb]amp was found 12 months after transplantation (12.7±1.6 vs. 14.5±1.74 a.u.; p<0.01). There was a significant decrease in peak HR (R=-0.33 and R=-0.13, respectively). The transition constant (Kₜ) was found 12 months after transplantation (12.77±1.6 vs 14.55±1.74 g/dL (p<0.01)).

**CONCLUSION:** There were no changes in the O2 kinetics during moderate intensity exercise.

Gemfibrozil And Oxygen-hemoglobin Binding Affinity

Chad C. Wiggins, Paolo B. Dominelli, Sarah E. Bakar, John-Rodger A. Shepherd, Koji Uchida, Michael J. Joyner, FACSM.
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**No relevant relationships reported**

Exercise tolerance, in humans, is determined primarily by the diffusive and convective components of oxygen transport. Each of these can be acutely altered by changing the oxygen binding affinity for hemoglobin (right-shifting the oxygen-hemoglobin dissociation curve (ODC)). The tradeoffs associated with any acute shift in the ODC includes the components of oxygen transport. Each of these can be acutely altered by changing the oxygen binding affinity for hemoglobin, in vitro.

**PURPOSE:** To determine if fibrates (gemfibrozil) are effective in therapeutic doses, in vivo, at altering binding affinity for hemoglobin, and oxygen uptake kinetics during moderate intensity exercise.

**METHODS:** Five volunteers (3M/2W, age=32.3±2.3 years, BMI=23.5±1.6 kg/m², VO2max = 42.5±4.2 ml/kg/min) completed a single study visit in which we measured oxygen binding affinity (P50 and Hill’s n), and oxygen uptake kinetics during moderate intensity exercise (power output that elicited 40% VO2max) at rest and following two separate 1,200mg doses of gemfibrozil (administered approximately 2h apart). **RESULTS:** Gemfibrozil did not alter oxygen-hemoglobin binding affinity with either dose (Baseline P50 = 26.8±1.4, Hill’s n = 2.5±0.1; Dose 1 P50 = 27.0±0.7, Hill’s n = 2.5±0.0; Dose 2 P50 = 27.5±1.1, Hill’s n = 2.5±0.0). Oxygen uptake kinetics during exercise at a power output eliciting 40% VO2max were not different following the administration of either dose of gemfibrozil (Baseline: VO2 = 0.88±0.32 L/min, τ = 22.1±9.7 s; Dose 1: VO2 = 0.88±0.31 L/min, τ = 21.5±9.7 s; Dose 2: VO2 = 0.90±0.31 L/min, τ = 19.7±8.2 s). **CONCLUSION:** Therapeutic doses of gemfibrozil administered acutely are not an effective allosteric modifier of oxygen binding affinity for hemoglobin, in vivo, therefore, there were no changes in the O2 kinetics during moderate intensity exercise.

Aerobic exercise capacity is reduced in kidney transplant recipients (KTRs), with a progressive improvement after transplantation. KTRs show central exercise limiting factors such as chronicotopic incompetence, anemia, heart or vascular diseases. However, there is strong evidence that exercise produces beneficial adaptations to cardiovascular function, as well as overall health and well-being in the KTR population. There is a lack of studies that examine the effects of exercise on the O2 uptake in KTRs, which would be of interest to better understand the factors influencing O2 handling in this population.

**PURPOSE:** To analyze the VO2 kinetics in a population of KTRs.

**METHODS:** Two groups of KTRs enrolled 3 and 12 months (n=21 and 14, respectively) after transplantation and a control group of healthy young adults (n=16) underwent cardiopulmonary exercise testing at cycle-ergometer. The protocol consisted in two subsequent constant, moderate-load exercise phases with a final incremental test until exhaustion.

**RESULTS:** The t was increased in KTRs compared to controls (54.6±13.1 s at 3 and 41±5.3 at 12 months vs 28.91±8.37 s in controls; both P<0.01) while VO2peak was reduced, but significantly higher in the group evaluated at 12 months (21.30±4.34 vs 26.36±7.96 ml/kg/min (P<0.04), vs 41.7±7.82 ml/kg/min in controls (both P<0.01). Consistently with this result, an increased hemoglobin (Hb) concentration was found 12 months after transplantation (12.7±1.6 vs 14.5±1.74 g/dL (P<0.01)). Also, lower peak heart rate (HR) (R=0.03 and R=0.13, respectively).

**CONCLUSION:** KTRs show slower VO2 kinetics, reduced peak VO2 and HR when compared to a population of healthy young adults. VO2 peak and Hb seem to improve during the first year after transplantation. The reduced aerobic capacity of KTRs was associated with slower VO2 kinetics, which seem to be less affected by the oxygen transport. These findings suggest that an impaired oxidative muscle metabolism could be a peripheral limiting factor contributing to decreased exercise capacity in KTRs.
CONCLUSIONS: These data suggest that the contraction-relaxation cycle may result in fluctuations in fractional oxygen extraction during extreme but not severe isometric exercise. Furthermore, the contraction-relaxation cycle does not appear to alter microvascular hemodynamics. The prevalence of these supports varied by sex, age, education level, and physical activity level. Access to walkable locations and safe streets were the two supports most often reported together (13.6%). Access to walkable locations (60.0%) and safe streets (50.6%) were most often selected as highest priority for communities, followed by promotional campaigns (23.6%) and walking groups (18.8%). For all supports, positive associations were observed between having the support and rating it as highest priority (range of adjusted prevalence ratios: 1.57-2.53).

CONCLUSIONS: The most commonly reported community supports for walking in the U.S. are access to walkable locations and safe streets. In addition, these two supports are most often selected as the highest priorities to encourage walking in communities. Establishing community supports for walking and improving resident awareness of them may help promote walking among U.S. adults.
METHODS
We used data from the 2015 Cancer Control Supplement of the National Health Interview Survey (NHIS) to assess adults’ past week participation in transportation and leisure walking for ≥10 minutes (n=33,672). NWI scores were linked to HIS data based on the block group of the respondent’s residence. NWI scores were categorized into national level quartiles. Logistic regression analyses were used to describe the association between NWI quartiles and transportation and leisure walking.

RESULTS
NWI quartiles exhibited significant linear and quadratic trends (p<0.05) with transportation walking and a significant linear trend (p<0.05) with leisure walking. Prevalence of transportation walking increased 23 percentage points and leisure walking increased 5 percentage points from least to most walkable communities (see Table).

CONCLUSIONS
NWI is a free and publicly available standardized tool to measure community walkability. Our findings suggest NWI is positively associated with transportation and leisure walking, although, the association was stronger for transportation walking.

Table. Prevalence of walking, adjusted for selected characteristics1, by National Walkability Index (NWI) quartiles2

<table>
<thead>
<tr>
<th>NWI range</th>
<th>Least walkable</th>
<th>Below average walkable</th>
<th>Above average walkable</th>
<th>Most walkable</th>
</tr>
</thead>
<tbody>
<tr>
<td>NWI</td>
<td>(1.00-5.75)</td>
<td>(&gt;5.75-10.50)</td>
<td>(10.50-15.25)</td>
<td>(&gt;15.25-20.00)</td>
</tr>
<tr>
<td>Transportation</td>
<td>24.5 (22.7, 26.5)</td>
<td>27.7 (26.4, 29.0)</td>
<td>38.0 (36.2, 39.9)</td>
<td>47.7 (44.6, 50.7)</td>
</tr>
<tr>
<td>walking (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leisure walking</td>
<td>49.5 (47.2, 51.9)</td>
<td>52.5 (51.1, 53.9)</td>
<td>52.3 (50.6, 54.0)</td>
<td>54.9 (52.3, 57.4)</td>
</tr>
<tr>
<td>(%)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

1Prevalence adjusted for sex, age, race/ethnicity, education, region, and rural/urban status
2NWI encompasses density, land use mix, and proximity to transit

CONCLUSIONS
NWI is a free and publicly available standardized tool to measure community walkability. Our findings suggest NWI is positively associated with transportation and leisure walking, although, the association was stronger for transportation walking. These findings may be useful to researchers and to public health, transportation, and planning professionals and other relevant stakeholders, as they promote transportation-related walking and walkability in communities.

Board #4
May 30 9:30 AM - 11:30 AM
A Research-grade Accelerometer Is Sensitive In Detecting Step Changes In Free-living Settings
Albert R. Mendoza1, John Staudenmayer2, Patty S. Freedson, FACSM1, 2University of Massachusetts-Amherst, Amherst, MA. (Sponsor: Patty S. Freedson, FACSM) (No relevant relationships reported)

Research-grade wearable accelerometers (RGA) are valuable tools to monitor steps. Despite the broad appeal of such devices, there is limited evidence as to how well RGA detect change in steps in free-living settings. PURPOSE: To determine the sensitivity of RGA in detecting change in steps compared to changes in directly observed steps (criterion) in free-living settings. METHODS: Thirty-two participants were directly observed and video-recorded on three separate days for 2-hours each day in free-living settings. Sessions-to-session step differences (session 1 - session 2 - session 3) were calculated. Linear-mixed models were used to determine within-subject standard deviation of criterion measured session-to-session changes in steps and to identify significant changes in steps (greater than ±1 SD of within-subject SD). DO classified pairs of sessions for each participant based on whether steps changed (i.e., greater than ±1 SD of within-subject SD). The same classification method was applied to the RGA's and percent agreement between the two methods was then calculated.

RESULTS
CONCLUSIONS: These data show that RGA's worn on the wrist and hip are sensitive in detecting change in steps in free living settings and both detect changes in steps in free-living settings. This device can be employed for interventions designed to increase walking behavior.

Board #5
May 30 9:30 AM - 11:30 AM
Assessing Walkability By Questionnaires: Construct, Validity, And Reliability
Jingyuan Zhu, Zezhao Chen, Weimo Zhu, FACSM. University of Illinois at Urbana-Champaign, Urbana, IL. (No relevant relationships reported)

PURPOSE: To determine the psychometrics of the walkability questionnaires, including their construct, validity, and reliability. METHODS: Using keywords “walkability,” “measurements,” “scales,” “NEWS” etc., a comprehensive literature search was conducted, and identified questionnaires were reviewed and analyzed. RESULTS: Over 200 research publications were found and 27 questionnaires, including 14 different versions of Neighborhood Environment Walkability Scales (NEWS), focusing mostly on urban settings, were used for the final analysis. Ten key components were found in forming the construct of walkability, including residential density, land use mix-density, land use mix-access, street connectivity, walking/cycling facilities, aesthetics. Furthermore, 209 subcomponents were nested within the key components; e.g., “Residential Density” is consist of subcomponents of detached single-family residences, townhouses, apartments with diff erent floors and so on. For validity, about 80% of questionnaires have reported it. The most used validation method (about 70%) was the “contracted groups”, in which various levels of walkability and conditions neighborhoods were compared, with an effect size ranging from 0.65 to 3.81, followed by the correlational (with objective environmental attributes) approach (20%), with the validity coeffi   cients ranging from 0.45 to 0.87. Finally, intra-rater/retest-retest reliability was often (about 75%) computed for the reliability of the questionnaire, with a range from 0.25 to 0.99. CONCLUSION: A set of questionnaires with sound psychometric quality has been developed to assess the walkability in urban settings and more tools to evaluate walkability in a small community, rural settings are urgently needed.

Board #6
May 30 9:30 AM - 11:30 AM
The Effect of Environmental Changes on Hospital Employee Walking Duration
Ryan Doyel, Joseph Dadabo, Prakash Jayabalal. Northwestern University Feinberg School of Medicine / Shirley Ryan AbilityLab, Chicago, IL. (No relevant relationships reported)

Purpose
Employee health is known to be associated with work-related physical exertion. The objectives of this study were to assess the effect on employee daily steps taken by transitioning a free-standing rehabilitation hospital to a larger facility and to compare step count differences across age, sex, and occupations.

Methods
Data from personal fitness devices linked to an employer-sponsored wellness program assessed the number of steps taken in two specific months (July and November) in the year prior to and in the year following the move to a rehabilitation facility three-times

ACSM May 28 – June 1, 2019
Orlando, Florida
1166  Board #7  May 30 9:30 AM - 11:30 AM  Perceived Neighbourhood Walkability and Different Types of Physical Activity in Canadian Men and Women  Vikram Nichani1, Chelsea Christie1, Jennifer Vena1, Christine Friedenreich1, Gavin McCormack1. 1University of Calgary, Calgary, AB, Canada. 2Alberta Health Services, Calgary, AB, Canada. Email: Gavin.McCormack@ucalgary.ca  (No relevant relationships reported)

Purpose: Few Canadian studies have examined whether associations between perceived walkability and physical activity differ by gender. We estimated associations between perceived neighbourhood walkability and physical activity among urban Canadian men and women.

Methods: This study included cross-sectional survey data from the “Alberta’s Tomorrow Project” (2008; n=9101), in which the International Physical Activity Questionnaire captured weekly physical activity and the Neighbourhood Environment Walkability Scale abbreviated version (NEWS-A) captured self-reported neighbourhood characteristics. NEWS-A subscale scores were standardized and overall walkability scores computed. Sociodemographic characteristics were also captured. Covariate-adjusted generalized linear models estimated the associations between physical activity participation and minutes (transformation: walking: TW, recreational walking: RW, moderate-intensity: MPA, and vigorous-intensity: VPA) and walkability scores. Odds ratios (ORs) were estimated for participation and beta coefficients (Bs) were estimated for minutes of physical activity, with 95% confidence intervals (95CIs).

Results: Overall walkability was positively associated with participation in TW (OR 1.05; 95CI 1.04, 1.06), RW (OR 1.02; 95CI 1.01, 1.03), MPA (OR 1.02; 95CI 1.01, 1.03) and VPA (OR 1.02; 95CI 1.01, 1.03) and minutes of TW (B 1.14; 95CI 0.59, 1.69). In men, positive associations were found between lack of parking and MPA participation and minutes (transformation: walking: TW, recreational walking: RW, moderate-intensity: MPA, and vigorous-intensity: VPA) and walkability scores. Odds ratios (ORs) were estimated for participation and beta coefficients (Bs) were estimated for minutes of physical activity, with 95% confidence intervals (95CIs).

Conclusions: Neighbourhood walkability is associated with participation and time spent in different physical activities for men and women. Modifying perceptions, possibly via improving neighbourhood urban design, has the potential to increase physical activity in Canadian adults.
Muscle atrophy is a major sequela occurring after spinal cord injury (SCI) that results from disuse. Additionally, other secondary complications of SCI (e.g., alterations in muscle blood flow) may contribute to muscle loss. PURPOSE: To determine the time course of muscle blood flow changes in relation to muscle atrophy in a rodent severe contusion SCI model.

METHODS: Sixty-three 4-months-old (skeletal-mature) male Sprague-Dawley rats received SHAM surgery (T9 laminectomy) or severe (250 kdyne) contusion SCI using a computer-guided impactor. At 1-, 2-, and 4-weeks (wk) post-surgery, an intravenous catheter was implanted into the tail vein of SHAM and SCI animals. Colored microspheres (15 µm diameter) were then infused into the circulation, allowing for the measurement of regional blood flow (ml/min/g tissue mass). Subsequently, the animals were euthanized and the mass of the dissected right and left soleus, gastrocnemius, and plantaris was taken. Concentrations of the colored microspheres within each muscle were determined via spectrophotometry, following chemical digestion of the muscle. Muscle blood flow calculations were then averaged across the contralateral hindlimbs for the aforementioned muscles. SCI vs SHAM comparisons were made at each time point using independent samples t-tests and Pearson’s correlation coefficients. RESULTS: SCI animals exhibited 23-41% lower soleus mass, 17-27% lower gastrocnemius mass, and 16-29% lower plantaris mass vs SCI animals. Mass and blood flow (corrected for mass) was identified at 1-wk (r = 0.687, p < 0.01). SCI, respectfully, at 1-wk only. Additionally, a positive relationship between soleus mass, 17-27% lower gastrocnemius mass, and 16-29% lower plantaris mass vs SCI animals. Colored microspheres (15 µm diameter) were then infused into the circulation, allowing for the measurement of regional blood flow (ml/min/g tissue mass). Subsequently, the animals were euthanized and the mass of the dissected right and left soleus, gastrocnemius, and plantaris was taken. Concentrations of the colored microspheres within each muscle were determined via spectrophotometry, following chemical digestion of the muscle. Muscle blood flow calculations were then averaged across the contralateral hindlimbs for the aforementioned muscles. SCI vs SHAM comparisons were made at each time point using independent samples t-tests and Pearson’s correlation coefficients. RESULTS: SCI animals exhibited 23-41% lower soleus mass, 17-27% lower gastrocnemius mass, and 16-29% lower plantaris mass vs SHAM, at all time points (p < 0.001). Soleus and gastrocnemius blood flow (corrected for tissue mass, ml/min/g) was 51% lower (p < 0.001) and 25% lower (p < 0.05) after SCI, respectfully, at 1-wk only. Additionally, a positive relationship between soleus mass and blood flow (corrected for mass) was identified at 1-wk (r = 0.687, p < 0.01). No significant alterations in plantaris blood flow were identified at any time point. CONCLUSION: Hindlimb muscle atrophy and reduced muscle blood flow occurred within 1-wk of severe contusion SCI. Thereafter, muscle blood renormalized in comparison with SHAM animals. Further research is needed to determine whether the reductions in muscle blood flow occurring after SCI contribute to muscle mass loss and/or whether prevention of blood flow deficits preserves muscle mass.

Severe cancellous bone loss occurs after spinal cord injury (SCI), which increases fracture risk. Bodyweight-supported treadmill training (TM) and passive Cycle training are activity-based rehabilitation therapies that improve neuromuscular plasticity after SCI. However, the skeletal adaptations to these therapies remain unknown.

PURPOSE: Determine whether TM or Cycle training alter the rate of cancellous bone loss in a rodent severe contusion SCI model. METHODS: 16-week old male Sprague-Dawley rats (n = 28) were randomized to receive no surgery (Non-Surgical Controls), T9 laminectomy (SHAM), or T9 laminectomy plus severe (250 kdyne) contusion SCI using a computer-guided impactor and were euthanized 2- or 4-wks post-surgery. Hindlimb locomotion was assessed weekly using the BBB locomotor scale and trabecular bone integrity at the proximal tibia was assessed weekly using microCT. Comparisons were made using one-way ANOVA and Bonferroni post hoc analyses when appropriate. RESULTS: SCI animals exhibited significant losses in hindlimb locomotor function (BBB score < 6 (0-21 scale); p < 0.01 vs SHAM at all time points). Percent cancellous bone volume (cBV/TV) was 32% lower at 2-w and 42% lower at 4-w in SCI vs SHAM animals (p < 0.01). This bone loss was exacerbated by progressively lower trabecular thickness (Tb.Th) and trabecular number (Tb.N) at 2- and 4-w (p < 0.01) and higher trabecular separation (Tb.Sp) (p < 0.01 at 4-w only). No differences in trabecular pattern factor (Tb.Pf), an inverse indicator of trabecular network connectivity, were present at 1-w. However, Tb.Pf was higher at 2- and 4-w in SCI vs SHAM (p < 0.01). Structure model index (SMI) was higher at 2- and 4-w in SCI vs SHAM (p < 0.01), indicating transition from rod- to plate-shaped trabecular spicules. Similarly, in SCI animals, cBV/TV was 48-75% lower, Tb.Th was 15-27% lower, Tb.N was 36-62% lower across the 4-w period in comparison with Non-Surgical Controls (p < 0.01 for all), while Tb.Sp was progressively higher in SCI animals (p < 0.05 for 2- and 4-w). Higher Tb.Pf and SMI were also found in SCI vs Non-Surgical Controls at all timepoints (p < 0.05). Only cBV/TV was lower in SCI vs Non-Surgical Controls across the 4-w period (p < 0.01). CONCLUSION: Our findings indicate that trabecular bone integrity at the proximal tibia was significantly impaired in rats following a severe contusion SCI due to both bone loss and diminished bone quality. As such, our rodent model may be useful to examine effectiveness of strategies intended to prevent SCI-induced bone loss.

Bone loss following spinal cord injury (SCI) is a major contributor to bone fracture risk, particularly at the proximal tibia. PURPOSE: To determine longitudinal changes in trabecular bone integrity at the proximal tibia in a rodent contusion SCI model.

METHODS: 16-week old male Sprague-Dawley rats (n = 28) were randomized to receive no surgery (Non-Surgical Controls), T9 laminectomy (SHAM), or T9 laminectomy plus severe (250 kdyne) contusion SCI using a computer-guided impactor and were euthanized 2- or 4-wks post-surgery. Hindlimb locomotion was assessed weekly using the BBB locomotor scale and trabecular bone integrity at the proximal tibia was assessed weekly using microCT. Comparisons were made using one-way ANOVA and Bonferroni post hoc analyses when appropriate. RESULTS: SCI animals exhibited significant losses in hindlimb locomotor function (BBB score < 6 (0-21 scale); p < 0.01 vs SHAM at all time points). Percent cancellous bone volume (cBV/TV) was 32% lower at 2-w and 42% lower at 4-w in SCI vs SHAM animals (p < 0.01). This bone loss was exacerbated by progressively lower trabecular thickness (Tb.Th) and trabecular number (Tb.N) at 2- and 4-w (p < 0.01) and higher trabecular separation (Tb.Sp) (p < 0.01 at 4-w only). No differences in trabecular pattern factor (Tb.Pf), an inverse indicator of trabecular network connectivity, were present at 1-w. However, Tb.Pf was higher at 2- and 4-w in SCI vs SHAM (p < 0.01). Structure model index (SMI) was higher at 2- and 4-w in SCI vs SHAM (p < 0.01), indicating transition from rod- to plate-shaped trabecular spicules. Similarly, in SCI animals, cBV/TV was 48-75% lower, Tb.Th was 15-27% lower, Tb.N was 36-62% lower across the 4-w period in comparison with Non-Surgical Controls (p < 0.01 for all), while Tb.Sp was progressively higher in SCI animals (p < 0.05 for 2- and 4-w). Higher Tb.Pf and SMI were also found in SCI vs Non-Surgical Controls at all timepoints (p < 0.05). Only cBV/TV was lower in SCI vs Non-Surgical Controls across the 4-w period (p < 0.01). CONCLUSION: Our findings indicate that trabecular bone integrity at the proximal tibia was significantly impaired in rats following a severe contusion SCI due to both bone loss and diminished bone quality. As such, our rodent model may be useful to examine effectiveness of strategies intended to prevent SCI-induced bone loss.

Spinal cord injury (SCI) adversely affects muscle quality and testosterone levels. Following SCI, resistance training (RT) has been shown to increase muscle cross-sectional area (CSA). Testosterone replacement therapy (TRT) in other populations has also been shown to improve muscle quality. PURPOSE: To examine if the combination of RT and TRT (RT+TRT) can maximize the beneficial effects to muscle quality following SCI. METHODS: Twenty-two SCI subjects were randomized into two intervention groups for 16-weeks: RT+TRT (n = 11), or TRT (n = 11). Muscle quality was assessed by measuring the peak torque at speeds of 0, 60, 90, and 180°/sec (PT-0°, PT-60°, PT-90°, PT-180°), knee extensor CSA (KE-CSA), specific tendon (ST), and contractile speeds (rise time [RTi], and half-time to relaxation [½TiR]) for each limb prior to testing and following the intervention. 2x2 mixed models with subject identifiers added as random effects and post-hoc Tukey-Kramer HSD tests identified pairwise differences within interventions (P < 0.05). RESULTS: Following the intervention period, participants in the TRT+RT group increased PT-0° (48.4%, P < 0.001), KE-CSA (30.8%, P < 0.001), ST (8%, NS), and RTi (17.7%, P = 0.012). PT-0° decreased (17%, NS), KE-CSA slightly increased (10%, NS), ST decreased (20%, NS), and RTi also slightly decreased (9%, NS) in the TRT group. Changes to
Intervertebral disc (IVD) and bone health is strongly associated with nutrient flow and loading. Running places repeated substantial axial forces on the lower back, which likely influence its tissue health. Two theories exist: 1) cyclic loading is correlated to improved IVD and vertebral health parameters, because it brings about hypertrophic changes that make the tissue stronger, and 2) mechanical overload produces localized trauma and tissue damage, which outpaces the tissue’s ability to repair itself and leads to accelerated degradation. Both theories are based on sound research, but the implications contradict. PURPOSE: To determine if long-term runners exhibit different IVD and bone health parameters compared to matched sedentary controls. METHODS: 10 male runners with an average of 25 year history of running (average 84km/week) and 5 age and sex-matched sedentary controls received Magnetic Resonance Imaging (MRI) and DXA scans. MRI T1 and T2 imaging techniques were used to obtain morphological characteristics, including the level of disc degeneration. The DXA scan was used to obtain bone mineral density (BMD) of the lumbar spine and femoral neck. RESULTS: The groups were not different in age, height or weight, but in BMI (p=0.03) and total fat mass (p=0.005). On average the sedentary controls demonstrated significantly greater L5 vertebral heights (p=0.009). The runners exhibited greater L5/S1 mid-IVD height (p=0.03) and less disc degeneration, but this difference was not significant. There was no difference in ADC. There was no difference in BMD. There was no difference in Z-scores, but on average the runners’ Z-score was below 0 in the lower spine and above 0 in the femoral neck, while this was reversed in the sedentary controls. CONCLUSIONS: This small sample seems to indicate that long term running is correlated with better IVD morphology, but smaller lumbar vertebral height. Running is not correlated with significantly higher BMD. The latter might change with an increased subject number, as all the runners’ BMD numbers are consistently higher in respect to femoral neck and shaft and consistently lower in respect to L1-L4 vertebral.

PURPOSE: To evaluate trunk and thorax alterations prevalence in health sciences students. METHODS: 293 recently admitted students to the Health Sciences Division of the University of Guanajuato, in Central Mexico, were clinically assessed for scapular girdle, spine alignment and thorax deformities. RESULTS: In 208 women, and 85 men no previous diagnostic, symptomatology nor orthosis use were detected. Two of the participants had thorax asymmetry, corresponding to 0.7%. By contrast, 14.0% (41) presented dorsal hump. Also, the shoulder blades exhibited asymmetric in 19.5 (57) and 3.1% (9) for the right and left sides, respectively. Shoulder humps descended occurred in 23.5 (69), 4.4 (13), and 0.7% (2) (right, left, and both, in such order). Lumbar hump was observed in 45 (15.4%) students. No scoliosis was detected. CONCLUSIONS: The structural problems detected involved the upper body and are quite important due to its implications for low back pain development. In fact, they can progressively evolve to cause nerve compression and its derived musculoskeletal conditions (MEC). In their practice, health professionals are exposed to risk behaviors for MEC, between others long standing periods, abnormal postures, patient’s mobilization, etc. The information obtained can support new ways to train and physically fit the health sciences students as preventive measures for MEC development.
Of note, a trend between a higher number of bouts of moderate intensity physical activity and lower depressive symptoms was observed but did not reach significance (p=0.208, p=0.052). Based on significant univariate correlations and age, a stepwise multiple regression analysis was performed. The regression model was statistically significant [R²=0.286, F(3,86)=11.483, p<0.001], and showed that age, somnolence and frequency of protective foods consumed each contributed 4%, 12% and 8% to the variance in depressive symptom severity, respectively. CONCLUSIONS: Outcomes of this study demonstrate that age, somnolence and the intake of protective foods account for a considerable proportion (28.6%) of depressive symptom severity in older adults ‘at risk’ for dementia. These results support recent research highlighting the benefit of non-pharmacological interventions for depressive symptom management. Further research looking at the longitudinal relationship, underlying mechanisms and the possibility of a bidirectional relationship is now warranted.

**1179**

May 30 10:00 AM - 10:15 AM

The Effects of a Physical Activity Program on Mood States in College Students

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(No relevant relationships reported)

College students are at risk for adverse mental and physical health. Physical activity (PA) can reduce risks and promote positive mental health; however, less than half (49.9%) of college students meet the ACSM recommendations for PA (American College Health Association, 2017), reporting barriers such as lack of motivation, energy and time. Evidence-based, person-centered PA programs can overcome such barriers to enhance mood states and overall health. PURPOSE: To implement and evaluate a PA program (#cnubwell) designed to enhance mood states and promote continued PA in college students. METHODS: College students (n=10) participated in #cnubwell for 5 wks. Students completed pre and post measures of perceived health, PA (Godin), intrinsic motivation (IMI), and mood states (POMS) and #cnubwell program evaluation. Additionally, participants recorded Feeling Scale (FS) and Feel Arousal Scale (FAS) ratings before, during and after each weekly PA session. RESULTS: Participants experienced significant (p<0.05) increases in positive feelings (FS) and energy levels (FAS) during each of the #cnubwell PA sessions. Intrinsic motivation increased from pre (M=34.8) to post (M=37.4), but the difference was not significant (p>0.05). Ratings of perceived health and mood states remained unchanged from pre to post. On the evaluations, participants reported feeling more autonomous, confident and connected; and that they enjoyed learning new workouts, exercising at their own pace/abilities (i.e., modifications provided), engaging in structured activities, and connecting with new people. CONCLUSION: While notable positive feelings and energy levels were experienced by the participants during the PA sessions, pre and post measures of perceived health and mood states did not differ. Confounding factors such as participant illness and campus mourning (i.e., deaths of two students the week before) may influence results. Also, the study was conducted from beginning to mid-semester, which is likely a more stressful time for students. Possibly, PA provided a coping strategy during those stressful times. Additional research with larger samples may provide greater insight into benefits of the program on mental health and wellness.

**1180**

May 30 10:15 AM - 10:30 AM

The Relationship Between Self-reported Lifestyle Habits and Depressive Symptoms in Older Adults ‘At Risk’ for Dementia

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(No relevant relationships reported)

PURPOSE: Depressive symptoms are now well-established as an independent risk factor for dementia, however the association between health-related lifestyle habits and depressive symptom severity remains unclear. As such, this study aimed to investigate the relationship between self-reported physical activity levels, sleep behaviour and diet quality, and self-reported depressive symptoms in older adults ‘at risk’ for dementia. METHODS: Participants aged ≥50 years were recruited from the Healthy Brain Ageing Clinic at the Brain and Mind Centre, The University of Sydney, and underwent comprehensive neurological, psychiatric, medical and neuropsychological assessments. Self-reported symptoms of depression were assessed via the 15-item Geriatric Depression Scale. Participants completed questionnaires to quantify volume of physical activity, and to characterise sleep behaviour and diet quality. RESULTS: A total of 90 participants (mean age=66yrs) with subjective and/or objective cognitive impairment were recruited. Depressive symptoms were correlated with somnolence (r=0.342, p=0.001), greater symptoms of insomnia (r=0.270, p=0.010), larger meal portion size (r=0.232, p=0.029), and a lower intake of protective foods (r=0.355, p=0.001).
but not yet studied in U.S. Navy Explosive Ordnance Disposal (EOD) Technicians. Characterizing EOD and understanding these interactions is a key aspect of managing warfighter health and performance.

**PURPOSE:** The primary purpose is to assess bodily pain and medication (med) use in EOD Technicians. The secondary purpose is to evaluate associations between bodily pain and biobehavioral correlates, such as depression, anxiety, and posttraumatic stress disorder (PTSD).

**METHODS:** Eighty-four EOD Technicians self-reported bodily pain (0–10 scale) pre and post exercise, and symptoms of depression, anxiety, and PTSD. One-way analysis of variance evaluated the relationship between med type and bodily pain. Pearson product-moment correlations examined associations between pain and biobehavioral measures. RESULTS: Self-reported bodily pain: none = 6.9%, mild = 69.4%, moderate = 22.2%, severe = 1.4%, x̅ = 2.4±0.1 for bodily pain. Of those reporting pain, 67.4% were taking meds, which represents 36.9% of all participants. Higher pain was reported by those taking prescription meds compared to over-the-counter meds or no meds [F(4, 67) = 8.72, p < .001]. Positive relationships were found between pain and depression (r = .34), anxiety (r = .33), and PTSD (r = .53) symptoms (all p < .01). CONCLUSION: Most EOD Technicians reported some level of pain contrasted with roughly half the general population (55.7%). Compared to U.S. Marines, pain ratings were similar; however, EOD Technicians reported over twice the prevalence of pain use. Additionally, findings indicate that EOD Technicians using prescription meds reported higher pain. With respect to biobehavioral correlates, the relationship between pain and depression in EOD Technicians was similar to reports in Marines. Combined with the associations observed between pain, anxiety, and PTSD, this reinforces the premise that pain and behavioral health are interrelated. These findings may be useful for clinicians when evaluating military members for potential comorbidities, particularly following trauma when symptoms may be most severe.

**CONCLUSION:** The chronic effects of exercise training have previously been explored in Persian Marines. Combined with the associations observed between pain, anxiety, and PTSD, the prevalence of pain contrasted with roughly half the general population (55.7%). Compared to U.S. Marines, pain ratings were similar; however, EOD Technicians reported over twice the prevalence of pain use. Additionally, findings indicate that EOD Technicians using prescription meds reported higher pain. With respect to biobehavioral correlates, the relationship between pain and depression in EOD Technicians was similar to reports in Marines. Combined with the associations observed between pain, anxiety, and PTSD, this reinforces the premise that pain and behavioral health are interrelated. These findings may be useful for clinicians when evaluating military members for potential comorbidities, particularly following trauma when symptoms may be most severe.

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Delayed onset muscle soreness (DOMS) is an acute muscle pain condition occurring after eccentric muscular activity in some but not all people. Physiological and psychological factors may affect DOMS. PURPOSE: To investigate whether individual pain sensitivity and psychological variables levels predict DOMS. METHOD: Thirty-two participants completed pain-related psychological questionnaires and quantitative sensory testing (QST) and thereafter the DOMS protocol was carried out for the upper extremity. The second session was held 24 h later, participants completed the DOMS-related interference questionnaire and QST was then reapplied. To compare QST parameters and psychological variables between those developing DOMS and those who did not, non-parametric Mann-Whitney U-tests were conducted. Multiple regression analyses were used to determine the predictive role of QST and psychological variables on DOMS intensity. RESULTS: Out of the 32 participants, 17 showed a DOMS response. Participants who developed DOMS had higher trait anxiety (p = 0.010), depression (p = 0.025), and stress (p = 0.034) scores, compared to those who did not develop DOMS. Trait anxiety predicted the intensity of DOMS (r = 0.63, P < 0.001). Additionally, those who developed DOMS demonstrated a higher systemic pain sensitivity at baseline, expressed by a lower pressure pain threshold in the muscle that was exercised and in a remote muscle, and by a lower pain inhibition efficiency (P = 0.02). No correlation was found between the level of pain sensitivity at baseline and the intensity of DOMS. CONCLUSIONS: The endogenous ability to regulate pain has a significant impact on pain development in DOMS. Development of DOMS is affected by baseline systemic pain sensitivity as well as psychological and personality traits. Our findings highlight the contribution of physiological and psychological factors to the development of DOMS.

The chronic effects of exercise training have previously been explored in Persian Gulf War Veterans (GV) with chronic musculoskeletal pain (CMP). However, the effect of a single bout of resistance exercise on pain and fatigue has not been reported. The magnitude and direction of those effects over several months of a progressive resistance exercise training (RET) program is also unknown.

**PURPOSE:** To examine changes in pain and fatigue in response to acute bouts of resistance exercise across 16 wks of RET among GV with CMP. It was hypothesized that perceived pain and fatigue would decrease after each training session and the magnitude of this change would increase over the course of the intervention.

**METHODS:** Eighty-six participants, symptoms criteria for widespread CMP (r=22, 50±7 years) were recruited and randomized to complete 16 wks of RET. Training intensity started at 25% and 35% of estimated one-repetition maximum (1RM) and systematically progressed over the course of the intervention.

Pre and post exercise pain and fatigue scores on a 0–100 visual analog scale were examined for the first RET session of each training wk. Data gathered during IRM testing (baseline, mid-program, and end-program) were excluded, resulting in analysis of 13 training wks. Hypothesis testing was conducted using separate 2 (time: pre, post) x 13 (program length: wk 1-13) repeated measures ANOVA models.

**RESULTS:** Average pre-exercise pain and fatigue were 27.8±2.2 and 21.8±3.3, respectively. Pre-exercise trend line slopes were 0.04 and 0.02 for pain and fatigue, respectively. Significant interaction effects for pain, F = 2.80, p = 0.06, partial eta squared = 0.12, and fatigue, F = 2.25, p = 0.03, partial eta squared = 0.10, models were found. Relative to pre-exercise, post-exercise scores were lower following earlier training sessions (e.g., wks 1-5) and higher following later training sessions (e.g., wks 10-13).

**CONCLUSION:** Contrary to our hypothesis, pre-exercise pain and fatigue appeared to increase across wks 1-13, which could be related to the progression of exercise intensity over the course of the program. However, the stability of the pre-exercise scores across wks 1-13 suggests that weekly pre-exercise pain and fatigue were not exacerbated by acute responses to RET.

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1187 May 30 9:45 AM - 10:00 AM
Body Fat Is More Strongly Associated Than Lean Mass With Physical Function In Middle-aged Women
Christie L. Ward-Ritacco, Ashley L. Meyer, Walker Grace, Natalie J. Sabik, Deb Riebe, FACSM. University of Rhode Island, Kingston, RI. (Sponsor: Deb Riebe, FACSM)
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(No relevant relationships reported)

PURPOSE: Research in older adults suggests that percent body fat is more strongly associated with physical function compared to lean mass when examining relationships between body composition and functional performance. Poor physical function has been associated with increased risk for disability and loss of independence in older women; however, the component of body composition most strongly associated with physical function in middle-aged females is incompletely characterized. Poorer physical function earlier in the lifespan may predispose people to decreased quality of life in older age. The purpose of this study was to examine the strength of the associations between lean mass and percent fat on objectively measured physical function performance in middle-aged females.

METHODS: Eighty-four females (ages 52.58 ± 6.10 yrs) were assessed for body composition (lean mass, percent fat) via dual-energy x-ray absorptiometry, physical activity and sedentary time via accelerometer (steps per day, time sedentary), and physical function via timed Up-And-Go, 30-Second Chair Stand, Transfer Task, Six-Minute Walk, and Lift and Carry.

RESULTS: Measures of lean mass (total lean mass, lean mass index) were not related to any measures of physical function (all p > 0.05), while percent fat was related to Timed Up-And-Go (r = -0.32), 30-Second Chair Stand (r = -0.35), Transfer Task (r = -0.53), and Six-Minute Walk (r = -0.48) performance (all p < 0.05) but not Lift and Carry performance (r = -0.22, p = 0.06). Hierarchical linear regression analyses revealed: (1) age, steps per day, and percent fat were related to Transfer Task, 30-Second Chair Stand, and Six-Minute Walk performance, explaining 40%, 25%, 25% of the variance, respectively (all p < 0.05; (2) age, sedentary minutes per day, and percent fat were related to Timed Up-And-Go, explaining 18% of the variance, p < 0.01; (3) age, and average steps per day, but not percent fat, were associated with Lift and Carry performance, explaining 11% of the variance.

CONCLUSIONS: In middle-aged women, percent fat was more strongly associated with physical function performance compared to total mass, lean mass, or lean mass index. This suggests that reducing percent fat via intervention may be an effective method for improving functional performance among women in this age group.

1188 May 30 10:00 AM - 10:15 AM
Age-related Differences in Rectus Femoris Muscle Size and Hip Flexion Maximal and Rapid Torque Characteristics
Ty B. Palmer, Bailey M. Palmer. Texas Tech University, Lubbock, TX. (Sponsor: C. Roger James, FACSM)
(No relevant relationships reported)

Previous studies have reported that decreases in muscle size of the rectus femoris (RF) may contribute to age-related deficits in leg extension strength. However, we are aware of no studies that have examined the contribution of RF muscle size to age-related differences in hip flexion strength, and more specifically, the age-related differences in maximal and rapid torque values observed in healthy older individuals. To more closely replicate the musculoskeletal composite of strength and fatigue, may be a proximal determinant of physical function in mobility-limited older individuals. To more closely replicate the musculoskeletal composite of strength and fatigue, may be a proximal determinant of physical function in mobility-limited older individuals. The current findings suggest that the proprioception and mobility of older people can be improved by a short duration of balance control or strength training exercise. However, we suggest that the exercise program must be target-specific with respect to different impairments associated with the aging process for optimal results.

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Skeletal muscle weakness and an increase in fatigability independently contribute to age-related functional decline. PURPOSE: The objective of this study was to examine the combined contribution of these deficiencies (i.e., torque capacity) to physical function, and then to assess the functional implications of progressive resistance training (PRT) mediated-torque capacity improvements in mobility-limited older adults. METHODS: Seventy mobility-limited (Short Physical Performance Battery [SPPB] < 11) older adults (~70 yrs) were recruited and randomized to either PRT or twice weekly cup-tap or strength exercise program was delivered for 5 weeks duration. Key outcome measures included ankle proprioception measured using the active movement extension apparatus (AMEDA), and mobility assessed by using the Timed Up and Go test (TUG) and the 30-second Sit to Stand test (30STS). RESULTS: ANOVA analysis showed that there was no significant difference in baseline measures: ankle proprioception (F = 1.605, p = 0.209), TUG (F = 0.473, p = 0.625), and 30STS (F = 1.201, p = 0.307) among the three groups. Paired t-tests used for examining pre- and post-intervention differences indicated that 1) for the CTE group, the performance of 30STS and the ankle proprioception were significantly improved (p = 0.005, 0.016 respectively), TUG was significantly improved (p = 0.023, p = 0.03 respectively), and 3) no significant changes were observed for the EC group. In addition, Pearson’s correlation analysis showed that 30STS and TUG performances were moderately correlated (r = 0.598, p < 0.01) and TUG was significantly correlated with age (r = 0.416, p < 0.001). CONCLUSION: The current findings suggest that the proprioception and mobility of older people can be improved by a short duration of balance control or strength training exercise. However, we suggest that the exercise program must be target-specific with respect to different impairments associated with the aging process for optimal results.
1191 May 30 10:45 AM - 11:00 AM Muscularity Of Non Sedentary Elderly Over Three Decades Trends

Rafael Benito Mancini1, João Pedro Da Silva Junior2, Carolina Gonzalez Beltran2, Tatiane Kosimeno Ferrari2, Timoteo Leandro Araújo1, Sandra Mahecha Matsudo3, Victor Keihan Rodrigues Matsudo2, José da Silva Guedes4, 1Center of Studies of the Physical Fitness Research Laboratory from São Caetano do Sul (CEPAS), São Caetano do Sul - SP, Brazil. 2Universidade de São Paulo - USP, São Paulo, Brazil. 3Faculdades Metropolitanas Unidas - UNIFMU, São Paulo - SP, Brazil. 4School of Medicine – Universidade Mayor, Santiago, Chile. 5Santa Casa, São Paulo - SP, Brazil. 6Email: mancini.rafael@gmail.com

(No relevant relationships reported)

Purpose: To describe and analyze the muscular trend, related to circumstances of non-sedentary women over three different decades. Methods: This current study is part of the Mixed Longitudinal Project of Physical Fitness and Aging. Sample composed of women’s, 50 years-old and older and participated in at least one evaluation between 1998 and 2017, totaling a sample of 6367 individuals. The circumstances (cm) analyzed were: contracted and relaxed leg and arm. To analyze the trend, the sample was divided into age groups: 50 to 59 years, 60 to 69 years and 70 years old and over. Polynomial regression models were estimated. In the modeling process, the mean of each one of the anthropometric variables was considered as dependent variable and the years of evaluation as independent variable. For each variable, the model with the highest statistical significance and the best accuracy measure (r²) was selected. Results: Leg circumstance (cm) presented a positive trend in the age group of 50 to 59 years, and a negative trend in the age groups of 60 to 69 years, and in the 70 years and over group. The contracted arm circumference (cm) presented a positive tendency in the age groups of 50 to 59 years and 60 to 69 years. On the other hand, the circumference of the relaxed arm (cm) presented a positive tendency only in the 50 to 59 years-old group. In the age group of 50 to 59 years, the mean leg circumference was 35.77 cm, the mean arm circumference was 30.68 cm and the mean arm circumference, relaxed was 30.43 cm. In both cases, there was an increase of 0.01 cm every year. In the age group of 60 to 69 years, mean leg circumference was 35.11 cm, and there was a decrease of 0.01 cm every year; the mean of the contracted arm circumference was 29.97 cm, with an increase of 0.01 cm every year; the mean of the contracted arm circumference was 29.97 cm, with an increase of 0.01 cm every year. Conclusion: Over the three decades analyzed, the younger elderly showed a positive tendency for the muscularity indices, while older groups presented mixed results.

1192 May 30 11:00 AM - 11:15 AM Health and Lifestyle Behaviors of U.S. Master’s World Cup Field Hockey Players

Karen A. Croteau, FACSM1, Nina Eduljee1, Laurie Murphy1, Lisa Ahearn2, 1Saint Joseph’s College of Maine, Standish, ME. 2Plymouth State University, Plymouth, NH. Email: keroteau@sjcme.edu

(No relevant relationships reported)

Purpose: The purpose of this study was to examine health status and lifestyle behaviors of U.S. master’s field hockey athletes. METHODS: Participants were 122 athletes (72 females, 50 males) who competed for the U.S. in the Master’s Field Hockey World Cup in 2018. Mean age was 30.12 ± 9.00. Exercise frequency at ≥3 days per week and ≥30 minutes was cited by 95.9% and 98.4% of the sample. Exercise frequency at ≥3 days per week and ≥30 minutes was cited by 95.9% and 98.4% of the sample. Exercise frequency at ≥3 days per week and ≥30 minutes was cited by 95.9% and 98.4% of the sample. Conclusion: Master’s field hockey athletes practice lifestyle behaviors conducive to positive health.

1193 May 30 11:15 AM - 11:30 AM Effects of Tai Chi Exercise Versus BINGO on Fine Motor Functions in Older Adults

Saira Talwar1, Chih-Chia Chen2, John Lamberti2, Yonjoong Ryu1, Poram Choi2, Morgan Hommel2, Zhujun Pan2, 1University of Wisconsin - Milwaukee, Milwaukee, WI. 2Mississippi State University, Mississippi State, MS. (Sponsor: Scott Strath, FACSM)

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(No relevant relationships reported)

Tai Chi exercise (TC) improves gross motor skills in older adults; however, fine motor skills, which enhance performance of daily living activities (ADLs), have not been thoroughly examined. PURPOSE: The purpose of this study was to investigate the effects of TC versus BINGO on fine motor skills in older adults. METHODS: Twenty-seven self-ambulatory older adults (age: 76 ± 9.00; female: N = 26) with no restrictive health conditions and MMSE score ≥ 21, completed this study. Participants engaged in 1-hour, twice-per-week TC or BINGO sessions for 8 weeks (wk). Fine motor skills were assessed using the unilateral Jethsen Taylor Hand Function Test (JTHFT), including 7 ADL-like tasks; less time (s) to complete a task reflected better performance. Repeated measures 2 x 2 (TC × BINGO) x 4 (Baseline x Intra/retention x Post x Retention) ANOVA was used with alpha of 0.05; data was analyzed separately for each hand. RESULTS: There were no significant group differences (p > 0.05). Significant time main effects were found for 6 tasks using the dominant hand (DH) and 7 tasks using the nondominant hand (NH) (Table 1). Significant time x group interaction was found for simulated feeding using the DH (p = 0.001). TC improved by 1.69 s across the 8-wk intervention, with a 1.23 s improvement after 4 wk. BINGO improved by 0.07 s across the 8 wk. Significant time x group interaction was also found for lifting large, heavy objects using the NH (p = 0.039). TC improved by 0.65 s across the 8 wk intervention, with a 0.50 s improvement after 4 wk. BINGO improved by 0.09 s across 8 wk. CONCLUSION: This study was one of the first to explore the effects of TC on fine motor functions. TC does not demand precise finger movements such as those required for BINGO; however, improvements specific to tasks requiring eye-hand coordination, manual dexterity, wrist range of motion, and hand grip strength were noted 4 wk into the TC intervention. TC may improve fine motor functions in older adults. Supported by MSU College of Education.

Abstracts were prepared by the authors and printed as submitted.
Clinical Case Slide - Leg and Tibia

Thursday, May 30, 2019, 9:30 AM - 10:50 AM
Room: CC-305

1194 Chair: Mark R. Hutchinson, FACSM. University of Illinois at Chicago, Chicago, IL. (No relevant relationships reported)

1195 Discussant: Jay Hertel, FACSM. University of Virginia, Charlottesville, VA. (No relevant relationships reported)

1196 Discussant: Sean Engel. University of Minnesota, Minneapolis, MN. (No relevant relationships reported)

1197 May 30 9:30 AM - 9:50 AM
Leg Pain in a 23 Year Old Football Player
Kyle H. Yost, Valerie Cothran, Ralph F. Henn. University of Maryland Medical System, Baltimore, MD. Email: kyleyost08@gmail.com (No relevant relationships reported)

HISTORY:
A 23 year old male reported getting kicked in the leg during a collegiate football game. He noted immediate pain in his lateral calf after attempting a tackle. He did not feel or hear a pop. He had a noticeable limp walking off the field. There was no pain in the ankle or foot, but he noted pain with ankle movement. He had pain with weight-bearing but denied any numbness or tingling. The next day, he developed worsening pain that was unbearable with any change of position or movement. The pain was greatest along the mid-lateral leg but extended along the entire leg anterior and laterally. He had limited ability to move his toes and foot which was a new symptom.

PHYSICAL EXAMINATION:
General: Alert and oriented in mild distress at rest.

Leg:
Edema: Anterior and lateral leg without pitting.
Compartment:
Diffusely tender but not tense.
Tenderness:
Diffuse, anterior and lateral compartments more than fibula and posterolateral.
Range of motion:
DF 0 degrees, PF 30 degrees. Pain was worse with initiation. He tolerated gradual passive stretch of the anterior, more than the lateral.

Pain with inversion and eversion.

Range of motion:
DF 0 degrees, PF 30 degrees. Pain was worse with initiation. He tolerated gradual passive stretch of the anterior, more than the lateral.

Test and results:

1. Fluoroscopic imaging of the tib-fib and ankle were negative.
2. MRI of the lower leg posterior superficial compartment: 27
3. MRI of the left lower leg lateral compartment: 28
4. MRI of the left lower leg anterior compartment: 20
5. Diastolic pressure: 74

DIFFERENTIAL DIAGNOSIS:
1. Gastrocnemius Strain
2. Compartment Syndrome
3. Posterior Tibial Strain
4. Tibial Fracture
5. Pulled Ankle Sprain

3. Popliteal Artery Entrapment Syndrome

TREATMENT AND OUTCOMES:
1. Referred to plastic surgery colleagues.
2. Underwent bilateral popliteal artery release 1 year, 8 months after index surgery.
3. Improvement of both pain and numbness along medial aspect of foot.
4. Last seen at 3 months post-operatively. Full, painless ROM. No pain with resisted plantarflexion. Normal sensation. Anticipate return to sport over the next 6 weeks.

1199 May 30 10:10 AM - 10:30 AM
Pain And Function: A Ten(din)uous Link In The Runner
Peter Francis, Isabel Thornley, Ashley Jones. Leeds Beckett University, Leeds, United Kingdom. Email: peter.francis@leedsbeckett.ac.uk (No relevant relationships reported)

HISTORY:
A male runner (30-years, 10-km time: 33-min 46-sec) had been running with suspected insertional achilles tendinopathy (AT) for 2.5 years when the pain reached a threshold that prevented running.

PHYSICAL EXAMINATION:
Diagnostic ultrasound (US), prior to a high volume stripping injection, confirmed right sided medial insertional AT.

DIFFERENTIAL DIAGNOSIS:
Right sided medial insertional AT.

TEST AND RESULTS:
The athlete failed to respond to the injection and ceased running for a period of 5-weeks. At the beginning of this period, the runner completed the Victoria institute of sports assessment-achilles questionnaire (VISA-A) and the foot and ankle disability index (FADI), prior to undergoing an assessment of bi-lateral gastrocnemius medialis (GM) muscle architecture (muscle thickness (MT) and pennation angle (PA) (US), muscle contractile properties (maximal muscle displacement (Dm) and contraction time (Tc); Tensionomyography (TMG)) and calf endurance (40 raises/min). VISA-A and FADI scores were 59%/100% and 102/136 respectively. Compared to the left leg, the right GM had a lower MT (1.60 cm vs. 1.74 cm), a similar PA (22.0° vs. 21.0°), a lower Dm (1.2 mm vs. 2.0 mm) and Tc (16.5 ms vs. 17.7 ms). Calf endurance was higher in the right leg compared to the left (48 vs. 43 raises).

FINAL WORKING DIAGNOSIS:
Right sided medial insertional AT.

TREATMENT AND OUTCOMES:
The athlete began a metronome guided (15-BPM), 12-week progressive eccentric training protocol using a weighted-vest (1.5kg increments per week), whilst receiving 6-sessions of shockwave therapy concurrently (within 5-weeks). On returning to running, the athlete kept daily pain (VAS) and running scores (miles*RPE). Foot and ankle function improved according to scores on the VISA-A (59%/97%) and FADI (102 vs. 127/136). Improvements in MT (1.60 cm vs. 1.76 cm) and PA (22.0° vs. 24.8°) were recorded via US. Improvements in Dm (1.15 mm vs. 1.69 mm) and Tc (16.5 ms vs. 15.4 ms) were recorded via TMG. Calf endurance was lower in both legs and the asymmetry between legs remained (L: 31, R: 34). Pain intensity (mean weekly VAS scores) decreased at two weeks, he was weaned out of the boot and allowed to progress into activities.

At six weeks, he was participating in football without any limitations.
between week-1 and week-12 (6.6 vs. 2.9), while running scores increased (20 vs. 38) during the same period. The program was maintained up to week-16 at which point weekly mean VAS was 2.2 and running score was 47.

1200 May 30 10:30 AM - 10:50 AM
Medial Lower Leg Pain in a Middle-Aged Triathlete
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HISTORY: A 43-year-old triathlete presented with left distal medial lower leg pain that started gradually about 2-3 weeks prior to presentation. He denied inciting trauma and described the pain as a 5/10 sharp pain provoked by walking, running, and ankle dorsiflexion and plantarflexion movements. He endorsed mild left distal medial leg swelling but denied leg weakness or numbness and previous injury to this area. He was taking ibuprofen and had seen a chiropractor who performed several treatments including grastin, massage, taping, and a compression sleeve with minimal relief. He was training for his first full Ironman triathlon, scheduled for 12 days from presentation.

PHYSICAL EXAMINATION: Gait was non-antalgic. No visible swelling or ecchymoses of the left lower leg. Only tender to palpation in the left distal medial leg near the myotendinous junction of the medial gastrocnemius. Full ROM at the knee and ankle, but left end-range ankle dorsiflexion was painful. Strength was 5/5 about the knee and ankle, but he had pain with toe raises and toe walking on the left.

DIFFERENTIAL DIAGNOSIS:
1. Gastrocnemius strain or tear
2. Soleus strain or tear
3. Plantaris strain or tear
4. Achilles tendon injury
5. Posterior tibialis strain or tear
6. Fascial defect/muscle herniation
7. Deep posterior compartment syndrome
8. DVT

TEST AND RESULTS: Limited diagnostic ultrasound of the left distal medial leg revealed a near tear of the plantaris tendon near the myotendinous junction with evidence of disruption of tendon fibers and surrounding anechoic fluid. There was neovascularization on color doppler and tenderness to sonopalpation.

FINAL/WORKING DIAGNOSIS: Plantaris Tendinopathy

TREATMENT AND OUTCOMES: He was encouraged to continue symptomatic treatments with his chiropractor and could also consider kinesiotaping. His goal was to complete the full Ironman, even if he was slower than anticipated and called about one treatment with his chiropractor and could also consider kinesiotaping. His goal was to complete the full Ironman within his original goal time.

1201 May 30 9:30 AM - 9:50 AM
Post-concussion Syndrome With Retrograde Amnesia in a Pediatric Patient
Andrew Alexander, Weston Northam, Kevin Carneiro, Jason Mihalik. University of North Carolina at Chapel Hill, Chapel Hill, NC. (Sponsor: Kevin Guskiewicz, FACSM)
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HISTORY: A 14-year-old female with a history of pervasive developmental disorder (PDD), mild speech abnormalities, dyslexia, hearing loss and migraines sustained a concussion after falling on a slip and slide. The patient hit her head but did not lose consciousness. At clinic 3.5 weeks post injury, she complained of a headache with varied intensity. Reading provoked headaches and blurred vision. The patient experienced photophobia, phonophobia and dizziness. She took more naps during the day and had mood lability. The patient was amnesic to the event and had severe memory lapses. She forgot how to do simple math problems, the names of her family, friends, boyfriend, and that she was a cheerleader.

PHYSICAL EXAMINATION: Neurologic: 1) Slow eye movements that provoked headache, 2) Accommodation (blurred vision) and convergence (diplopia) insufficiencies, and 3) Undershooting and eye strain with vertical and horizontal saccades. Tenderness to palpation on right side of the neck and suboccipital region. Patient named current president when asked, but unable to name previous or first president. Otherwise, normal neurologic and musculoskeletal exam.

DIFFERENTIAL DIAGNOSIS:
1) Post-concussion syndrome with retrograde amnesia
2) Anxiety disorder exacerbated by trauma
3) Malingering

TESTS AND RESULTS: CT head and neck:
— Normal

Neuropsychology Evaluation:
— Test of Memory Malingering - adequate effort
— ImpACT: deficits in Verbal Memory, Visual Memory, Visual Motor Speed, and Reaction Time

Behavior Rating Inventory of Executive Functioning: Normal
Revised Children’s Anxiety and Depression Scale:
— Clinically insignificant

Sensory Organization Test:
— No significant balance problems

FINAL/WORKING DIAGNOSIS:
Post-concussion syndrome with retrograde amnesia. Underlying PDD, and comorbidities at baseline described earlier likely contributing to headache and cognitive difficulties.

TREATMENT AND OUTCOMES:
1. Physical therapy for cervicogenic headaches
2. Vestibular therapy for dizziness and vestibulo-oculomotor dysfunction
3. Neuro-optometry evaluation and rehabilitation
4. All deficits and symptoms greatly improved 2 months post-injury. Vision rehabilitation will be continued prior to return-to-sport.
Final Diagnosis: or midline shift.

Tests and Results:
- Toxic metabolic encephalopathy
- Anoxic encephalopathy
- Extremities.

Abdominal exam was significant for an in-place PEG tube. Integumentary was significant for partial thickness wounds on his anterior chest and right lower calf. During the patient’s stay on the burn unit, he was noted to have severe cognitive impairments. He had a PEG tube placed after developing aspiration pneumonia. Following the burn unit, his neurocognitive status continued to deteriorate. He had a Rancho Los Amigos level three.

History:
Jt is a 20 y/o male with 2 episodes of acute posterior neck pain with radiation into his occiput followed by acute loss of vision bilaterally and brief loss of consciousness vs. presyncopal like episode. The first event occurred while wrestling and the second while bench pressing. There was no preceding chest pain, shortness of breath, or other symptoms. All symptoms resolved approximately 15 minutes after each event.

At the time of the visit he was asymptomatic and unable to reproduce symptoms with head movement. No recent illness. No cardiac or pulmonary past medical history.

Physical Examination:
The examination is overall unremarkable with normal pupillary and extra ocular muscle exam, no visual deficits, normal visual acuity, no midline cervical tenderness, and negative Spurling’s test. Jt had a normal extensive neurologic exam including cranial nerves, coordination, sensation and strength. Cardiovascular and pulmonary exams are also normal.

Differential Diagnosis:
Hypoplastic Vertebrobasilar system

TREATMENT AND OUTCOMES
At the time of the diagnosis, there was no evidence of ischemia as a result of the occurrences. Possible treatment options for hypoplastic vertebrobasilar systems without ischemia include aspirin and lifestyle modifications. Activity modifications have been made to include proper hydration, training to the start of symptoms but no further and reducing the activities that induce valsalva unnecessarily. Since these modifications have been put in place, there have been no new events. Follow up plans include repeat MRI at 6 months.

1206 May 30 10:10 AM - 10:30 AM
After Lightening Strikes: A Case Of Anoxic Encephalopathy In A 30 Year Old Soccer Player

Michael Habus, Miguel X. Escalon. Mount Sinai School of Medicine, New York, NY.

History:
A 30 year old male with a past medical history of hypothyroidism was out playing soccer when he was struck by lightning. After the lightening strike, the patient experienced cardiac arrest, and CPR was performed. Spontaneous circulation was achieved after a 17 minutes of CPR, and the patient was admitted to a burn unit for partial thickness burns of his left anterior chest, abdomen, and right medial lower calf. During the patient’s stay on the burn unit, he was noted to have severe cognitive deficits secondary to an anoxic brain injury sustained during his cardiac arrest, and also had a PEG tube placed after developing aspiration pneumonia. Following the burn unit, the patient was transferred to an acute rehab facility to address the severe cognitive deficits he had developed. Upon arrival at the acute rehabilitation facility, the patient was a Rancho Los Amigos level three.

Physical Exam:
The patient was lying comfortably in bed. He was able to mimic behavior, but was unable to follow commands consistently. On ocular exam, the patient had a left pupil that was fixed and dilated, and sub-conjunctival hemorrhages. Abdominal exam was significant for an in-place PEG tube. Integumentary was significant for partial thickness wounds on his anterior chest and right lower extremity. The patient demonstrated full active range of motion of his upper and lower extremities.

Differential Diagnosis:
Anoxic encephalopathy

Encephalopathy secondary to electrocution
Torticollis metabolic encephalopathy

Tests and Results:
-Labs on admission were significant for the following: White blood cell count of 5.0; hemoglobin of 10.3; blood urea nitrogen of 55; AST of 42 and ALT of 70. -CT head on admission showed no evidence of intracranial hemorrhage, lobar infarct, hydrocephalus, or midline shift.

Final Diagnosis: Anoxic encephalopathy secondary to lightening strike

C-15 Rapid Fire Platform - Muscle Fatigue and Force Development

Thursday, May 30, 2019, 9:30 AM - 10:50 AM
Room: CC-Hall WA2

1208 Chair: R. Andrew Shaney. Appalachian State University, Kannapolis, NC.

May 30 10:30 AM - 10:50 AM
She’s Only Weak Because She Doesn’t Play Sports


History:
8-year-old female presents to pediatric sports medicine for evaluation of clumsiness and muscle weakness. She had been following with the school physical therapist for about one year for concerns about balance, coordination, and core strength. School initially had a concern about her confidence and speed on stairs and not keeping up in gym class. She was referred due to continued coordination issues.

Per mother, her difficulty with stairs started when she was pushed down the stairs by a peer. She typically places both feet on the step when she climbs stairs. Her core weakness had been attributed to deconditioning and disinterest in sports. Mom feels the school PT is cutting into education time and would like to it stop. She has always been a bit clumsy, which is present in the rest of the family as well.

The patient endorses mild hip and gluteal muscle soreness that has been attributed to growing pains. She falls a lot but no significant injuries. She has always been a bit of a walkie. No handwriting difficulties. Normal developmental milestones per mother.

Physical Examination:
Genu valgum. Holds thighs together during gait with poor hip swing. Intermittent toe walking with pes cavus. Full pain free ROM about the hips and knees. Mild heel cord tightness. Ligamentous laxity throughout. No tenderness to palpation about the lower extremities. Muscle tone diffusely decreased other than mild increased tone at ankles and feet without atrophy. Strength testing reveals 3/5 straight leg testing, using hands under thighs to move legs. Otherwise, she is 4/5 strength throughout other than 5/5 strength with ankle plantarflexion, great toe extension. DTRs 1+ throughout. Gower’s sign negative, but she does walk hands up to feet before standing with difficulty.

Differential Diagnosis:
Muscular dystrophy - Beckers, limb-girdle, spinal muscular atrophy, facioscapulohumeral muscular dystrophy, Myositis, Other myopathy

Test and Results:
CMP, lipids, TSH unremarkable

Fetal Muscular Atrophy Type 3 FINAL WORKING DIAGNOSIS: Spinal Muscular Atrophy Type 3

TREATMENT AND OUTCOMES:
She has started nusinersen (Spinraza) therapy and continues with physical therapy. She remains ambulatory 3 months into treatment. Starting to use AFOs for toe walking.

1209 May 30 9:30 AM - 9:40 AM
Tropomyosin-based Effects Of Acidosis On Thin-filament Regulation During Muscle Fatigue

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Skeletal muscle fatigue is defined by a loss in the force and velocity generating capacity of a muscle. A portion of the loss in function is attributable to effects of acidosis (i.e. low pH) on the regulatory proteins, tropinin and tropomyosin (Tm), which regulate the binding of myosin and actin in a calcium (Ca++) dependent manner. However, the relative role of the regulatory proteins is not clear, nor are the mechanisms underlying the effect acidosis has on them. PURPOSE: To determine the role of Tm in the acidosis-induced depression of muscle function using isolated muscle proteins in an in vitro motility assay.
METHODS: To test this idea we expressed 3 mutant constructs of Tm with the 2 amino acid residues affected by low pH (histidine residues) replaced with alanine residues (1211, 1212, 1215). These constructs were compared to a wild-type Tm, to test the hypothesis that acidosis-induced charge changes of the histidine amino acid governs tropomyosin’s pH-dependent decrease in maximal velocity and Ca++-sensitivity. The effect on RTF function was determined by testing the magnitude of the depression in force, therefore we are currently testing the impact of these residues in tropomyosin do not mediate the acidosis-induced depression in contraction velocity observed during muscle fatigue. However, it is possible that these residues are more important in mediating the depression of force velocity curves as they are currently testing the impact of these mutations in Tm on the acidosis-induced depression in the Ca++-sensitivity using a loaded in vitro motility assay. Supported by: 2018 UMass UMOVE Initiative

RESULTS: A two-way ANOVA (pH x Tm construct) revealed that acidosis significantly (p<0.05) depressed the maximal sliding velocity of the RTFs across all versions of Tm, but that the magnitude of the depression was similar among the wt and all of the Tm mutants. Acidosis did not significantly depress the sensitivity to Ca++ under the unloaded conditions of this assay (p>0.05).

CONCLUSIONS: These data suggest that the histidine residues in tropomyosin do not mediate the acidosis-induced depression in contraction velocity observed during muscle fatigue. However, it is possible that these residues are more important in mediating the depression of force velocity curves as they are currently testing the impact of these mutations in Tm on the acidosis-induced depression in the Ca++-sensitivity using a loaded in vitro motility assay. Supported by: 2018 UMass UMOVE Initiative

CONCLUSIONS: LFF can be induced by different types of muscle contraction and affects both maximal isometric force, maximal velocity and maximal power during concentric contractions. These effects can be mitigated by caffeine, indicating an impaired calcium release during LFF.
Diet-induced obesity can lead to higher intramuscular fat deposition and inflammatory cell accumulation, ultimately having a negative impact on skeletal muscle morphology and function leading to mitochondrial dysfunction and insulin resistance. Intermittent fasting (IF) and high intensity interval training (HIIT) are both effective strategies for losing weight, specifically fat mass. However, the effects on skeletal muscle, specifically genes that regulate mitochondrial function, energy homeostasis, and muscle atrophy are unknown. PURPOSE: To investigate the effects of IF and/or HIIT on molecular markers of skeletal muscle mass and metabolic function in diet-induced obesity. METHODS: Eight week old mice (C57BL/6, n=39) had ad libitum access to an obesogenic diet (60% fat, 30% sugar) for 12 weeks. They were then randomly allocated to three intervention groups: IF (fasting for 2 alternate days/week), HIIT (2 days fast days, 3 days HIIT) or control (CON) for a further 12 weeks. Extensor digitorum longus (EDL) muscle weight and expression of PGC1α, AMPK, citrate synthase (CS), muscle atrophy F-box (MAFBx), and muscle RING Finger-1 (MuRF1) were measured at the end of the intervention period. Data was analysed using ANOVA. RESULTS: Muscle weights were similar between groups at the end of the intervention period (CON: 9.5±1.3mg, HIIT: 9.2±0.8mg, IF: 9.2±0.4mg; IF+HIIT: 9.7±0.8mg, p<0.05). PGC1α and CS gene expression was significantly lower in the IF group compared to the CON (PGC1α: 0.8±0.1 vs 1.0±0.2, CS: 0.8±0.2 vs 1.0±0.4; p<0.05). AMPK gene expression was also significantly lower in the IF group, but only compared to the IF+HIIT group (0.9±1.0 vs 1.0±1.0; p<0.05). MAFBx and MuRF1 gene expression was significantly higher in the HIIT group (1.0±0.8 vs 2.2±0.9) compared to CON (1.0±0.4 & 1.0±0.2; IF: 0.9±0.2 & 0.8±0.2), and IF+HIIT (1.4±0.3 & 0.9±0.2; p<0.05) groups. CONCLUSIONS: Intermittent fasting reduced gene expression markers of mitochondrial biogenesis and energy homeostasis, while HIIT appeared to increase expression of PGC1α, AMPK, citrate synthase (CS), muscle atrophy F-box (MAFBx), and muscle RING Finger-1 (MuRF1). The synergistic effects observed in isolated rat EDL muscles stimulated either by constant frequency trains of tetanic (150 Hz), by supra-tetanic (300 Hz) frequencies, or by a sub-tetanic frequency (50 Hz) with or without an initiating doublet (300 Hz). Muscles were incubated at 30°C in Krebs Ringer buffer at 4 or 11 mM K+.

RESULTS: Increasing frequency from 150 Hz to 300 Hz increased maximal power (Pmax) by 15 ± 3 %, maximal velocity (Vmax) by 8 ± 3 %, and rate of force development (RFD) by 23 ± 3 % at 4 mM K+, but at 11 mM K+ these increases were attenuated (Pmax increased by 5 ± 2 %) or abolished. When using sub-tetanic frequency trains, addition of a high frequency doublet induced increases at both 4 and 11 mM K+ in maximal force (Pmax) (15 ± 3 % and 6 ± 2 %), Pmax (62 ± 13 % and 23 ± 3 %), Vmax (53 ± 3 % and 22 ± 2 %) and RFD (59 ± 7 % and 31 ± 4 %). These relative doublet-induced increases were significantly higher at 4 mM K+ than at 11 mM K+. However, the absolute level of dynamic contractile function (with or without doublets) was equal or better at 11 mM K+ than at 4 mM K+ because an increase in [K+]pse potentiated the dynamic contractile parameters at the sub-tetanic stimulation frequency. CONCLUSION: These results show that the improved contractile activity achieved with high constant stimulation frequency is strongly attenuated when excitability is suppressed by high extracellular [K+]. However, when using doublets to initiate a train of sub-tetanic frequency, thus mimicking an in vivo-like activation pattern, contractile improvements may be achieved both at normal and at high extracellular [K+].
PURPOSE: Recent evidences suggest that the athletes have distinct microbial features compared to the sedentary subjects. However, few data have been assessed for the gut microbiota characteristics of athletes at different levels of competition. The aim of this study is to investigate whether gut microbiome is significant difference between higher and lower-level athletes. METHODS: Fecal microbiota communities were analyzed by using hypervariable tag sequencing of the V3-V4 region of the 16S rRNA gene among 28 professional hard martial arts athletes, including 12 higher-level and 16 lower-level athletes. RESULTS: The gut microbial richness and diversity (Shannon diversity index (p = 0.019) and Simpson diversity index (p = 0.001)) were significantly higher in higher-level athletes than in lower-level ones. Genera Phascolarctobacterium, Parabacteroides, Anaerostipes, Anaerotruncus, Bilophila, Cloacibacillus, Desulfovibrio, Flavonifractor and Oscillibacter were enriched in the higher-level group. Interestingly, the genera Parabacteroides abundance was significantly correlated with time reported exercising during an average week. Further analysis of the functional prediction revealed that three energy metabolism and methane metabolism were markedly over-represented in the gut microbiota of the higher-level athletes. CONCLUSIONS: This study provides the first insight into the gut microbiota characteristics of professional hard martial arts athletes. The higher-level athletes have increased diversity and high metabolic capacity of the gut microbiome, which may be positively influential to their performances. This study was supported by China Postdoctoral Science Foundation (grant number 194837) and SZN201612071.

CONCLUSION: It was found subjects exercised at an average of 75 ± 12.74% of HRmax and 48.0 ± 4.54% of VO2max. Average RPE was 12.3 ± 1.35. Males burned an average of 10.9 ± 1.57 kcal/min and females burned an average of 6.6 ± 0.9 kcal/min. CONCLUSION: Collectively these data suggest that exercising on the Freebounder™ provides a "moderate-intensity" workout that would result in significant improvements in aerobic capacity and body composition if the product is used regularly.
test. During tests, their oxygen uptake (VO$_2$) by 2 arm cranking modes; Syn or Asyn). They cranked at 50 rpm for 10 min at each.

However, these studies have not considered BL concentration during exercise. peak blood lactate (BL) and UL have reported moderate to high linear correlations.

Post-exercise urine lactate (UL) has been suggested as a novel exercise biomarker of lactate production. The few studies examining the association between post-exercise peak blood lactate (BL) and UL have reported moderate to high linear correlations. However, these studies have not considered BL concentration during exercise.
Sickle cell Trait (SCT) has measurable physiological effects. Whether SCT has marked psychological effects in elite collegiate football players (e.g., perceived their energy levels, mood state, and overall well-being) compared to position-matched controls is unknown. **Purpose:** To examine self-perceptions of sleep quality, mood state, and general well-being in Division 1 football players with and without SCT. **Methods:** Participants with SCT were identified by a team physician and confirmed by electromorphology and paired with position-matched controls (12 of each). Data included the Pittsburgh Sleep Quality Inventory (PSQI), Daily Analysis of Life Demands for Athletes Questionnaire (DALDA), Activation-Deactivation Adjective Check List (AD-ACL), and General Well-Being Questionnaire (GWQ). Data was collected at three time points: before pre-season camp, after pre-season camp, and post-season. **Results:** SCT reported higher levels of energy on the AD-ACL assessment than the control group at baseline (13.65 ± 0.68 vs. 11.56 ±0.66, p<0.05). No group-time interaction existed (p=0.20). On the GWQ, no differences between groups were found; however, a significant decrease in perceived well-being between pre- and post-season was observed (1.86 ± 1.80 vs. 1.72 ± 1.80, p<0.05) and pre- and post-season (38.86 ± 1.80 vs. 32.69 ± 1.86, p<0.05). Perceived sleep quality was similar across all participants at all time points. **Conclusion:** Participants with SCT reported a greater energy level coming into training camp and had similar perceived energy at the beginning and end of the competitive season compared to position-matched controls. GWB did not differ between groups but decreased in all athletes throughout the season. Interestingly, the post-season survey may be skewed by the win or loss from the final game. The decrease at the start of the season could be due to increased stress due to academic responsibilities or the expectation to perform well and win competitions. Future research will correlate these psychological findings to biological markers of stress and fatigue.

**Abstracts were prepared by the authors and printed as submitted.**
that performing metabolic gas measures during the 3 min CP test does not bias the CP and W’ data. As no significant differences were found for VO2peak between the ramp and CP test, the data supports the contention that it is possible to obtain VO2peak in a 3 min all-out CP test.

Obtaining valid and reliable measurements for resting metabolic rate (RMR) via indirect calorimetry is critical for clinical and research purposes. PURPOSE: The primary aim of the study was to determine the reliability of RMR measurements under standard (best practice conditions). The secondary aim was to determine if normal fluctuations in skin temperature, core temperature, heart rate, or environmental factors affect repeated RMR measurements. METHODS: Twenty college-aged men entered the lab following an overnight fast. Following twenty minutes of sitting quietly, continuous measurements of environmental temperature, relative humidity, skin temperature, core temperature, and heart rate were recorded along with RMR. Following the initial RMR measurement, participants sat quietly for an additional forty minutes. A second RMR measurement was then completed following the same protocol. Differences between the initial measurement and second measurement for RMR, inter-beat interval, costal temperature, skin temperature, and environment were determined using a paired samples t-test for normally distributed data. A Wilcoxon signed-rank test was used for non-normally distributed data. Multiple linear regression was used to determine the relationship between inter-beat interval, core temperature, skin temperature, and environment on RMR measurements. All data are presented as mean ± SEM. RESULTS: The higher of the two RMR measurements was 2067.58 ± 66.03 kcal/day while the lower of the two RMR measurements was 1975.31 ± 64.85 kcal/day (t = 4.32, p < 0.01). Similarly, the higher of the two core temperature measurements was 37.05 ± 0.9°C while the lower of the two core temperature measurements was 36.74 ± 0.9°C (t = 7.17, p < 0.01). The change in R-R interval for heart rate was significantly correlated with the higher and lower RMR measurements (r = 0.47, p = 0.04 and r = 0.53, p = 0.02, respectively). No other factors were significantly related to changes in RMR. CONCLUSION: Even when best practice guidelines are followed, significant variability in RMR measurements separated by forty minutes suggest that two measurements of RMR may be necessary to obtain accurate data.

The variability in the insulin-stimulated glucose uptake of different skeletal muscles may be partly attributable to the differences in the muscle fiber type composition and the level of expression of the insulin-responsive glucose transporter known as Glucose transporter type 4. PURPOSE: To compare and evaluate the functional and metabolic changes from each work intensity. Correlation coefficients and systematic bias were used to compare the accuracy of a commercially available mobile system (CareFusion Oxycon Mobile) with a standardized criterion stationary cart system (ParvoMedics TrueOne 2400). METHODS: In a double-blinded, randomized, crossover protocol. Differences between the initial measurement and second measurement for metabolic exchanges, specifically volume of oxygen and carbon dioxide (V̇O2 and V̇CO2). A paired t-test was used to determine V̇O2peak; and, 4 days after, a steady-state IT 10x200-m test with 1-min passive rest at V̇O2peak, measuring BL and HR after reps. 2-4-6-8-10. Paired t-tests were used to compare V̇O2peak vs. IT speeds and times and BL after reps. 2-4-6-8-10. In addition, repeated measures ANOVA was used to compare BL after reps. 2-4-6-8-10. Finally, Pearson’s correlations (r) were obtained between BL vs HR in both incremental and steady state tests. RESULTS: Same speeds and times for V̇O2peak and HR were observed (1.38±0.07 m/s and 145.4±7.6 s vs 1.38±0.07 m/s and 145.5±7.5 s, respectively, p>0.05). BL was significantly maintained at BL@V̇O2peak levels only during reps 2 and 4 (4.10±0.52; 3.72±0.63 mMol/l, respectively, p<0.05 vs. BL@V̇O2peak); however, BL levels decreased over time during reps 6, 8, and 10 (3.95±0.29; 3.40±0.33; 3.13±0.30 mMol/l, respectively, p<0.01 vs. BL@V̇O2peak and reps 2 and 4). Additionally, there was a moderate correlation (r = 0.69) between BL and HR during the incremental test. However, a low correlation (r = 0.26) between BL and HR during the steady state IT test was observed. CONCLUSION: V̇O2peak from an incremental test underestimates BL level showing, a progressive decrease during the steady-state IT test. These results suggest that IT at V̇O2peak might not be enough to maintain metabolic stress during an IT bout, especially during the second half of it. Additionally, the moderate and low correlations observed between BL and HR suggest that HR might not be a good marker of exercise intensity in swimmers.

Indirect calorimetry is a practical and accurate method of measuring metabolic gas exchange rate, specifically volume of oxygen and carbon dioxide (VO2 and VCO2). Commercial stationary and mobile systems typically include automated metabolic gas analyses. Metabolic cart systems are considered the standard; however, they pose limitations due to cost and portability. PURPOSE: To compare the accuracy of a commercially available mobile system (CareFusion Oxycal Mobile, OXYCON) to a criterion stationary cart system (ParvoMedics TrueOne 2400, PARVO). METHODS: Fifteen volunteers (13 Male, 2 Female; 24 ± 6 y (mean ± SD), 77 ± 13 kg BW, VO2peak 3.9 ± 0.7 L/min) completed four trials over two non-consecutive study days. Trials consisted of a rest period, followed by three incremental treadmill work rates: walk (23-36% VO2peak), jog (49-67% VO2peak), and run (60-76% VO2peak) in controlled laboratory conditions (20 ± 0.5°C; 45 ± 22% RH). Metabolic system order was randomized and data collected was averaged over 3-4 minute steady-state periods from each work intensity. Correlation coefficients and systematic bias were used to evaluate the agreement between the systems. RESULTS: Measurements of VO2 from
Tissue Oxygen Index Response During Maximal On-Ice And Cycling Performances With Short Track Speed Skaters

Fanie St-Jean Miron1, Emily Walsh2, Bianca Marois1, Gilles Goussipoull1, Alain Steve Comtois1. 1University of Quebec in Montreal, Montreal, QC, Canada. 2Loyola University Chicago Stritch School of Medicine, Chicago, IL.

PURPOSE: The aim of this project was to create an on-ice test to compare skaters’ VO2 max and tissue oxygen index (TOI%), while performing maximal progressive tests during on-ice skating and on a cycle ergometer.

METHODS: Twenty-four Canadian short track speed skaters of the provincial level or higher participated in the study. Skaters took part in two separate progressive maximal tests on ice and on a cycle ergometer. Oxygen consumption (VO2) was continuously monitored during both tests with a portable metabolic analyzer. Tissue oxygen index (TOI%) was also continuously measured on the vastus lateralis of both legs during both tests and during the post exercise recovery phase. A modified Borg scale was used to assess the rate of perceived cardiovascular effort (RPE), as well as leg pain.

RESULTS: VO2 max on-ice was significantly lower than VO2 max reached on a cycle ergometer (3.56±0.65 vs 4.26±0.79 L·min⁻¹, p=0.001, respectively). When expressed as a function of VO2, the TOI% was significantly lower during skating vs cycling for any tested VO2. The TOI% of the right leg (RL) was significantly lower than the left leg (LL) at any VO2, for both skating and cycling. At maximal capacity (VO2 max), TOI% was similar for both skating and cycling (~15%). During the recovery phase, TOI% peaked at 80% after 160% of recovery after skating, while it took 120% after cycling. The RPE of cardiovascular effort was significantly lower at the end of the on-ice test vs ergometer cycling test (15.9±2.1 vs 17.0±2.1, p=0.005). However, no differences were detected for leg pain (18.5±1.1 vs 18.4±1.5, p=0.671, respectively).

CONCLUSIONS: The low position adopted by speed skaters appears to restrict blood flow to the lower limbs and thereby negatively impacts muscle oxygenation. These findings reveal the importance of testing short track speed skaters directly on the ice.

Dual stress challenges (e.g. paired physical and psychological challenges) have been shown to increase catecholamine and cortisol responses above that of exercise alone; however, the underlying mechanisms to explain this effect are not well defined. The increased hormonal response is thought to be the result of a greater glucose demand due to the challenges imposed on both the brain and skeletal muscle. PURPOSE: To determine whether a dual stress warm-up protocol significantly alters circulating glucose concentrations before and after a Wingate Anaerobic Test (WAnT).

METHODS: Thirteen college-aged subjects (Mean ± SD; age = 21 ± 3 y; Height = 177 ± 9 cm; Weight = 81.8 ± 11.8 kg) volunteered to participate and completed a familiarization WAnT on a Monark cycle ergometer using a resistance of 7.5% bodyweight prior to testing. On two separate visits, separated by at least 3 d but no more than 1 wk, subjects randomly completed a WAnT preceded by either a 5 min warm-up at a resistance of 1.5% at a pedal rate of 70-80 rpm (CTRL) or the same warm-up while also completing the Paced Auditory Serial Test, which is a mental arithmetic challenge (EXPT). Blood glucose was measured at 5 time points (pre, post warm-up, post WAnT, and at 5 and 10 min post WAnT) using a Contour NEXT Blood Glucose Monitor. Subjects abstained from caffeine, alcohol, and exercise for the 24 hr prior to testing. Diet was standardized across subjects for the 12 hr prior to each visit. Data were analyzed using 2x5 repeated measures ANOVA (α = 0.05).

RESULTS: There were no significant interactions between the two conditions. However, there was a main effect for time (p = .001) with glucose concentrations significantly increased at 5 min post WAnT. CONCLUSION: These findings suggest that incorporating a psychological challenge during a warm-up session had no effect on glucose concentrations following a WAnT when compared to warm-up session alone. The lack of a significant finding may be due to the relatively small sample size or by the lack of difficulty of the mental challenge. Future studies are warranted using high-stress cognitive tests to gain a better understanding of the effect of dual stress challenges on glucose concentrations prior to and following exercise.

Variable high-intensity exercise bouts may generate similar energy expenditures and possibly be favored over moderate-intensity exercise as an alternative to obtain optimal health benefits. PURPOSE: To examine exercise intensity, energy expenditure and perceptual responses to work-matched moderate-intensity steady-state exercise (MIE) and variable-intensity exercise (VIE) conditions in healthy adults (n = 6; age = 24.3 ± 5.4 yrs). METHODS: A graded exercise test on the cycle ergometer to maximal exertion was utilized to determine maximal oxygen uptake (VO2max), maximal heart rate (HR) and work rate (Wmax) for subsequent conditions. The two experimental conditions (MIE and VIE) were randomized and performed on separate days. MIE consisted of continuous moderate-intensity exercise at 40% of Wmax. VIE consisted of sixteen 10-s sec supramaximal sprints (120% Wmax), sixteen 20-s high-intensity bouts (60% Wmax) and low-intensity recovery (20% Wmax) interspersed throughout the exercise. Total duration and total work were matched between conditions. VO2, heart rate (HR) were averaged for the entire bout for both conditions. OMNI ratings of perceived exertion (RPE) and affect, via Feelings Scale, were measured during exercise and enjoyment was measured post-exercise using the physical activity enjoyment scale. Reponses between conditions were analyzed.

High-intensity exercise performed under hypoxic conditions may yield beneficial physiological adaptations due to altered reliance on the anaerobic energy system. This type of intervention is commonly evaluated during lower body cycling; however, considerable differences exist in the upper body musculature, particularly in women. PURPOSE: To determine the effects of normobaric hypoxia on energy system contributions in females during high-intensity upper-body time to exhaustion trials. METHODS: Thirty recreationally active women (age: 22.7 ± 2.6 y; height: 167 ± 8.6 cm; weight: 66.4 ± 9.7 kg; body fat: 27.6 ± 5% body fat) completed a graded exercise test in both normoxic hypoxia (H; FO2 = 14%) and normoxia (N; FO2 = 20%) to exhaustion. Each ergometer test was performed at a high O2 uptake and peak power output (POO). Each participant completed two constant work-rate arm-cranking tests at 110 and 120% POO in both N and H. Utilizing oxygen consumed during the constant work-rate tests, energy system contribution was determined using the accumulated oxygen deficit method. Two-way (condition × intensity) repeated measures ANOVA was used to compare the percent contributions of the aerobic and anaerobic energy systems. Results are reported as

95% confidence intervals (CI). RESULTS: No significant condition × intensity interactions were noted for relative or absolute AOD (p>0.05). A main effect was observed for both aerobic values (05.98% to 71.3%) being greater than anaerobic values (95% CI: 28.7% to 40.2%), while an intensity × energy system interaction was shown (p<0.05) with greater anaerobic contribution at 120% POO (95% CI: 32.6% to 44.3%) compared to 110% POO (95% CI: 22.9% to 27.9%). CONCLUSIONS: Moderate normobaric hypoxia had little effect, if any, on energy system contribution during high-intensity, constant work-rate arm-cranking in women. These findings suggest that limitations may exist for women when considering hypoxia as a means of altering metabolic stress during supramaximal upper body exercise.
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Purpose: The purpose of this study was to determine the impact of competing in a 100-mile ultramarathon on muscle fuel stores and cytokine production. Methods: One experienced male runner (40 yrs, 76.3 kg, 178 cm) completed the 100-mile distance in 32.9 hrs. Measurements were collected pre-race, at each support crew accessible aid station (28.5, 41.2, 56.6, and 80 miles), and post-race. Measures included saliva cytokine markers (IL-6 and TNF-α), muscle energy status, and body mass. Saliva was collected using a passive drool technique and samples were stored on dry ice until they could be sent out for analysis. Muscle energy status (MES) was determined by scanning the right rectus femoris with a portable ultrasound transducer. Scanned muscle images were uploaded to a cloud-based application where they were analyzed for MES, which is an arbitrary number assigned to the muscle based on predicted glycogen concentration. Celiacal expenditure was predicted based off average pace and terrain. Celiacal intake was monitored by a combination of self-reporting, product wrapper collection, and unconsumed fluid measurement. Results: Celiacal expenditure was estimated at 13,184 kcal (401 kcal/hr), while celiacal intake was recorded at 8883.3 kcal (180 kcal/hr). Body mass declined 2.4% from pre to post-race, although it fluctuated throughout the race (76.3, 74.7, 74.1, 75.1, 75.9, 75.4, 74.5 kg, respectively). Celiacal intake was reduced by 57% from pre to post-race, but also fluctuated throughout the race (88,90, 34.4, 71.9, 25.1, 69.1, 70.9, 38.2). IL-6 levels correlated with MES values (R² = 0.6997). TNF-α values followed a similar pattern to IL-6; however, there was no correlation between TNF-α and MES. Conclusion: These data provide some interesting insights into potential MES plasticity and cytokine regulation during prolonged exercise. More specifically, fluctuating MES values observed during the current activity suggest that glycogenolysis and glycogenesis may occur throughout an event depending on terrain and intensity, even with a discrepancy between celiacal intake and expenditure. Additionally, salivary IL-6 activity may be related to MES, suggesting that periods of low glycogen may increase physiological stress.

Purpose: The purpose of this study was to determine the SmO₂ recovery rate in both the Vastus Lateralis (VL) and Biceps Femoris (BF) muscles in traditional back squats. Methods: Absolute VO₂ during VIE and MIE were 1.42±0.22 L·min⁻¹ and 1.3±0.22 L·min⁻¹, respectively. The recovery rate of SmO₂ was calculated as the slope of SmO₂ over time between 10-50 seconds of during each recovery period. The mean recovery rate during the third set recovery for VL in back squats was 0.885±0.194 %SmO₂/0.5 sec and 0.290±0.059 %SmO₂/0.5 sec in front squats. There were significant differences in the SmO₂ recovery rates between the BF and VL in both legs (p<0.05). There were no significant differences between the recovery rates in back vs front squats. Similar differences were found in the first and second set recovery periods.

Conclusion: During front and back squats the initial rate of recovery of SmO₂ was more rapid in the VL than in the BF. Additionally, there are no differences in SmO₂ recovery rate between front and back squats.

ABSTRACT

Introduction

To date, there has been limited literature pertaining to Athlete’s Heart Syndrome in Asian athletes, especially for those in South East Asia.

Methods

We performed a single center cross-sectional case-control study of elite athletes and controls, using current speckle-tracking echocardiography (STE) and tissue Doppler imaging (TDI)-based techniques. We reanalyzed previous data to further characterize the biomechanical changes in exercise induced cardiac remodeling elite athletes and controls at a tertiary hospital in Singapore.

Results

The Left Ventricular (LV) strain of the athletes’ group was significantly lower as compared to the control group (-19.0±2.0 vs -20.3±1.8, p=0.011). Furthermore, both LV torsion (14.3±17.8° vs 14.4±6.7°, p=0.031) and Lateral S’2 (1.2±1.4 vs 2.7±1.6, p=0.001) showed small but statistically significant decreases in the athletes’ group versus the controls. The athletes group demonstrated a significantly lower Basal Right Ventricular (RV) free wall strain as compared to the controls (19.8±5.5 vs 22.9±4.5, p=0.031). The mid RV strain was marginally higher in the athletes’ group versus the controls (25.0±4.3 vs 24.7±1.5, P=0.023).

Conclusions

We found no differences in LV strain and torsion as well as RV free wall strain in the South East Asian athletes group mirror studies done in Western cohorts. The mid RV free wall strain could represent compensatory response to the impaired basal RV function in athletes.

Purpose: The study was conducted to measure heart rate variability (HRV) in South East Asian athletes with respect to gender.

Methods

We performed a cross-sectional study of 1260 athletes (789 male, 471 female) from South East Asia. The athletes were categorized as endurance (n=656), strength (n=400), and martial arts (n=204) athletes. HRV measures were collected using a portable device. The devices were programmed to collect data for 2 minutes at rest and 1 minute during exercise. The athletes were tested during their normal training routine.

Results

The prevalence of ARD was 15.2%±2.4 and 2.4%±1.0 according to pIAR and ASi methods, respectively. However, when age and sex were considered a covariate for PG, only IAR tended to remain significant (p=0.0018, p<0.0001, and p=0.0560, respectively). Both age and sex were predictors of ARD prevalence (p<0.0001) and ARD prevalence was higher in hypertensive groups (p<0.0001). The prevalence of ARD was significantly higher in males than females (p<0.0001). The prevalence of ARD was significantly higher in athletes with a family history of ARD (p=0.011) and those who engaged in high-intensity training (p=0.0056). The prevalence of ARD was significantly higher in athletes who reported a positive family history of ARD (p=0.0001).

Conclusions

The prevalence of ARD was higher in male athletes than female athletes. The prevalence of ARD was significantly higher in athletes with a family history of ARD. The prevalence of ARD was significantly higher in athletes who engaged in high-intensity training. The prevalence of ARD was significantly higher in athletes who reported a positive family history of ARD.
Effects of Aerobic and Resistance Training on Cardiac Function: Roles of Titin and Collagen

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(No relevant relationships reported)

PURPOSE: To examine the effects of aerobic and resistance exercise training on cardiac function, and investigate the roles of cardiomyocyte passive tension regulators (titin and collagen) in the mechanism of exercise-induced changes in cardiac function in diabetic rats.

METHODS: Sixty male SD rats were randomly divided into six groups: control (C), aerobic exercise (A), resistance exercise (R), diabetic (D), diabetic plus aerobic exercise (DA), and diabetic plus resistance exercise (DR). Type II diabetes was induced by high-fat diet feeding and low-dose streptozocin injection. Rats in the A and DA groups ran on a treadmill at 21m/min for 60 min, and rats in R and DR groups climbed a ladder bearing incremental loads daily, 5 days per week for 8 weeks. Fasting blood glucose (FBG) and insulin (FINS) concentrations were determined by a standard procedure. Cardiac function (such as the specific indicators of cardiac diastolic dysfunction—Min dp/dt, Tau) was measured using a catheter insertion through the right carotid artery and a Labchart data acquisition and analysis system. Expression levels of collagen I, collagen III and TGFβ1 were determined using Western blot, and titin expression levels were analyzed using Immunofluorescence. Two-way ANOVA and post-hoc tests were used to assess differences between groups.

RESULTS: Compared to non-diabetic groups, diabetic groups had higher FBG (<0.01), lower Min dp/dt (<0.05), and longer Tau (P<0.05); in addition, the diabetic groups had significantly lower expression levels of titin (<0.05), and higher expression levels of collagen I and TGFβ1 (<0.05). Compared to non-exercise diabetic rats, diabetic plus exercise groups had lower FBG (P<0.01, -54.3% in DA and -66.0% in DR) and HOMA-IR (P<0.01, -46.6% in DA and -53.8% in DR); the DA rats had higher expression levels of titin (P<0.05) and Min dp/dt (P<0.05), lower expression levels of collagen I (<0.05) and TGFβ1 (<0.05), and shorter Tau (P=0.05), but the DR rats had higher expression levels of collagen I (<0.05) and TGFβ1 (<0.05). CONCLUSION: Greater improvements in diabetic cardiac function occurred with aerobic exercise training, possibly through decreasing titin-dependent myocardial stiffness and collagen-dependent interstitial fibrosis.
in obese postmenopausal women. METHODS: Twenty obese postmenopausal women [age (54 ± 1 years) and body mass index (34.4 ± 0.8 kg/m²)] were randomized to either (n = 10) no exercise control (CON) vs. (n = 10) for 12 weeks. LIRET consisted on 4 different exercises for the leg musculature per session 3 x week. Participants performed 2-3 sets involving 18-22 repetitions for each exercise per session. Total power (TP), low-frequency power (LF), high-frequency power (HF) (vagal tone), the LF to HF ratio (LF/HF) (sympathovagal balance), heart rate (HR) and leg strength were measured before and after 12 weeks. LF and HF were normalized to TP resulting in nLF (sympathetic activity) and nHF. Logarithmic transformation (Ln) was performed to normalize the HRV variables in absolute units. RESULTS: There were significant group-by-time interactions (P < 0.05) for nHF, LnHF, LnLF/HF, and (P<0.01) for LF. There were significant increases (P<0.01) in nHF (5 ± 1%) and leg strength (27 ± 2% of body mass) following LIRET compared with no changes after control. No significant changes were observed in LnTP or HR after 8 weeks for both groups. CONCLUSIONS: Our findings indicate that LIRET improves CAF by improving sympathovagal balance in obese postmenopausal women.

1265  Board #27  May 30 9:30 AM - 11:00 AM  
Atg7 Involves In Cardioprotection Induced By Exercise Preconditioning Against Exhaustive Exercise-induced Myocardial Injury  
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(No relevant relationships reported)

The cardioprotective effects induced by exercise preconditioning (EP) in early phase has been proved, while the mechanism involved in cardioprotection is a multifactorial process. Several studies have identified that autophagy is one of the mechanisms of cardioprotection induced by EP. As a rate-limiting enzyme, Atg7 plays a pivotal role in autophagy. Purpose: The aim of this research was to investigate the alteration of Atg7 during the early cardioprotective effects of EP against exhaustive exercise-induced myocardial injury. Methods: Male 8-week-old Sprague-Dawley rats were divided into four experimental groups randomly: Group C (control), Group EE (exercise exhaustive), Group EEP (early exercise preconditioning) and Group EEP+EE (early exercise preconditioning plus exhaustive exercise) was used to explore cardioprotection of EE against exhaustive exercise-induced myocardial injury. Atg7 was detected by immunofluorescence and western-blots. Results: In group C, Atg7 positive expression stained red and scattered in myocardial cytoplasm, and the nucleus was bright blue. Compared with group C, the positive reaction of Atg7 increased strongly in group EE and group LEP. The high Atg7 levels observed after exhaustive exercise were increased significantly (P< 0.05). The levels of Atg7 were increased significantly after early phase of exercise (P = 0.05). Although there were no significant differences of Atg7 levels between group EE and group EEP+EE (P = 0.05), they had a downward trend in group EEP+EE. Conclusion: The increased levels of Atg7 induced by autophagy might involve in the early cardioprotection of EP against exhaustive exercise-induced myocardial injury. Supported by the National Natural Science Foundation of China (Grant no. 31471136).

1266  Board #28  May 30 9:30 AM - 11:00 AM  
Reliability Of A Vagal Modulation Index In Different Conditions  
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(No relevant relationships reported)

Previous studies conducted with athletes have suggested a minimum of 3 days are required for identifying training induced adaptations in supine, morning, resting condition. However, limited information exists on the beneficial effects of physical activity engagement in growth restriction caused by early life undernutrition leads to an increased risk of cardiovascular disease, hypertension, type II diabetes and sarcopenia. However, cardioinhibitory function was assessed by echocardiography (ECO) and cardiac electrical activity by electrocardiography (ELECTRO). Cardiomyocyte contractile function was assessed in isolated cardiomyocytes by measuring cardiomyocyte and sarcomere contractility following LIRET. Cardiomyocyte and sarcomere contractility during LIRET was compared with no changes observed a significant decrease in nHF (5 ± 1%) and leg strength (27 ± 2% of body mass) following LIRET compared with no changes after control. No significant changes were observed in LnTP or HR after 8 weeks for both groups. CONCLUSIONS: Our findings indicate that LIRET improves CAF by improving sympathovagal balance in obese postmenopausal women.

Growth restriction caused by early life undernutrition leads to an increased risk of cardiovascular disease, hypertension, type II diabetes and sarcopenia. However, cardioinhibitory function was assessed by echocardiography (ECO) and cardiac electrical activity by electrocardiography (ELECTRO). Cardiomyocyte contractile function was assessed in isolated cardiomyocytes by measuring cardiomyocyte and sarcomere contractility during LIRET was compared with no changes observed a significant decrease in nHF (5 ± 1%) and leg strength (27 ± 2% of body mass) following LIRET compared with no changes after control. No significant changes were observed in LnTP or HR after 8 weeks for both groups. CONCLUSIONS: Our findings indicate that LIRET improves CAF by improving sympathovagal balance in obese postmenopausal women.

Carnosine is present in high concentrations in heart, where it appears to increase the sensitivity of the contractile apparatus to Ca²⁺. However, it is currently unknown whether this role is relevant to the cardiac physiology. Purpose: To evaluate the impact of the lack of carnosine on myocardial contractile function in rats knockout (KO) for the CARNS1 gene (carnosine synthase). Methods: We developed the first KO animal model for the CARNS1 gene through CRISPR-Cas9 technology. Male wild-type (WT) and KO rats (4 months-old) were used. Results: Final body weight showed significant lower (P = 0.003) in KO rats than in WT (268 ± 10 g vs. 328 ± 10 g). The ventricular weight was significantly heavier (P = 0.008) in KO rats than in WT (13 ± 2 g vs. 8.6 ± 1 g). The systolic diameter was significantly bigger (P = 0.001) in KO rats than in WT (0.009 ± 0.001 mm/g vs. 0.006 ± 0.001 mm/g). The left ventricular ejection fraction was significantly lower (P = 0.001) in KO rats than in WT (60 ± 1% vs. 66 ± 1%). Conclusion: KO rats showed a higher systolic diameter (0.009 ± 0.001 mm/g; 0.006 ± 0.001 mm/g; p = 0.001) and lower left ventricular ejection fraction (60 ± 1%; 66 ± 1%; p = 0.001) compared with WT. KO rats showed a lower systolic pressure (100 ± 5 mmHg; 120 ± 5 mmHg; p = 0.001) and higher left ventricular diastolic pressure (80 ± 5 mmHg; 70 ± 5 mmHg; p = 0.001). KO rats showed a higher aortic pressure (180 ± 5 mmHg; 160 ± 5 mmHg; p = 0.001). KO rats showed a higher systolic pressure (100 ± 5 mmHg; 120 ± 5 mmHg; p = 0.001) and lower left ventricular ejection fraction (60 ± 1%; 66 ± 1%; p = 0.001) compared with WT. KO rats showed a lower systolic pressure (100 ± 5 mmHg; 120 ± 5 mmHg; p = 0.001) and higher left ventricular diastolic pressure (80 ± 5 mmHg; 70 ± 5 mmHg; p = 0.001). KO rats showed a higher aortic pressure (180 ± 5 mmHg; 160 ± 5 mmHg; p = 0.001). KO rats showed a higher systolic pressure (100 ± 5 mmHg; 120 ± 5 mmHg; p = 0.001) and lower left ventricular ejection fraction (60 ± 1%; 66 ± 1%; p = 0.001) compared with WT. KO rats showed a lower systolic pressure (100 ± 5 mmHg; 120 ± 5 mmHg; p = 0.001) and higher left ventricular diastolic pressure (80 ± 5 mmHg; 70 ± 5 mmHg; p = 0.001). KO rats showed a higher aortic pressure (180 ± 5 mmHg; 160 ± 5 mmHg; p = 0.001).
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non-cardiogenic causes of syncope, but LV morphology and systolic function are not. These results suggest that impaired LVDF is one possible pathophysiology for repeated

HR, but not in HRV. Research supported by: NSERC Discovery Grant & Canadian Graduate Scholarship - Master’s

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in the Ca²⁺ channels. In vitro contractility data (WT: n=3; KO:n=3) showed that sarcomere shortening is reduced in the KO (WT:11.75±2.40%; KO:9.28±3.71% (WT:8.1±3.15%; KO:4.3±3.87%; p<0.0001), and the time to reach 50% of maximal shortening is longer in the KO (WT:0.04±0.01s; KO:0.05±0.01s; p<0.001). Ca²⁺-transient analysis showed lower amplitude of Ca²⁺ in the KO group (WT:0.20±0.010; KO:0.16±0.06 F340/380 ratio; p<0.001) and longer time for to reach 50% of the Ca²⁺ decay rate (WT:0.21±0.04; KO:0.24±0.03; p<0.001).

Conclusion: Absence of carnosine resulted in systolic dysfunction associated with Ca²⁺-transient changes in cardiac muscle. This is the first evidence to demonstrate in vivo, ex vivo and in vitro that carnosine is essential for normal cardiac function.

Purpose: It has been known that number of syncope episodes during life is the strongest predictor for future syncope recurrence. It has been reported that impaired left ventricular diastolic function (LVDF) and low cardiac output due to left ventricular (LV) atrioventricular are related with orthostatic intolerance. The aim of this study was to clarify whether the number of syncope episodes would be related to LV morphology and function.

Methods: We enrolled clinically non-cardiogenic syncope patients who presented at the emergency department of Kyorin University Hospital between 2015 and 2018. We divided them into 2 groups: F (episodes of syncope during life) and B (2 or more). Early diastolic filling velocity (E), atrial filling velocity (A), deceleration time (DT), peak early diastolic velocity of the mitral annulus (e’), E/A, E/e’ were assessed by echocardiography. LV mass (LVM) was calculated by Devereux Formula, which was normalized by BSA (LVM index, LVMi). Stroke volume (SV) and ejection fraction (EF) were estimated by modified Simpson’s method. ANCOVA statistics, adjusting for sex and age, was used to compare those parameters between the 2 groups.

Results:

Of 80 patients enrolled, F group were 35 (68±17 years old, 19 men) and R group were 45 (56±23 years old, 23 men). E/e’ was significantly lower in the F group than that in the R group (E’ (6.81±3.15; vs. 7.22±1.87; p=0.048), and function.

CONCLUSIONS:

post-exercise recovery.

parasympathetic decrease after postural change at rest, highest was CRR during the initial 1st to 5th min of the recovery period after sub-maximal graded exercise is exercise is positively correlated with the parasympathetic decrease (reserve) after active postural change at rest in physically active, non-athlete men. In others words, we observed that highest parasympathetic decrease after postural change at rest, highest was CRR during post-exercise recovery.

POSTexercise Heart Rate And Vagal Reactivation Correlates With Vagal Withdrawn After Orthostatic Maneuver In Men


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(Purpose: The relationship between post-exercise parasympathetic reactivation, chronotropic reserve recovery (CRR) and the cardiac autonomic modulation responsiveness to active postural change at rest is still an open field to be explored. Therefore, our objective was correlate parasympathetic reactivation, CRR with cardiac autonomic status after an orthostatic maneuver (active stand from supine position) at rest.

METHODS: Cardiac Parasympathetic reactivation (rMSSD) at 1st min and CRR from the 1st, to 5th min following sub-maximal graded exercise were correlated with absolute and relative change of time-domain index (rMSSD) after active postural change from supine to standing position using heart rate variability (HRV) in 20 physically active, non-athlete men. Statistical analysis employed non-parametric tests with two-tailed p-value set at 5%.

RESULTS: Parasympathetic reactivation in the 1st min of post-exercise recovery correlated positively with absolute and relative vagal withdrawal (rMSSD) after orthostatic maneuver (r = 0.51 ± 0.02 and 0.55 ± 0.01). CRR at 1st min post-exercise time did not correlated with absolute or relative cardiac autonomic modulation responsiveness after active postural change at rest. However, CRR from the 2nd to the 5th min positively correlated with absolute and relative vagal withdrawal (rMSSD) after orthostatic maneuver (Absolute: r = 0.64 ± 0.73; p< 0.01 < 0.001) and (Relative: r = 0.37 ± 0.53; p = 0.04 < 0.001).

CONCLUSIONS: Parasympathetic reactivation and CRR during the initial 1st to 5th minutes of the recovery period after sub-maximal graded exercise is exercise is positively correlated with the parasympathetic decrease (reserve) after active postural change at rest in physically active, non-athlete men. In others words, we observed that highest parasympathetic decrease after postural change at rest, highest was CRR during post-exercise recovery.

Sympathetic Activity and Cardiovascular Risk Markers in Non-diabetic and Diabetic Mexican Older Adults

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(Purpose: To examine the impact of acute hyperglycaemia on HRV, in men and women during the early and late follicular phases of the menstrual cycle.

HRV , in men and women during the early and late follicular phases of the menstrual cycle.

[Abstracts were prepared by the authors and printed as submitted.]

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Age-related metabolic dysfunctions occur in a wide variety of clinical manifestations, including hyperglycemia, dyslipidemia and increased body fat. These conditions increase the risk of cardiovascular diseases (CVD), which can develop low heart rate variability (HRV) and higher heart rate (HR). The pathological metabolic conditions in older adults are associated with a hyperactive sympathetic nervous system (SNS). PURPOSE: To compare the SNS activity and metabolic markers associated to CVD in type 2 diabetic (T2D) and non-diabetic (ND) Mexican older adults. METHODS: Volunteers were 11 T2D (Age = 60.8 ± 5.2 yr., body mass index [BMI]= 29.9 ± 4.6 kg/m²) and 17 ND (Age = 64 ± 4.8 yr., BMI = 28.4 ± 4.1 kg/m²) older adults residing in Baja California, Mexico. Morning blood serum samples were collected after 8-h fasting following body composition analysis (InBody 770, Cerritos, CA). A 5-min resting ECG recording (BioRadio, Cleveland, OH) was used to analyze HRV. Time and frequency domain analysis were assessed with Kubios HRV 3.1 software (Kubios Oy, Finland). RESULTS: Between-group differences were found on blood glucose (T2D = 171.9±91.9 vs. ND = 80.17±12.0mg/dL, p < 0.001), and triglycerides (T2D = 266.9±126.17 vs. ND = 60.54 ± 47.8mg/dL, p < 0.001). Significant differences were found on lipids (T2D = 183.0±45.1 vs. ND = 180.9±29.7mg/dL, p = 0.88), HDLc (T2D = 60.54±55.8 vs. ND = 47.88±20.73mg/dL, p < 0.001) and LDLc levels (T2D = 84.4±44.6 vs. ND = 107.84±26.74mg/dL, p < 0.001). The HR (T2D = 72.61±11.5 vs. ND = 71.7±8.78 bpm, p = 1.0), beat-to-beat intervals (RR) (T2D = 845.7±128.7 vs. ND = 843.7±93ms, p =

No relevant relationships reported

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No relevant relationships reported

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There has been a clear trend of increased cardiovascular disease risk development in adulthood as children have begun to develop large artery stiffness at an earlier age due to possible increased adiposity and poor diet. In recent years, there has been a pressing need to observe the implications of maturation on central hemodynamic parameters among children before and after pubertal development. PURPOSE: This study sought to observe the differences in central hemodynamic parameters between children in pre- and post-adolescence. METHODS: 104 children pre- and post-adolescence (ages 7-12 and 13-17 years, N= 33, N= 20, respectively) were included in this study. Central hemodynamics including ejection duration percentage (ED%), forward pulse height (PH), reflected pulse height (PHr), reflection magnitude (RM%), augmentation index (Aix75), heart rate period (HRP), and time to reflected wave (T2) were assessed through brachial blood pressure measurement using the SphygmoCor XCEL device. Pulse wave velocity (PWV) was obtained through carotid applanation tonometry. RESULTS: From pre-adolescence to post-adolescence, values indicate a significant decrease in ED% (42.2 ± 5.7% to 37.4 ± 4.3%, p < 0.002), Aix75 (13.6 ± 13.6% to 3.2 ± 9.7%, p < 0.004), and RM% (49.2 ± 6.1% to 44.0 ± 5.9%, p < 0.003). However, significant differences were observed in PWV (4.3 ± 0.7 m/s to 5.1 ± 0.8 m/s, p = 0.0002), HRP (791.2 ± 133.5 ms to 929.8 ± 134.3 ms, p < 0.0001), and PHr (235.5 ± 4.0 mmHg to 29 ± 4.5 mmHg, p = 0.002). CONCLUSION: Major findings indicate that increases in PWV may be due to pubertal development and ED%, and HRP may be associated with an increase in heart mass. decreases in Aix75 and RM% and an increased PH, may be associated with increased height or vessel length. Future studies are necessary to determine possible factors responsible for seen changes.

### 1275 Board #37
May 30 9:30 AM - 11:00 AM
Early Ovarian Hormone Deprivation Increases Cardiac Contractility In Old Female Rats - Role Of Physical Training

HUGO C.D. SOUZA, Ana Carolina S. Felix, Sabrina G.V. Dutra, Stella V. Philibois, Tâbata P. Facioli. UNIVERSITY OF SÃO PAULO, Ribeirão Preto, Brazil. Email: hugocsou1@frmp.usp.br

(No relevant relationships reported)

Physiological menopause occurs around 51 years of age. However, in some cases, menopause can happen early, that is, before the age of 40. Of the main consequences of early ovarian hormones deprivation or early menopause, one of the most alarming is the increased risk of cardiovascular diseases, contributing to an increase in the morbidity and mortality rate in these women. Our hypothesis is that early deprivation of ovarian hormones, when associated with the aging process, promotes more adverse cardiac remodeling and greater damage to cardiac function related to physiological ovarian failure. Thus, aerobic physical training is fundamental to attenuate these deleterious effects. PURPOSE: The objective of the present study was to investigate the effects of early deprivation of ovarian hormones on cardiac morphological and functional parameters in 82 week-old female rats subjected to ovariectomy at 10 weeks of age, as well as to evaluate the application of aerobic training as a non-pharmacological therapeutic tool. METHODS: Female Wistar rats (N = 48) were divided into two groups, at 10 weeks of life: early ovarian hormones deprivation by ovariectomy (OVX; N=24) and sham (SHAM; N=24). Between weeks 62 and 82, 12 animals of each group underwent aerobic training (OVX-T and SHAM-T, N=12). At the end of week 82, all were evaluated by echocardiography, cardiac function (Langendorf technique) and cardiac β-adrenergic receptor expression quantification. RESULTS: Echocardiography showed slight changes in morphology between OVX and SHAM. OVX (A’= 101 ± 4.7 mmHg) showed higher values for maximal left intraventricular pressure in response to dobutamine, when compared to SHAM (A’= 55 ± 11.8 mmHg). Both OVX-T (A’= 70 ± 4.0 mmHg) and SHAM-T (A’= 62 ± 6.6 mmHg) showed a reduction in this response. While, β-adrenergic receptor expression was not different between the sedentary groups, SHAM-T (0.23 ± 0.02AU) and OVX-T (0.29 ± 0.01AU) showed decreased expression of these receptors when compared to their respective sedentary groups. CONCLUSIONS: Early ovarian hormones deprivation associated with aging, promotes discrete changes in cardiac morphology, increasing cardiac contractility. Aerobic training decreases β-adrenergic receptors expression, influencing the cardiac contractility. Supported by FAPESP Grant 019379-9.

### 1276 Board #38
May 30 9:30 AM - 11:00 AM
Strength Training Attenuates Hypertension And Preserves The Diastolic Function Of Spontaneously Hypertensive Rats: Role Of Linear Periodization

Danilo S. Bocalini1, Roberta L. Ribe2, Ariana S. Silva3, Adriano F. Maia1, Mauro S. Perilhão3. 1Federal University of Espirito Santo, Vitoria, Brazil. 2São Judas Tadeu University, São Paulo, Brazil. 3Federal University of São Paulo, São Paulo, Brazil. (No relevant relationships reported)

PURPOSE: Among non-pharmacological strategies to hypertension control, aerobic physical training as well as strength training has been indicated as an important time point to general treatment. However, little is known when the training program is periodized in a linear progression. In this way the aim of this study was evaluated the effects of a linear strength training program on parameters of cardiac remodeling, spontaneously hypertensive rats. METHODS: Thirty rats were distributed in three groups: untrained normotensive (N, n = 10), untrained hypertensive (H, n = 10) and trained hypertensive (TH, n = 10). The training protocol (12 clumps with 90 seconds intervals) was organized in three mesocycles of four weeks, with an increase in the training load organized in a linear progression (60%, 65%, 70% and 75%) for each block, considering the weight established in the maximum load test. The following parameters were evaluated: ventricular function evaluated by echocardiogram, systemic blood pressure, ventricular hemodynamics, cardiac morphometric and myocardium contractility. RESULTS: No significant changes (p>0.05) were found in FEAT between groups, however animals from group to group had a lower isovolumetric relaxation time compared to other groups, which did not differ between them. There was a significant reduction of caudal BP in the TH group after eight training weeks, additionally, negative correlations were found between systolic blood pressure and increased muscle strength as well as total work, indicating the influence of these parameters on SBP control. The HR, PSVE, and PDfVE values of the H and TH groups did not differ, but both were higher than N group. The values of dP/dt of H group were lower than the N and HT groups, which did not differ from each other. The RV, LV and cardiac mass values did not differ (p>0.05) between the H and HT
groups, however, they were superior to the N group. The nuclear volume was not different between groups; however, the total collagen content of H group was higher than N and HT group. CONCLUSIONS: Briefly, the analyses in this study suggest that the training program performed promoted pressure attenuation and preserved the ventricular function of spontaneously hypertensive rats with no change in heart mass.

C-31 Free Communication/Poster - Imaging and Assessment in Skeletal Muscle, Bone and Connective Tissue

Thursday, May 30, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

1277 Board #39 May 30 9:30 AM - 11:00 AM Dynamic Ultrasonography of Anterior Femoral Translation: Comparison to Ballet Turnout and Hip Symptoms in Dancers
Kristin E. Schwarz, Sarah Jackson, Dai Sugimoto, Rebecca Zwicker, Pierre A. d’Hemecourt, FACSM, Boston Children’s Hospital, Boston, MA.
Email: kristin.schwarz@childrens.harvard.edu
(No relevant relationships reported)

Purpose:
To determine if there is a relationship between turnout, self-reported hip symptoms, and femoral head anterior translational motion under dynamic ultrasound in a population of adolescent ballet dancers.

Methods:
Cross-sectional cohort study. Population: 25 ballet academy students, 17 females and 8 males, ages 14-18 yrs. Dynamic ultrasound of the bilateral hips was performed on each study participant in supine position. With the low frequency linear ultrasound probe in sagittal oblique plane, the distance between the femoral head and acetabular rim was measured in 3 positions: both hips in neutral position, ipsilateral hip in neutral and contralateral hip hyperflexed, and with the ipsilateral hip in extension and external rotation and the contralateral hip hyperflexed. Compensated turnout was defined as difference between functional turnout angle in first position and total bilateral hip rotation and the contralateral hip hyperflexed. Compensated turnout was defined as difference between functional turnout angle in first position and total bilateral hip passive external rotation in prone. Each participant completed the Hip Osteoarthritis and Outcome Score (HOOS) questionnaire.

Results:
Spawman’s rho correlation coefficient (r) was used to test strength of association between variables, defined as <0.3 = poor, 0.3-0.5 = fair/moderate, 0.5-0.7 = good, >0.7 = strong. P<0.05 was used as threshold for statistical significance. IBM SPSS software (version 23, SPSS, Chi, IL) was used for all analyses. Mean maximal femoral translation distance for the right hip: 0.66mm (+/- 1.74mm), and the left hip: 1.56mm (+/- 1.93mm). Mean compensated turnout: 62.8 (r = 14.8 AU). There was no significant correlation between femoral translation and HOOS scores, nor between femoral translation and compensated turnout (right: p = .36, r = .123, left: p = .203, r = .64). There was a significant correlation between greater compensated turnout and higher mean bilateral HOOS scores, with strongest association in the domains: symptoms (p = .02, r = .463), quality of life (p = .003, r = .561) and activities of daily living (p = .034, r = .426).

Conclusions:
In this population of adolescent ballet dancers, there was no significant correlation between femoral head translational motion on ultrasound and compensated turnout or self-reported symptoms. There was significant correlation between degree of compensated turnout and more favorable self-reports on hip symptoms and function.

1278 Board #40 May 30 9:30 AM - 11:00 AM Effects Of Downhill Running On Muscle MRI T2 In Young mdx Mice
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(No relevant relationships reported)

Previous studies have demonstrated that downhill treadmill running causes skeletal muscle damage that can be detected with magnetic resonance transverse relaxation time (T2) in adult dystrophic mice (mdx). However, young mdx mice (under 12 weeks of age) are characterized by a peak inflammatory phase with greater heterogeneity among muscles, potentially making it more difficult to detect T2 changes. PURPOSE: To determine whether muscle damage following downhill running can be detected in young mdx mice using proton magnetic resonance imaging (MRI) and spectroscopy (MRS). METHODS: C57BL/10ScSn-DMDmdx (mdx, n=5) and wild-type C57BL/10ScSn (controls, n=5) male mice of 6-9 weeks of age performed downhill running on a treadmill (14% grade at 8-12m/min for 45-60 min). MRI/MRS was conducted prior to and post 24 hours following running in the mice hindlimbs. T2-weighted, multiple-slice, single-slice echo-echo MR axial images were acquired (TR 2s, TE 14/40 ms, 12 slices) from the hindlimbs. MRS T2 values were calculated on a pixel-by-pixel basis for the anterior compartment (AC), posterior compartment (PC), and the deep medial region between the tibia and fibula (MC). In addition, single voxel ‘H-MRS data were acquired from the soleus and gastrocnemius using stimulated echo acquisition mode (STEAM, TR 9.9 s, 32 TE’s exponentially spaced; 5-288 ms, 4 phases) with a 4.7 T Varian/Agilent MR system. RESULTS: At baseline, T2 was elevated (p<0.05) in mdx mice (26.1±1.2ms) compared to controls (24.8±1.0 ms). Following downhill running, the mdx mice had elevated (p<0.05) T2 values compared to baseline when a composite of the compartments were compared (Pre: 26.8±1.2ms; Post: 28.8±1.5 ms). The MC was typically (80%) the most affected hindlimb region in the mdx mice. Similarly, ‘H-MRS derived T2 values were increased (p<0.05) in a composite measure of the soleus and gastrocnemius after downhill running (29.8±4.2ms) in mdx compared to before downhill running (26.4±2.8ms). There were no significant changes in T2 in control mice after performing the downhill running protocol. CONCLUSIONS: Overall, our findings support the use of downhill running coupled with MR T2 as a valuable approach for testing potential therapeutic interventions in young dystrophic mice. Funding Source: NIH (NIAMS) R01 AR070101.

1279 Board #41 May 30 9:30 AM - 11:00 AM Interactions Among Age, Sex, and, and Scanning Location in the Assessment of Rectus Femoris Echo Intensity
Adam Burton, Matthew Stock. University of Central Florida, Orlando, FL.
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(No relevant relationships reported)

Echointensity is an ultrasound-derived measurement of skeletal muscle quality believed to reflect both fibrous tissue content and adipocyte infiltration. Moderate correlations between echo intensity and measures of muscle function have been reported in older adults. But, it is less clear if the aging process results in comparable declines in muscle quality in men and women. It has been suggested if age and sex discrepancies are unique throughout a muscle. PURPOSE: The purpose of this investigation was to examine differences in echo intensity among younger and older men and women along the length of the rectus femoris. METHODS: Fifteen younger men (mean = SD age = 23 ± 3 years), fifteen younger women (21 ± 2 years), eight older men (75 ± 6 years), and sixteen older women (70 ± 5 years) participated in this study. Participants were able, healthy, and had a body mass index < 30 kg/m². B-mode ultrasonography was used to acquire panoramic images of the dominant rectus femoris in the transverse plane at the one-third, one-half, and two-thirds distances along the length of the rectus femoris. ImageJ software was used to analyze the images. Echo intensity was corrected for subcutaneous tissue thickness using sex-specific equations. Analyses of variance and effect size statistics were used to analyze the data. RESULTS: Scanning location had a large influence on EI, while having minimal impact on muscle thickness (MT). However, age had a strong influence on differences in echo intensity, with proximal echo intensity (107.8 ± 14.5 AU) being significantly lower in older men and women (marginal mean difference = 28.1 AU, p = .004) compared to younger counterparts (p<0.05). There were no significant changes in echo intensity across the proximal, middle, and distal sites (marginal mean difference = 7.0 AU, p = .237). However, age had a strong influence on differences in scanning locations, with proximal echo intensity (107.8 ± 14.5 AU) being significantly lower than the middle (127.6 ± 13.7 AU) and distal (130 ± 19.6 AU) values for older men (F = 7.4, p = .018, partial η² = .054), with a similar trend for older women (F = 2.9, p = .073, partial η² = .164). Within each sex, younger adults had very similar echo intensity values at the proximal, middle, and distal sites (greatest mean difference = 5.0 AU). CONCLUSION: The difference in corrected echo intensity is greater for men versus women control. Further research, aging results in nonuniform changes in muscle quality throughout the belly of the rectus femoris, with greater deterioration at the middle and distal portions.

1280 Board #42 May 30 9:30 AM - 11:00 AM Can Changes In Echo-intensity Be Used To Detect The Presence Of Muscle Swelling?
Noam Yitzchaki, Tayla E. Kuehne, Samuel L. Buckner. University of South Florida, Tampa, FL. (Sponsor: Marcus Kilpatrick, FACSM)
Email: noamy@mail.usf.edu
(No relevant relationships reported)

When examining skeletal muscle, it has been suggested that changes in echo-intensity (EI) measured with B-mode ultrasound can detect the presence of edema-induced muscle swelling. Specifically, if an increase in muscle size is accompanied by an increase in EI it is thought that true growth has not occurred. Interestingly, our research group has shown that small upward and downward tilting of the ultrasound probe can have a large influence on EI, while having minimal impact on muscle thickness (MT). This suggests that proposed changes in EI following resistance exercise may be artifact from probe tilt as opposed to swelling. PURPOSE: To examine the acute changes in biceps MT and EI, while accounting for probe tilt, following 4 sets of biceps curls.
METHODS: 49 resistance-trained men and women were recruited. Individuals in the experimental group (n = 23) visited the laboratory twice. During the first visit, participants performed 4 sets of biceps curls to volitional failure using 70% of their 1RM. B-mode ultrasound images of the biceps were taken to examine changes in both MT and EI. In addition, we acquired MRI-T2 weighted images to identify regions of muscle damage in the hindlimbs and performed localized 31P-MRS measures to co-register with damaged regions.

RESULTS: Downhill running resulted in a significant (p<0.01) decrease in relative intracellular Mg2+ concentration in mdx compared to pre-exercise (Pre: 0.398 ± 0.072 mM, Post: 0.241 ± 0.050 mM), but no differences were observed in controls. Also, there was a trend (p=0.18) towards an elevated Pi/PCr in the gastrocnemius and soleus muscles in mdx after exercise compared to before exercise (Pre: 0.066 ± 0.026; Post: 0.061 ± 0.013). The energetic alterations in mdx were maintained in the regions of muscle damage identified with T2-weighted MRI. Conclusions: Downhill running resulted in intracellular changes in mdx mice evident with 31P-MRS, including lower intracellular Mg2+ concentrations, likely due to compromised sarcolemma integrity. Overall, 31P-MRS measures are sensitive to acute muscle damage induced by downhill running and may be a valuable technique for testing potential therapeutic interventions in dystrophic muscle.

Funding Source: NIH (NIAMS) R01 AR070101.

1283 Board #45 May 30 9:30 AM - 11:00 AM Evaluation of Resistence Exercise-Induced Muscle Swelling Using Bioelectrical Impedance Analysis Maki Atsuta, Yuri Misonoo, Shun Kondo, Hiroaki Ito, Yuto Yamada, Natsuko Okamoto, Atsushi Iwashita, Yusuke Mizutani, Haruna Nagatsuka, Kurumi Watanabe, Mikihiro Wata, Seishiro Kawanuma, Ayame Iwata, Kazushige Goto. Ritsumeikan University, Kusatsu, Japan. (Sponsor: Robert Kraemer, FACSM)

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(No relevant relationships reported)

PURPOSE: The purpose of the present study was to examine time course changes of muscle swelling evaluated by bioelectrical impedance analysis (BIA) following resistance exercise.

METHODS: Nine subjects (20.8 ± 0.4 yrs, 174 ± 6.8 cm, 67 ± 8.1 kg) conducted exercise condition (EX) and rest condition (REST) on different days (a week between conditions). In the EX, subjects conducted unilateral arm curl exercise (12 repetitions × 5 sets, 90 s rest period between sets) for biceps brachii muscle at 60% of maximal voluntary contraction. In the REST, the subjects maintained rest for identical period from exercise duration in the EX. Time course changes in BIA (locally evaluated BIA for biceps brachii muscle), muscle thickness (evaluated by ultrasound) for biceps brachii muscle, circumference of upper arm and blood lactate concentrations were determined before exercise (or rest), immediately after, 30 min and 60 min after exercise (or rest).

RESULTS: The EX caused significant increases in muscle thickness and circumference during post-exercise (p < 0.05). Moreover, blood lactate concentration was significantly increased in the EX after exercise (p < 0.05). In contrast, no significant change was observed for these variables in the REST. The EX showed rapid reduction of BIA immediately after exercise (from 28.7 ± 14.0 kΩ to 18.5 ± 4.6 kΩ, p < 0.05). Furthermore, BIA revealed significantly lower values in the EX than those in the REST immediately after exercise (EX: 18.5 ± 4.6 kΩ vs. REST: 27.7 ± 6.7 kΩ, p < 0.05) and 15 min after exercise (EX: 22.0 ± 7.0 kΩ vs. REST: 29.5 ± 9.5 kΩ, p < 0.05). CONCLUSION: Resistance exercise reduced local BIA during post-exercise, with concomitant increases in muscle thickness and circumference. Therefore, acute reduction of BIA following resistance exercise may reflect exercise-induced muscle swelling and increased water volume in the muscle.

1284 Board #46 May 30 9:30 AM - 11:00 AM The Assessment Of Muscular Characteristics Using Tensiomyoグラフィー In Hemiplegic Stroke Patients Shin Who Park, M.D., Won Kim, M.D., Kyoung Hyo Choi, M.D., Ph.D. Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea, Republic of.

(No relevant relationships reported)

PURPOSE: Tensiomyoグラフィー (TMG) has been used to assess muscular characteristics of the lower extremity. However, in stroke patients, the TMG characteristics have not been reported to date. The aim of this study was to investigate the functional behavior and stiffness of muscles in hemiplegic stroke patients.

METHODS: Fifteen patients with hemiplegic stroke (mean age: 64±12.51 years; 13 males, 2 female) were recruited. In the healthy side, the presence of hypotonia was proved by the I/H ratio and we excluded the subjects with abnormal muscle tone in sound side. The evaluation included: muscular function by TMG with a digital sonographic device (TMG II, Tensiomed®), muscular stiffness by Tensiomed® and a digital device (TS-100, Tensiomed®), and muscular hyperreacitivity by dynamic trans-skeletal Tensiomed® probe (D-CT). Additionally, the clinical rating scales including Fugl-Meyer Upper Extremity Assessment (FMA-UE) and modified Ashworth Scale (MAS) were administered before and after the intervention for both extremities and Tensiomed® parameters were assessed from muscular point of view: contraction time (Ts), delay time (Td), relax time (Tr) and displacement maximal amplitude (Am). The assessment included: muscular stiffness and stiffness reduction of sound side and affected side. Then, we checked the correlation among TMG parameters and the Tensiomed® parameters. RESULTS:1) There were no significant differences in the vast majority of the TMG parameters between affected and sound side of lower extremities. The RF-Tr (p=0.008), the RF-Dm (p=0.041) and the TA-Tr (p=0.05) were decreased, compared to the sound side. 2) At the affected side of RF, BCM and TA, the quantitative analysis of
the color histogram revealed a significantly greater intensity of red (p=0.030, p=0.001, p=0.0044) and a lower intensity of blue (p=0.004, p=0.001, p=0.026) than sound side. 3) In affected side, the red intensity of TA is correlated with the RF-Tc (r=-0.566, p=0.0441) and TA-Ts (r=0.618, p=0.043). The red intensity of GCM is correlated with the GCM-Tc (r=0.714, p=0.047) and the GCM-Tr (r=0.786, p=0.021). The red intensity of BF is correlated with GCM-Tr (r=0.857, p=0.014).

CONCLUSIONS: The results of our study help understand muscle physiology change associated with CNS lesion. These are useful to detect muscle dysfunction and assess the effect of neuromuscular rehabilitation in stroke patients.

Acute changes in muscle thickness (MT) following resistance exercise are often examined to determine the anabolic potential of an exercise stimulus. This acute change is often attributed to swelling and has been postulated to act as a proliferative signal resulting in a shift towards muscle growth. B-mode ultrasound is commonly used to record acute changes in MT. However, A-mode ultrasound presents a more affordable alternative to measure these same changes. Although A-mode ultrasound may be used to image skeletal muscle, this method does not allow live imaging across a large area of tissue like B-mode ultrasound. In addition, interface detection may be more difficult due to the quality of the image. PURPOSE: To compare MT values between A-mode and B-mode ultrasound before and following four sets of biceps curls. METHODS: Participants visited the laboratory twice. During the first visit, paperwork and one repetition maximum (1RM) strength assessment were taken before and immediately following exercise. MT measurements were taken with both A-mode and B-mode ultrasound. Results are displayed as means (95% CI). RESULTS: A total of 23 resistance trained men (n=12) and women (n=11) completed the study. For MT, there was no interaction, the mean difference in the exercise-induced change in ultrasound-measured MT between A-mode and B-mode was 0.02 (-0.11 - 0.05) (p = 0.51). There were, however, main effects for time (p = 0.001) and measurement type (p = 0.001). MT increased from pre (3.62 (1.25-3.99) cm) to post (4.07 (3.66-4.47) cm) exercise. In addition, MT values as measured by A-mode ultrasound were smaller than those measured by B-mode ultrasound [mean difference 0.174 (0.08-0.26) cm]. CONCLUSIONS: Our results suggest MT measurements taken using A-mode ultrasound are smaller than those using B-mode ultrasound. Despite this difference, it appears A-mode can detect similar acute changes in MT following resistance exercise when compared to B-mode. These results suggest that A-mode ultrasound can serve as a useful tool to examine acute changes in MT, which may also help to better understand the effectiveness of a resistance exercise stimulus.

Although skeletal muscle mass decreases in sarcopenia, it is not clear whether it occurs systemically or partially. It is important to clarify the age-related change of each skeletal muscle as a basic component of sarcopenia research. PURPOSE: The purpose of this study was to investigate characteristics of age related changes in the cross sectional area of psosas major muscle as part of elucidation of sarcopenia. METHODS: Subjects consisted of 2014 persons (938 males and 1076 females) aged 10 to 91 (classified every 5years) examined at our clinic. Using MRI, muscle cross-sectional area was measured using cross sectional area of the iliac crest (L4 - L5). Data was divided into gender and age, and analysis of variance and multiple comparisons were performed. We also examined the relationship with BMI for 614 subjects who were able to confirm their height and weight. RESULTS: The cross-sectional area of psosas major muscle peaked the ages of 15 to 19, and declined with age. The decline was noticeable after the aging 50s in both sexes. A remarkable decrease was also observed in the late 30s and 70s in men. Interaction between sex and age was observed, and differences in patterns were observed between men and women. As a result of analysis of variance, no correlation was found between BMI and age, but a correlation was found between gender and BMI and between sex and age. In all age groups, it was confirmed that the group having a larger BMI exhibited a larger muscle cross sectional area. CONCLUSIONS: These results showed the characteristics of age-related change of cross sectional area of the psosas major muscle. Further investigation is needed for sarcopenia research.
Effect of Limb Position On Vastus Lateralis Muscle Morphology Measured By B Mode Ultrasoundography

Isobel Thornley, Mark I. Johnson, Peter Francis. Leeds Beckett University, Leeds, United Kingdom.
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(Purpose: A narrative review of studies which measured vastus lateralis (VL) muscle thickness (MT) using Ultrasoundography(US) revealed inconsistencies in the procedures and techniques used for measurement. One consideration for measurement is the position of the limb and participant. Knee extension was the most commonly reported position, however some studies used knee flexion. The extent to which this alters muscle morphology is unknown and therefore, there is uncertainty as to whether data from studies using different positions can be compared. The aim of this study was to analyse whether limb position, knee extension or knee flexion, had a significant effect on VL-MT, pennation angle and fascicle length.

Methods: In order to have a homogenous sample, thirty two true time male professional soccer players took part in the study [age= 18.3 ± 0.5 years (mean ± SD), height= 179 ± 1.7cm, mass=73.3 ± 3.5kg]. In vivo MT and architecture were measured using B mode US (LOGIQ, GE Healthcare).Two images were taken of the VL in the dominant leg while the participant was supine with their knee extended or flexed at 90 degrees (leg off the bed). Images were downloaded to an imaging software (Image 1, v1 51k; NIH; Bethesda, USA). Analysis of the data was conducted in SPSS v24. Descriptive statistics were calculated for each of the dependant variables (MT, pennation angle and fascicle length). A Paired T test was performed for each of the data sets. P<0.05 was classed as significant.

Results: MT was significantly greater in the supine/knee extended position compared to the supine/knee flexed position (2430±102mm vs 2361±91mm; p<0.05). Pennation angle was also significantly larger in knee extension compared to knee flexion (18.47±1.18° vs. 16.87±1.14°; p<0.05). While fascicle length was significantly greater in knee flexion compared to knee extension (9.87±0.53cm vs. 9.04±0.92cm; p<0.05). Also, MT was observed between MG PA and ATLength (r=−0.42; p<0.001) and between VL PA and ATLength (r=−0.49; p<0.001). No other significant correlations were observed.

Conclusions: This study is the first to demonstrate differences in muscle morphology, dependent on limb position, as measured by US. The differences in MT were less significant than real difference calculated for US in our laboratory. A standard operating procedure for the measurement of MT using US is required. This study only addresses one aspect of a standard operating procedure.

Profiles of Quadriceps Muscles after Downhill Running using Ultrasoundography

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(Purpose: The aim of this study was to examine the changes of muscle properties after downhill running at different intensities, and further to investigate the optimal biomarkers for muscle damage. Methods: Eleven sedentary men were randomly assigned to repeated measured running sessions set either at High (70% of HRmax) or Low (50% HRmax) with -9° (-16% gradient). Each session consisted of 30 min downhill running on separate occasions 2-wk apart. Range of motion (ROM) was calculated from voluntary maximal extension and flexion. Muscle soreness was assessed using a visual analog scale (VAS) immediately post-exercise and 24 hr after exercise. Muscle thickness (MT) using Ultrasoundography(US) revealed inconsistencies in the procedures and techniques used for measurement. One consideration for measurement is the position of the limb and participant. Knee extension was the most commonly reported position, however some studies used knee flexion. The extent to which this alters muscle morphology is unknown and therefore, there is uncertainty as to whether data from studies using different positions can be compared. The aim of this study was to analyse whether limb position, knee extension or knee flexion, had a significant effect on VL-MT, pennation angle and fascicle length.

Methods: Images were downloaded to an imaging software (Image 1, v1 51k; NIH; Bethesda, USA). Analysis of the data was conducted in SPSS v24. Descriptive statistics were calculated for each of the dependant variables (MT, pennation angle and fascicle length). A Paired T test was performed for each of the data sets. P<0.05 was classed as significant.

Results: MT was significantly greater in the supine/knee extended position compared to the supine/knee flexed position (2430±102mm vs 2361±91mm; p<0.05). Pennation angle was also significantly larger in knee extension compared to knee flexion (18.47±1.18° vs. 16.87±1.14°; p<0.05). While fascicle length was significantly greater in knee flexion compared to knee extension (9.87±0.53cm vs. 9.04±0.92cm; p<0.05). Also, MT was observed between MG PA and ATLength (r=−0.42; p<0.001) and between VL PA and ATLength (r=−0.49; p<0.001). No other significant correlations were observed.

Conclusions: This study is the first to demonstrate differences in muscle morphology, dependent on limb position, as measured by US. The differences in MT were less significant than real difference calculated for US in our laboratory. A standard operating procedure for the measurement of MT using US is required. This study only addresses one aspect of a standard operating procedure.

Examination of Tendon and Muscle Architecture and Their Influence on Postural Stability

Lauren E. Pacinelli, Jeffery A. Williams, John P. Vardiman, Ryan M. Thiele.
Kansas State University, Manhattan, Ks.

(Purpose: Evaluate the relationship between AT and muscle thickness (MT) and medial gastrocnemius (MG) MT, as well as their influence on balance performance (overall stability index; OSI).

Methods: Eighteen female (mean ± SD: age = 19 ± 1 years) participants laid in a prone position on a cushioned chair, with their hip and knee in extension, and ankle maintained in a neutral position (90°). Ultrasoundography (US) PA images were scanned with B-mode ultrasoundography and analyzed with gray scale analysis. In addition, serum creatine kinase (CK) activity had evaluated as a blood biomarker. All parameters were taken at PRE, POST, 24, 48, and 72hr, respectively. Paired Student t-tests were performed to compare the parameters of each time point. The Paired students t-test was performed to compare the significant differences between the two conditions. A significant negative correlation (r =−0.49; p<0.05) was observed between OSI and MT. Blinding in the sham BFR group resulted in 80% of subjects unable to determine which limb was treated.

Results: The present investigation revealed a significant negative correlation (r =−0.49; p<0.05) was observed between MT and OSI. Also, MT was observed between OSI and AT (r =−0.49; p<0.05). No significant correlations were observed between OSI and MG MT. A significant negative correlation (r =−0.49; p<0.05) was observed between OSI and AT. The study is the first to demonstrate differences in muscle morphology, dependent on limb position, as measured by US. The differences in MT were less significant than real difference calculated for US in our laboratory. A standard operating procedure for the measurement of MT using US is required. This study only addresses one aspect of a standard operating procedure.

Feasibility of Using Shear Wave Elastography to Quantify Achilles Tendinopathy Stiffness Before and After Rehabilitation

Robert A. Whitehurst1, Shane L. Koppenhaver2, Stephanie R. Albin2, Matt T. Hartsorne2, Darren W. Hearn3, Mitu T. Lovalekar1, Bradley C. Nindl, FACSM1. 1University of Pittsburgh, Pittsburgh, PA. 2Regis University, Denver, CO. 3Geneva Foundation, Tacoma, WA. 4University of North Carolina, Chapel Hill, NC. (Sponsor: Bradley C. Nindl, FACSM)

(Purpose: Participants presenting with unilateral Achilles tendinopathy to outpatient physical therapy clinics performed eccentric exercises as a home exercise program (HEP) 2x/ day. Participants came into the clinic 2x/week for 12 weeks and were randomized to perform either BFR (limb occlusion pressure = 80%, n = 6) or sham BFR (limb occlusion pressure: 10%, n = 5). To balance the number of subjects at each site with US data, we randomized 2x/week to each site. At baseline both groups were similar in age, sex, weight, and weeks of symptoms. At 12 weeks the SYM group had normalized to the ASY side (530.0 ± 93.1 kPa vs 527.0 ± 75.4 kPa). The change in MT was significant within the BFR group (1232.2 ± 71.4 kPa vs 674.8 ± 185.8 kPa) but not in the sham group. Both groups had significant improvements in OSI (Δ Baseline to 12 weeks ΔBFR: 80.3% ± 14.1% vs ΔSham: 91.6% ± 6.7%). Also, MT was observed between OSI and MG PA (r =0.42; p<0.05). The change in MT was significant in the BFR group (1232.2 ± 71.4 kPa vs 674.8 ± 185.8 kPa) but not in the sham group. Both groups had significant improvements in OSI (Δ Baseline to 12 weeks ΔBFR: 80.3% ± 14.1% vs ΔSham: 91.6% ± 6.7%). Also, MT was observed between OSI and MG PA (r =0.42; p<0.05). The present investigation revealed a significant negative correlation (r =−0.49; p<0.05) was observed between OSI and MT. Blinding in the sham BFR group resulted in 80% of subjects unable to determine which limb was treated.

This work was funded by the AMEDD Advanced Technology Initiative #6042, TATRC, US Army MMRMC.
medial gastrocnemius in young females. Additionally, balance assessments may not be a sensitive measure for determining the influence of musculoskeletal architecture on functional performance.

**1293**

**Board #55**  May 30 9:30 AM - 11:00 AM  
**Assessing Agreement of Lateral Leg Composition Using Dual X-ray Absorptiometry**  
Christiana J. Raymond-Pope, Tyler A. Bosch, Donald R. Dengel, FACSM. University of Minnesota, Minneapolis, MN. (Sponsor: Donald R. Dengel, FACSM)  
Email: raymo191@umn.edu  
(No relevant relationships reported)

**PURPOSE:** Recently, we reported the accuracy of a novel lateral segmentation DXA scanning method using a Hologic Horizon A DXA scanner. METHODS: Thirty healthy college-age participants (16 female; \( X_{\text{age}} = 21.5 \pm 1.7 \) yrs) received three DXA scans (1 whole-body and 2 lateral leg scans) to quantify and compare leg composition in the frontal and lateral plane. To mark regions of interest (ROIs) that would be visible on the DXA scan, metallic markers were placed at 60% of the length above and below each leg's lateral epicondyle. Using lateral subject positioning, leg composition was measured with participants lying on their right and left sides, with the scanned leg elevated using two foam pads at the ankle and the widest portion of the upper-leg. Paired t-tests examined the lateral DXA scanning method's agreement when quantifying total, lean, and fat masses, and bone mineral content (BMC) compared to measurements of equal area obtained in the standard whole-body frontal DXA scanning view.  
**RESULTS:** Comparisons of frontal and lateral view DXA scan measurements for right leg total mass (7.12±0.91 kg vs. 6.40±1.85 kg), lean mass (5.14±1.05 kg vs. 4.78±0.93 kg), fat mass (1.70±0.44 kg vs. 1.36±0.33 kg), and BMC (0.28±0.06 kg vs. 0.23±0.05 kg), respectively, were significantly different (all \( p < 0.001 \)). Similarly, comparisons of frontal and lateral left leg total mass (7.12±0.97 kg vs. 6.44±0.93 kg), lean mass (5.15±1.12 kg vs. 4.82±1.01 kg), fat mass (1.70±0.44 kg vs. 1.35±0.41 kg), and BMC (0.28±0.06 kg vs. 0.23±0.06 kg), respectively, were all significantly different (all \( p < 0.001 \)).  
**CONCLUSIONS:** Unlike our previous study in which we reported agreement of lateral leg composition measurements in comparison to frontal composition measurements of equal area utilizing the GE iDXA scanner, we did not observe agreement between the two views using the Hologic Horizon A DXA scanner. Therefore, caution should be used when examining leg composition in the lateral view using a Hologic Horizon A DXA scanner.

**C-32**  Free Communication/Poster - Motor Control  
Thursday, May 30, 2019, 7:30 AM - 12:30 PM  
Room: CC-Hall WA2

**1294**

**Board #56**  May 30 10:30 AM - 12:00 PM  
**Neuromuscular Responses in Lower Limb Bilateral Deficit: A Pilot Study**  
Email: mark.travis.byrd@uky.edu  
(No relevant relationships reported)

**Neuromuscular Responses in Lower Limb Bilateral Deficit: A Pilot Study**  
M. Travis Byrd, Taylor K. Dinyer, Pasquale J. Succi, Haley C. Bergstrom  
University of Kentucky, Lexington, KY  
The bilateral deficit is the phenomenon in which the sum of the forces produced unilaterally is greater than the force produced bilaterally during maximal contractions of the limbs. **PURPOSE:** This study examined the neuromuscular responses during the measurement of lower limb bilateral and unilateral muscle strength. **METHODS:** Twelve (male: \( n = 6 \); female: \( n = 6 \)) subjects (mean ± SD age: 24.5 ± 4.8 yrs, body mass: 74.2 ± 14.6 kg) completed randomized, isometric, seated leg extension bilateral and unilateral maximum voluntary isometric contractions (MVIC). On a separate day, the subjects completed a randomized, bilateral and unilateral dynamic, seated leg extension for the determination of the 1 repetition maximum (1RM) strength. The electromyographic (EMG) and mechanomyographic (MMG) amplitude (AMP) and mean power frequency (MPF) were measured from the vastus lateralis of the right and left lower limbs during the MVIC and 1RM trials, and were normalized to the corresponding signal from the MVIC trials. Statistical analyses included paired samples t-test (\( p \leq 0.05 \)). **RESULTS:** Six of the 12 subjects demonstrated a 1RM bilateral deficit (BLD; -9% ± 2.9%). Within the BLD subjects, the EMG MPF was significantly greater (\( p = 0.03 \)) during the unilateral 1RM than the bilateral 1RM, but EMG AMP, MMG AMP, and MMG MPF were not different (Figure 1). There were no differences between unilateral and bilateral neuromuscular responses for the non-BLD (\( n = 6 \)) subjects. **CONCLUSION:** These findings indicated the BLD could be due to different motor control strategies, such as changes in muscle fiber conduction velocity, in a bilateral versus a unilateral movement of the lower limbs.

**1295**

**Board #57**  May 30 10:30 AM - 12:00 PM  
**Recommendations For The Evaluation Of The Foot Tapping Test (FTT) In A Healthy Population**  
Morgan K. Delp, Brian A. Fribble, Daniel J. Larson, Christopher D. Black, FACSM, Rebecca D. Larson. University of Oklahoma, Norman, OK.  
Email: Morgan.K.Delp-1@ou.edu  
(No relevant relationships reported)

The foot tapping test (FTT) is a neurological exam used to assess upper-motor neuron (UMN) function in clinical populations. However, little research has been done to determine the best method of conducting the FTT. Furthermore, it is unknown how participant characteristics such as lower limb lean mass may impact the FTT. **PURPOSE:** This study sought to evaluate the reliability of the FTT in a healthy population when using different counting methods and testing conditions, as well as to assess the impact of lower limb muscle mass on tapping rates. This information could be used to establish testing recommendations for the FTT in clinical populations. **METHODS:** Thirty-eight healthy individuals (age 18-63) completed a series of FTT trials over 4 visits. Participants had their foot positioned so that the ball of the foot was over a small force plate and the heel off. They were then instructed to tap as many times as possible over a 10 second period. A total of 32 trials under different conditions (shoes ON, shoes OFF, dom. foot, and non-dom. foot) were performed. A DXA scan was used to measure lower limb mass. Means were compared between trial #, visit #, shoe condition (ON or OFF), dom. vs. non-dom. foot (foothoodness), and counting method. Correlations between subject characteristics (such as age, activity level, shoe size, weight, height, and lower limb lean mass) and tapping rates were also calculated. **RESULTS:** Significant differences were found between foothoodness, shoes ON/OFF and in foot taps counted using each counting method (\( p < 0.001 \)). In addition, significant interactions were found between force plate count and shoes ON/OFF (\( p = 0.011 \)), as well as live count and shoes ON/OFF (\( p < 0.001 \)). Live and video counts showed no significant differences; however, force plate counts were significantly lower (\( p < 0.001 \)). Foot tapping rate was not correlated with any of the participant characteristics (\( r > 0.05 \), \( R = 0.282 \) for all). **CONCLUSION:** These results suggest that the FTT should be performed whilst wearing shoes, and measured using the force plate counting method. These conditions were found to be the most accurate for this population, and thus should be used if a force plate is available. Future research should attempt to determine normative FTT rates in clinical and aging populations in order to evaluate the extent that UMN function is affected.

**1296**

**Board #58**  May 30 10:30 AM - 12:00 PM  
**Sleep Restriction Negatively Influences Visually and Memory-Guided Force Control**  
Sarah A. Brinkerhoff1, Stephen M. Strayer1, Jaimie A. Roper1, Anne-Marie Chang2, Kristina A. Neely1.  
1Auburn University, Auburn, AL. 2The Pennsylvania State University, State College, PA. (Sponsor: Mark Tillman, FACSM)  
Email: sab0042@auburn.edu  
(No relevant relationships reported)

Cognitive performance is negatively influenced by sleep restriction, and athletic performance is improved through sleep extension. However, little work has quantified motor output under rigorous and controlled conditions of sleep restriction. **PURPOSE:** This study examined the effects of sleep restriction on visually and memory-guided grip force control. **METHODS:** Participants (N=9) were inpatients in a sleep restriction study, during which behavioral, physiological, and neuroimaging experiments occurred. Here, we report the results of a grip force task conducted on three days: (D1) after two nights of adequate sleep, (D2) after four consecutive nights of sleep restriction, and (D3) after one night of recovery sleep. Participants completed four
20-s trials of isometric force with their index finger and thumb, to 25% of their maximal voluntary contraction. In the full-vision (FV) condition, visual feedback was provided for the duration of the trial. In the no-vision (NV) condition, visual feedback was provided for the first 8 s of the trial, and then visual feedback was removed. Participants were to maintain force output for the remaining 12 s. RESULTS: In FV, participants produced less mean force on D2 (24.0% relative to D1 (24.9%) and D3 (25.0%). Mean force did not differ as a function of day in NV. The coefficient of variation was higher on D2 relative to D1 and D3, in both FV (D1: 1.7%, D2: 5.6%, D3: 1.5%) and NV (D1: 5.2%, D2: 5.6%, D3: 5.0%). CONCLUSIONS: These findings are the first demonstrations that restricted sleep negatively impacts force control.

Physiological systems exhibit high levels of complexity characterized by non-linearity and persistent fractal correlations (low levels corresponding to states such as disease, injury, and fatigue) and has become recognized as a defining feature of healthy physiological functioning. Neuromuscular complexity is affected by fatigue and intensity of contractions, although no study has investigated the effect of contraction type on complexity. PURPOSE: The purpose of this study was to investigate the effect of contraction type on neuromuscular complexity. METHODS: Twelve collegiate-aged resistance-trained females (21 ± 1 years, 63.3 ± 7.4 kg) were recruited to visit the laboratory on two occasions, the first for familiarization purposes. In session two, participants performed three maximal knee extensor contractions on an isokinetic dynamometer for each contraction type [centric (CON), eccentric (ECC), and isometric (ISO)] in random order. Relative knee angle was standardized to 120° during ISO contractions. Angular speed was standardized to 30° s⁻¹ and range of motion to 90° (90° - 180° at full extension) during CON and ECC contractions. Each contraction lasted 4 seconds, held it for 10 seconds and then 4 seconds rest with contractions. Electromyographic (EMG) signals were recorded from the vastus lateralis using a bipolar electrode configuration. Sample entropy (SE), a unitless measure of statistical irregularity was used as an index of physiological complexity. A one-way repeated measures ANOVA was performed to investigate differences in EMG SE among contraction types. Alpha level was set to 0.05.

RESULTS: Contract type was observed to have a significant effect on EMG SE (F(2, 22) = 7.212, p = 0.004). Specifically, CON contractions (1.671 ± 0.193) displayed significantly greater EMG SE than ECC (1.497 ± 0.321, F(2, 22) = 3.908, p = 0.028) contractions.

Conclusion: These findings indicated that neuromuscular complexity is contraction-type dependent, being significantly higher during CON than ECC and ISO contractions. In addition, there exists no generally accepted framework to explain the potential trains. The relationship between the motor unit recruitment threshold and derecruitment thresholds.

The isometric muscle action is primarily responsible for performing two different tasks: attempting to shorten the muscle against an immovable object, and maintaining a fixed posture/joint position while resisting the lengthening inertial imposed by an external load. PURPOSE: To compare the motor unit control strategies between the two different tasks with similar mechanical requirements. METHOD: Twelve healthy men (Age: 23.7 ± 3.9 years; Weight: 84.8 ± 12.1 kg; Height: 172.8 ± 5.7 cm) and seven women (Age: 21.1 ± 1.6 years; Weight: 73.4 ± 15.6 kg; Height: 164.3 ± 3.9 cm) participated in this study. After the first visit as the familiarization, Visits 2 and 3 were randomly sequenced for force task and position task experimental testing. During both visits, maximal voluntary isometric contraction (MVIC) was measured, followed by the designated submaximal isometric tetraepid contraction task. Specifically, the force task required the participants to gradually increase the force from 0 to 40% MVIC in 4 seconds, held it for 10 seconds, and then gradually decreased the force to 0% in 4 seconds. For the position task, the participants were required to maintain a constant position, and to resist against the pulling force, created by the investigator with the same rate and intensity as those during the force task. Surface EMG signals from the biceps brachii muscle were collected and decomposed into constituent motor unit activation patterns. The relationship between the motor unit recruitment threshold and average firing rate, and between the recruitment and derecruitment thresholds were examined using linear regression analyses. RESULTS: Paired samples t-tests showed no significant differences between two tasks for the mean slope coefficient (0.51 ± 0.34 vs. 0.58 ± 0.29, p = 0.515) and y-intercept (24.80 ± 12.37 vs. 26.59 ± 9.43, p = 0.589) for the recruitment threshold vs. average firing rate relationship. In addition, the mean slope coefficient (1.23 ± 0.76 vs. 1.62 ± 0.78, p = 0.125) and y-intercept (-12.98 ± 23.54 vs. -18.98 ± 13.45, p = 0.391) were also not different between two tasks for the relationship between recruitment and derecruitment thresholds. CONCLUSION: The motor unit control strategies did not seem to differ between the two submaximal isometric muscle actions.

The units of measurement. The coefficient of variation (CV) was also calculated by expressing the SEM relative to the grand mean (%). RESULTS: For intra- and inter-day analyses, 16 and 20 subjects met the inclusion criteria and were included in final analyses, respectively. Both intra- and inter-day reliability statistics are presented in Table 1. CONCLUSIONS: The MFR versus RT relationship of the VL demonstrates strong intra- and inter-day reliability during a maximal voluntary contraction in young, healthy men.
and 180%. Surface EMG were recorded from the tibialis anterior (TA) and lateral gastrocnemius (LG) muscles during the test. Normalized average amplitude of the integrated EMG and phase synchronization index (PSI) between the EMG of TA and LG were calculated.

**RESULTS:** Antagonist muscle coactivation were significantly lower (22.1% ± 9.4%, 24.7% ± 12.8%, 22.4%±9.4%, 22.4% ± 9.7% for non-players and 10.7% ± 3.7%, 10.1% ± 4.9%, 11.2% ± 2.5%, 10.6% ± 2.5% for badminton players in four angular velocity conditions. P<0.05 for left group comparison) and PSI in beta frequency band were significantly higher (0.42 ± 0.06, 0.36 ± 0.13, 0.36 ± 0.10, 0.35 ± 0.12 for non-players and 0.47 ± 0.15, 0.47 ± 0.15, 0.48 ± 0.11, 0.49 ± 0.14 for badminton players in four angular velocity speed, P<0.05 for four group comparison) in badminton players group compared to non-players group during isometric ankle dorsiflexion contraction, while no significant difference was found in antagonist muscle coactivation and PSI between two group subjects during ankle plantar flexion.

**CONCLUSIONS:** The decrease of antagonist coactivation may indicate an optimal motor control style to increase the contraction efficiency, while the increase coupling of antagonist muscles may be related to the compensation of joint stability as a result of the decrease of antagonist coactivation.

| Table 1. Simple regression coefficients of original (O) vs. validated (V) motor units
|----------------|----------------|
| Recruitment Threshold vs. Mean Firing Rate | Slopes
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>S01</td>
<td>-0.54</td>
</tr>
<tr>
<td>S02</td>
<td>-0.21</td>
</tr>
<tr>
<td>S03</td>
<td>-0.74</td>
</tr>
<tr>
<td>S04</td>
<td>-0.75</td>
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<tr>
<td>S05</td>
<td>-0.53</td>
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Improving knee proprioception is often recommended in rehabilitation after knee injuries. The best technique or tool for measuring knee proprioception is not yet identified. Additionally, evidence suggesting the role of proprioception in mechanics and injury risk is mixed, requiring further investigation. 

**PURPOSE:** To evaluate the validity and reliability of an inertial measurement unit (IMU) based clinical tool to assess knee proprioception, and to determine the association between proprioception and dynamic function.

**METHODS:** Active joint position sense (JPS) was measured using an IMU-based tool (CorNeX Therapy Pro, CX) and Biodex System III for 49 healthy participants (18F, aged 22-27y) with no current knee pain or prior knee surgery. On JPS on the Biodex, seated participants extended their knee and then flexed to 30° and held for 5s to learn the position. They extended the knee, and then matched the position as best they could. One practice and 5 trials were recorded. A similar procedure was completed for CX but testing was completed standing on the non-test leg. The anterior component of the Y-balance test was performed with heel down and hands on hips while standing on the test leg. Five recorded trials after 1 practice were averaged and normalized to leg-length. Intra-class correlation coefficients were calculated to establish within-session reliability of each proprioception measurement and Pearson correlation coefficients were used to test the association between proprioception and reach distance.

**RESULTS:** The middle 3 values of each JPS measurement were averaged. Intra-session reliability of CX (ICC(2,k) = 0.800) and Biodex (ICC(2,k) = 0.813) were both good. However, agreement between CX and Biodex measurements was poor (ICC(2,1) = 0.083). Neither the Biodex (r = 0.174) nor the CX (r = 0.198) correlated with single-leg reach distance.

**CONCLUSIONS:** After analyzing the differences between CX and Biodex measurements, we conclude the tools are assessing different aspects of proprioception. Additionally, knee proprioception does not appear to be the primary limiting factor in single-leg reaching. More research should be done to determine test-retest reliability of CX and Biodex and better understand the relationships between knee proprioception and knee function.
The loss of muscle strength during periods of disuse is rapid. Some investigators have postulated that these changes are due to neural, rather than muscular, adaptations. It is unclear, however, if short-term immobilization of the knee joint affects the voluntary control of motor units. PURPOSE: To determine whether the slope and y-intercept of the motor unit mean firing rate versus recruitment threshold relationship is altered by 72 hours of disease. METHODS: Fifteen healthy females (mean ± SD age = 21 ± 2 years, body mass index [BMI] = 23.1 ± 2.3 kg/m²) voluntarily underwent left knee joint unloading via ambulating on crutches and use of a brace. The brace was worn at all times except during sleep, and compliance was confirmed via accelerometers secured around both ankles. Following two extensive familiarization sessions at the laboratory, testing was performed immediately prior to immobilization (PRE) and 72 hours later (POST). During both testing sessions, participants performed trapezoidal isometric contractions at a torque level corresponding to 50% of their maximal voluntary contraction (MVC). Participants were instructed to increase torque from 0 to 50% in five seconds, maintain 50% MVC for 15 seconds, and decrease torque from 50% to 0 in five seconds. Bipolar surface electromyographic (EMG) signals were recorded from the vastus lateralis. A surface EMG signal decomposition algorithm was used to calculate the mean firing rate (pulses per second [pps]) and recruitment threshold (% MVC) of each detected motor unit. Motor units with decomposition accuracy levels < 90% were then used to quantify the slope (pps/%MVC) and y-intercept (pps) of each relationship. RESULTS: Immobilization had no influence on the linear slope coefficient for the mean firing rate versus recruitment threshold relationship (PRE = -0.362 ± 0.127, POST = -0.399 ± 0.108 pps/1%MVC, p = 0.413, d = 0.218). Similarly, no change in the y-intercept was observed (PRE = 23.2 ± 2.8, POST = 23.3 ± 4.0 pps, p = 0.972, d = 0.009) CONCLUSION: Our findings demonstrated that 72 hours of knee joint immobilization in healthy females had little influence on vastus lateralis motor unit control during submaximal contractions. Funding: The De Luca Foundation and the UCF Office of Research’s Advancement of Early Career Researchers program. The loss of muscle strength during periods of disuse is rapid. Some investigators have postulated that these changes are due to neural, rather than muscular, adaptations. It is unclear, however, if short-term immobilization of the knee joint affects the voluntary control of motor units. PURPOSE: To determine whether the slope and y-intercept of the motor unit mean firing rate versus recruitment threshold relationship is altered by 72 hours of disease. 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Aging results in a variety of muscular adaptations which may affect the recruitment of motor units. **Purpose:** We sought to determine if younger and older men recruit motor units at similar isometric force levels. **Methods:** Twelve younger (age = 25 ± 3 years, mass = 65.2 ± 8.9 kg, height = 1.72 ± 0.1 m) and twelve older (mean ± SD age = 75 ± 8 years, mass = 78.9 ± 10.2 kg, height = 1.74 ± 0.1 m) men performed trapezoidal isometric contractions of the dominant knee extensors at a force level corresponding to 50% maximal voluntary contraction (MVC). Bipolar surface electromyographic (EMG) signals were detected from the vastus lateralis during each contraction.

A surface EMG signal decomposition algorithm was then used to quantify the recruitment threshold of each detected motor unit, which was defined as the isometric force level corresponding to the first firing. Recruitment thresholds were calculated in both relative (% MVC) and absolute (N) terms. Motor units with accuracy levels <90% were not considered for analysis. **Results:** The mean ± SD number of motor units detected was 17 ± 5 for younger and 13 ± 4 for older men. MVC force was significantly greater in younger vs. older men (799.6 ± 197.8 vs. 520.8 ± 121.6 N [p = 0.010; Cohen’s d = 1.15]). The relative median recruitment threshold values were significantly greater for younger (26.6 ± 9.1% MVC) compared to older (15.6 ± 7.9% MVC [p = 0.005; d = 1.29]) men. Younger men also demonstrated greater median recruitment threshold values when expressed in absolute terms (198.0 ± 99.2 vs. 81.2 ± 43.0 N [p = 0.001; d = 1.53]). Similarly, large differences in the mean recruitment thresholds were found when expressed in both relative (25.9 ± 7.7 vs. 16.2 ± 7.8% MVC [p = 0.005; d = 1.27]) and absolute (191.4 ± 87.5 vs. 85.1 ± 44.9 N [p = 0.001; d = 1.53]) terms. The relative recruitment threshold range was not significantly different between younger (22.6 ± 9.5% MVC) and older (18.5 ± 6.4% MVC [p = 0.235; d = 0.50]) men. However, the absolute range was considerably larger for younger (167.6 ± 92.4 N) compared to older (95.7 ± 36.5 N [p = 0.020; d = 1.02]) men. **Conclusion:** Older men tend to recruit motor units at lower force levels. We speculate that motor unit recruitment threshold compression may be a neural adaptation that serves to compensate for denervation and subsequent re-innervation in aged muscle.

**Results:** The results demonstrated no significant differences involving the right and left VL muscles or main effects for repetitions for any of the neuromuscular parameters. The maximal bilateral peak torque (311.4 ± 51.2 N·m) decreased significantly (p < 0.01; η² = 0.235; d = 0.005; p = 0.001; d = 0.001; p < 0.05) moderate to strong linear, quadratic, or cubic model. Data were interpreted on an individual participant basis. **Conclusion:** While moderate to strong linear relationships were found between the firing rate of motor units and their recruitment thresholds for all participants, in certain cases the strength of the association was enhanced when analyzed via a non-linear model. Our findings provide further support for the need to examine motor unit data on a participant-by-participant basis.

Studies evaluating the electromyographic activation (EMG) of spine flexor muscles during Pilates exercises (PE) concluded that EMG is different among abdominal exercises, even when classified in the same intensity category. **Purpose:** To compare EMG of spine extensors, flexors, and rectus femoris in seven mat PE among basic (B), intermediate (I) and advanced (A) variations. **Methods:** The EMG of upper rectus abdominis (URA), lower rectus abdominis (LRA), external oblique (EO), internal oblique (IO), rectus femoris (RF) and multi- dorsi were assessed for the Roll Up (RU), Single Leg Stretch (SLS), Double Leg Stretch (DLS), Handed (HD), and Rolling Like a Ball (RLB) exercises in B, I, and A. Also evaluated in I and A were Double VL muscles of both legs were recorded simultaneously during each repetition of the fatiguing bout. The EMG RMS, EMG MPF, MMG RMS, and MMG MPF were normalized to the participant’s corresponding maximal isometric voluntary contraction values and torque values were normalized to maximal bilateral isokinetic concentric peak torque values at 180°·s⁻¹. The repetitions were normalized to each 10% of the total number of repetitions completed. Four, 2 (right and left VL) x 10 (10-100% of the total repetitions) repeated measures ANOVAs were used to determine mean differences for each neuromuscular parameter. A 1 x 10 repeated measures ANOVA was used to examine torque production. Post-hoc Student Newman-Keuls was used to identify when the neuromuscular and torque values changed from the values at 10% of the total repetitions. **Results:** The results demonstrated no significant interactions involving the right and left VL muscles or main effects for repetitions for any of the neuromuscular parameters. The maximal bilateral peak torque (311.4 ± 51.2 N·m) decreased significantly (p < 0.01; η² = 0.688) at 90% of the total repetitions.

**Conclusion:** The results of the present study demonstrated no differences between the right and left VL muscles for their patterns of neuromuscular responses during the fatiguing bilateral leg extensions. While peak torque decreased, no changes occurred for any of the neuromuscular parameters across the repetitions. Therefore, the current findings suggested that the decrease in torque production was due to peripheral mechanisms of fatigue and not a decrease in central neural drive to the muscles.
Straight Leg Stretch (DLSL) and Single Straight Leg Stretch (SSL). EMG results were expressed as a percentage of maximum voluntary isometric contractions. One-way ANOVA with repeated measures was used (p<0.05) to compare the three variations. RESULTS: In HD exercise, LRA and IO EMG was significantly less (p<0.01) in B variation (48.5% and 41.1%, respectively) than in A (68.7% and 68.5%, respectively) and A (75.1% and 80.7%, respectively), and EO EMG was significantly greater (p<0.01) in A (63.4%) compared to B (39.8%), while I (54.2%) was equal to A and B. In RU exercise, URA EMG was significantly greater (p=0.04) in A (43.8%) than B (34.9%). In DLS exercise, LRA EMG was significantly less (p<0.01) in B variation (43.7%) than I (53.2%) and A (66.8%). EO EMG was significantly greater (p<0.01) in A (57.7%) than B (36.1%), and IO EMG was significantly greater (p<0.01) in A (75.5%) than B (39.7%) and I (55.5%). In SLS exercise, LRA, IO and OE EMG were significantly less (p<0.01) in B (35.5%, 37.4% and 41.5%, respectively) than A (55%, 52.4% and 61.1%, respectively). In DLS exercise, EO and IO EMG were significantly greater (p<0.05) in A (81.6% and 29.3%, respectively) than I (71.7% and 23.9%, respectively). In SSLS and RLB exercises, no significant differences were found among B, I, and A. CONCLUSION: The higher URA EMG may be more related to upper limb positions, whereas higher LRA, IO and OE EMG may be more related to lower limb positions and changes greater than 45° of raising or lowering lower or upper limbs seems to be necessary. Supported by Capes and CNPq.

Neural and contractile factors have been suggested as important determinants for different phases of the rate of force development (RFD). PURPOSE: To examine the influence of rate of muscle activation, motor nerve conduction velocity (CV) and motor unit number estimation (MUNE) of the vastus lateralis on early and late phase RFD. METHODS: Fifteen males (age=23.3±2 years) completed 2 maximal (MVIC) and rapid (rMVIC) voluntary isometric contractions. Participants were instructed to kick out as hard as possible, and as fast as possible for the MVICs and rMVICs, respectively. The RFD values were calculated during the first 50 ms (nRFD50) and 100 to 150 ms (nRFD100-150) and normalized to maximal force (%MVMIC). The rate of electromyographic signal rise (RER) was calculated during the first 50 ms of muscle excitation (nRER50) and normalized to the peak-to-peak M-wave amplitude (%MMPs). MUNE was calculated as a ratio of the ensemble average of the single motor unit potential area to the compound muscle action potential area, and was corrected for alternation. Motor CV (m/s) was assessed as the time (m/s) from maximal stimulation of the femoral nerve to onset of muscle activity. Pearson's correlation coefficients were used to analyze the relationships between the dependent variables. Additionally, stepwise multiple regression was used to examine the degree to which the predictor variables (nRER50, MUNE, Motor CV) explained a significant proportion of the total variance in each RFD phase (nRFD50 and nRFD100-150). RESULTS: nRER50 (41.47±25.16 %MMPs) was significantly related to nRFD50 (249.4±94.45 %MVIC) (r=−64.0, p<0.01). nRFD100-150 was not related to any of the predictor variables. nRER50 was the only significant predictor (p=0.640, p<0.01), explaining 41% of the variance in nRFD50. CONCLUSION: These preliminary data are in agreement with previous research suggesting that the early phase RFD is primarily determined by neural factors. Continued sampling will determine if additional variables significantly contribute to predicting early and late RFD performance.

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PURPOSE: A metabolic threshold occurs during progressive exercise with a non-linear increase in blood lactate. The power output at which this occurs closely corresponds to the ventilatory threshold, a non-linear increase in minute ventilation (Ve). These factors may affect muscle excitability and thus force generating capacity. Muscle excitability has been shown to decrease after high-intensity whole-body exercise, however it has not been identified when this decrease occurs during progressive exercise. Therefore the purpose of this study was to examine quadriceps muscle excitability throughout a progressive exercise test. METHODS: Five men (age 23±3 years) performed a step-wise cycling test, beginning at 100W and increasing 25W/min until volitional exhaustion. Minute averages of oxygen consumption (VO2) and Ve were collected, and heart rate (HR) and rating of perceived exertion (RPE) were recorded at the end of every minute. M-waves were induced using a stimulating electrode positioned over the femoral nerve and given at a fixed crank angle of 90° while the subject was cycling. During the exercise test, supramaximal stimulations were given every 10 seconds and averaged over the minute. Using a mixed linear model to control for within-subject variance, both absolute and relative (percent decrease) M-wave amplitudes for each minute were compared to the first minute of exercise. RESULTS: Subjects exercised for an average of 10 ± (0.7) minutes. Ve, HR, and RPE increased significantly each minute in a linear fashion. Ventilatory threshold occurred at minute 7 ±1 minute. Compared to the first minute of exercise, absolute M-wave amplitude decreased significantly at minute 7 (2.14 ± 2.45mV versus 3.78 ± 2.58mV), whereas relative M-wave amplitude decreased significantly at minute 6 (-20.44% ± 28.53%). After this point, both remained reduced until exhaustion. CONCLUSIONS: These data show that the M-wave may exhibit an excitability threshold corresponding to that of the ventilatory threshold. This could reflect the metabolic state of the muscle, indicating the division between sustainable and unsustainable exercise intensities. Further research should examine the neural response to progressive exercise in relation to peripheral losses of excitability.

Dance comprises a broad range of techniques and styles, which have been utilized in classes specifically designed for individuals with Parkinson’s disease (PD) and healthy older adults. Previous studies have shown that a series of dance sessions can improve balance, posture, and mobility for people diagnosed with PD and healthy older adults. However, these studies have not analyze the linkage between repetitive movement types and persistent changes in motor skills. In order to begin understanding the causative factors of repetitive movement types that result in improved motor skill performance, the functional relationship between movement features and observed performance improvements needs to be examined. PURPOSE: To identify dance movement patterns resulting in the greatest improvement in tests of gait, balance and upper extremity function using partnered and non-partnered dance to music in PD and healthy older adults. We hypothesize that the link between movement features and observed performance improvements needs to be examined. METHODS: Participants in structured group dance classes were recruited for this study. Performance measures of upper and lower extremity were collected before and after each dance class. Motor capture, video and live observations were used to examine movement patterns. RESULTS: Individuals with PD had slower baseline performance in the 9 hole peg test (9HPT) than healthy older adults in both left (p=0.062, 33.5 s vs 24.9 s) and right hand (p=0.008, 31.2 s vs 26.5 s). There was also a significant improvement in the 9HPT for the left hand after the dance classes in the individuals with PD (p=0.035, 3.44 s). Factors that lead to observed improvements in mobility and movement execution included: repetition of foundational weight shifts in a separate preparatory exercise, engagement of the spine and arms in counterbalancing movement in the legs, incorporating flexion at the knee into the dance stride, and partnering with a moderately-skilled dancer. Increased amplitude and ease of stride and greater lift in the feet in locomotion were also documented. CONCLUSIONS: These preliminary results suggest that repetitive shifts in balance and movement during dance with music can lead to upper extremity motor performance and increased amplitude of movement in the lower extremity in individuals with PD.
Fatigue and heat sensitivity are commonly reported symptoms in persons with multiple sclerosis (PwMS). PwMS often also have difficulty performing concurrent cognitive and motor tasks that presents as a dual-task decrement. Heat sensitivity along with a dual-task decrement may hinder activities of daily living and quality of life for PwMS. Though using a cooling vest could help decrease heat sensitivity, it is currently unknown if it improves dual-tasking performance in PwMS. PURPOSE: To examine the effects of a cooling vest on cognitive-motor dual-task cost (DTC) and fatigability in PwMS. METHODS: 5 PwMS participated in two sessions that were at least 1 week apart. During one session participants wore a sham cooling vest and the other session an actual cooling vest. During each session participants completed a Timed 25-Foot Walk Test (T25FWT), 6 Minute Walk Test (6MWT), T25FWT while performing Serial 3’s, and a 6MWT while narrating a story. The type of vest and order of tests was randomized for each participant. Total times for T25FWT and total distances for 6MWT were recorded. DTC, defined as the percent change between single- and dual-task performance, was calculated. Fatigability, defined as the difference between the average of the first two and the last two lap times of the 6MWT, was calculated. Paired samples t-tests were used to compare DTC during cooling and non-cooling sessions and fatigability during single- and dual-task conditions within each session. RESULTS: The mean DTC during the 6MWT for cooling and non-cooling was 4.1% and 6.5%, respectively. The DTC during the T25FWT for cooling was 7.3% and 11.5% for non-cooling. The mean distance walked during 6MWT dual-task increased from 275.5m without cooling to 285.6m with cooling. There was a trend towards significant difference between single- and dual-task fatigability during 6MWT for non-cooling session (Single: 1.6±7.6m; Dual: 6.2±5.3m; p=.051), but not for cooling (Single: 0.7±3.8m; Dual: 12±16.4m; p=.082). CONCLUSION: There was a significant reduction in single-task and dual-task fatigability when using a cooling vest. Fatigue and heat sensitivity are commonly reported symptoms in persons with multiple sclerosis.

Muscle weakness is common in individuals with Prader-Willi Syndrome (PWS), but the source of weakness is unclear. PURPOSE: The purpose of this study was to compare neuromuscular function, and muscle size and quality of the plantar flexor muscles between individuals with and without PWS. METHODS: Ten participants with PWS were matched on sex to 10 obese control and 10 lean control participants. Hoffman (H) reflex and muscle response (M-wave) were obtained from the soleus by stimulating the tibial nerve to determine the H : R ratio. Isometric plantar flexor strength was assessed using an isokinetic dynamometer to find peak torque (PT), early (ET) and late (L) integrated EMG. Surface electromyography (EMG) was recorded from the soleus and gastrocnemii during strength assessments to determine early (ER100) and late (ER200) rise in EMG, and early (I100) and late (I200) integrated EMG. EMG data were normalized to peak EMG amplitude collected from the MVC trial. Strength variables were normalized to lean mass. Ultrasound imaging was used to quantify gastrocnemius cross sectional area (CSA) and echointensity (EI). One-way ANOVA was used to compare dependent variables between groups. RESULTS: There were group differences in H : R ratio (p<0.05), ET (p<0.001), ER100 (p<0.001), and CSA (p<0.05). Post hoc tests indicated that the PWS group had lower H : R ratio (0.29 ± 0.18 vs. 0.52 ± 0.13, p<0.03), and lower ET (496 ± 18.4 vs. 260 ± 65 W, p<0.001), and ER100 (2.20 ± 1.05 vs. 4.95 ± 2.48 W, p<0.001) compared to controls. The PWS group had lower ER100 (1.07 ± 1.4 vs. 2.8 ± 1.4 %MVIC/sec, p<0.02) in the soleus compared to obese controls. Obese controls had larger CSA compared to lean controls (2527.99 ± 579.02 vs. 1638.55 ± 354.52 mm², p<0.001) and compared to the PWS group (1797.29 ± 764.77 mm², p=0.026). There were no differences between groups in R200 (1.67 ± 0.5 vs. 1.59 ± 0.3, p=0.19) or CSA (p=0.07). It appears that significant differences are present between groups in H : R ratio, CSA and ER100. In addition, H : R ratio and CSA were lower in the PWS group compared to controls.

Deficit/Hyperactivity Disorder (ADHD), but little is known about girls with ADHD. PURPOSE: To determine differences in gait patterns between girls with and without ADHD. METHODS: 27 girls aged 7 to 18, were recruited through community agencies. Participants were divided into those girls identified as having ADHD (n=13; mean±SD 11.5±2.7 years) and those girls identified as not having ADHD (n=14; mean±SD 11.7±2.8 years). All girls were asked to walk barefoot at their comfortable pace. Timing and video data were collected using a Vicon Nexus motion capture system. Gait analysis data was analyzed using GaitLab software. The Global Motor Screen (GMS) is a gait assessment used to identify motor impairment. GMS variables include age at diagnosis, age at first symptom, motor development index (MDI), and motor development research index (MDRI). Variables that were significantly different between the two groups included age at diagnosis (p=0.002), motor development index (p=0.006), and motor development research index (p=0.007). Lower scores on these variables indicate a greater degree of motor impairment. Lower scores on the GMS are associated with better neuromotor development. CONCLUSION: It appears that significant differences are present between girls with and without ADHD. Findings of this study suggest that girls with ADHD have better gait impairments than girls without ADHD. Further motor development research should include female participants with ADHD and include an assessment of executive function. This would help better understand the possible causes of the motor impairment identified in individuals with ADHD.
**Board #81** May 30 10:30 AM - 12:00 PM

**Aquatic-based Exercise For Individuals With Parkinson’s Disease: A Systematic Review And Meta-analysis Of Randomized Controlled Trials**

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**PURPOSE:** What are the effects of aquatic-based exercise (AquEx) on motor and non-motor symptoms, functional performance and quality of life (QOL) in individuals with Parkinson’s disease (iPwPD)? Does AquEx have greater effects on these outcomes than other forms of exercise in iPwPD?

**METHODS:** A systematic review and meta-analysis of randomized controlled trials (RCTs), which enrolled iPwPD in supervised AquEx programs ≥t 2 weeks, was conducted. The primary outcomes were motor symptoms and functional performance; the secondary outcomes were non-motor symptoms and QOL outcomes.

**RESULTS:** Of the 129 records identified, seven trials met the inclusion criteria and six entered the meta-analysis (159 subjects). One trial assessed the effect of AquEx compared to usual care and found a significant improvement at the Unified Parkinson’s Disease Rating Scale Part-III (UPDRS-III, mean difference, MD -4.6, 95% CI -7.5 to -1.7) in favour of AquEx. Six studies compared AquEx with land-based exercise (LEx) -intervention (after an average of 7.2 ± 2.2 weeks of training; 159 subjects). The effect of AquEx was superior to LEx on the Berg Balance Scale (MD 2.7, 95% CI 1.6 to 3.9), the Falls Efficacy Scale (MD -2.1, 95% CI -3.1 to -1.1) and the 39-item Parkinson’s Disease Questionnaire (MD 60.9, 95% CI -11.3 to 0.6), with no significant between-groups differences in the other outcomes considered. The significant between-group difference for the Berg Balance Scale was maintained at the follow-up assessment (54 subjects, MD 6.3, 95% CI 2.1 to 10.5).

**CONCLUSIONS:** AquEx significantly improves motor symptoms in iPwPD. It also has slightly to moderately greater benefits than LEx on balance capacity, postural stability and perceptual deficits. However, a question that has yet to be addressed is whether individuals with severe motor impairments post hemiparetic stroke have between-arms torque perceptual impairments within their paretic arm and/or non-paretic arm.

**Background:** To perform activities of daily living safely and efficiently, an individual with hemiparetic stroke needs to accurately perceive how much force is generated about their joints, i.e., torque perception. We know that individuals with moderate to severe motor impairments post hemiparetic stroke have between-arms torque perceptual impairments. However, a question that has yet to be addressed is whether these individuals have a torque perceptual impairment within their paretic arm and/or non-paretic arm.

**Objective:** To compare single-arm torque perception between individuals with chronic hemiparetic stroke and individuals without neurological impairments (i.e., controls).

**Methods:** Nine individuals with chronic hemiparetic stroke and five similarly-aged individuals without neurological impairments (i.e., controls) partook in the study. By following automated audiovisual cues, each participant generated 25% of their maximum voluntary elbow extension torque for three seconds, relaxed for two seconds, and then matched the remembered torque for one second without receiving feedback on their torque-matching ability. This torque-matching task was performed in each arm.

**Results:** The mean ± standard deviation of the normalized absolute torque matching error was 26.5±18.3% and 28.2±23.3% for the participants with chronic hemiparetic stroke in their paretic and non-paretic arm, respectively, and 19.8±7.1% and 20.1±11.3% for the controls in their dominant and non-dominant arm, respectively. Absolute error was not found to significantly differ depending on the arm tested (p=0.53).

**Conclusions:** Our participants with chronic hemiparetic stroke and controls matched torques similarly in each arm. This result supports the notion that unilateral torque perceptual deficits may not occur in individuals with chronic hemiparetic stroke who exhibit motor impairments during unimanual activities.

**Board #83** May 30 10:30 AM - 12:00 PM

**Functional Motor Control Deficits In Fragile X Mental Retardation 1 Gene Premutation Carriers**

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Individuals with the fragile X mental retardation 1 (FMR1) gene premutation are at increased risk for fragile X associated tremor/ataxia syndrome (FXTAS). However, it is unknown whether FMR1 gene premutation carriers, with or without FXTAS, exhibit functional motor control deficits compared with healthy individuals.

**PURPOSE:** To determine whether FMR1 premutation carriers exhibit impaired ability to perform functional motor tasks.

**METHODS:** Eight FMR1 gene premutation carriers (4 with FXTAS and 4 without FXTAS; 58.88±9.25 yrs) and eight age- and sex-matched healthy individuals (60.13±9.25 yrs) performed 1) a constant isometric force control task with the index finger at 20% MVC; 2) a dynamic stance task where a participant continuously swayed anterior-posteriorly; and 3) a single step initiation task. We recorded the force from the index finger during a constant contraction task, the center of pressure (COP) during a dynamic stance task, and the time and velocity during a single step initiation task.

**RESULTS:** Compared with healthy controls, FMR1 gene premutation carriers exhibited 1) greater force variability (coefficient of variation of force) during a constant force task (1.48±1.02 vs. 0.63±0.37%; p<0.04); 2) less anterior-posterior trajectory distance (4.24±0.71 vs. 5.3±0.024cm; p<0.01) during a dynamic stance task; and 3) greater step duration (0.39±0.14 vs. 0.27±0.04s; p<0.05) and less step velocity (111.07±24.62 vs. 136.42±16.47cm/s, p<0.05) during a single step initiation task.

**CONCLUSION:** Irrespective of existence of FMR1-related tremor/ataxia syndrome, FMR1 premutation carriers exhibit functional motor control deficits compared with healthy individuals.

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**Board #84** May 30 10:30 AM - 12:00 PM

**The Relationship Between Y Balance Performance & Hip Strength &gt; Recreationally Trained Women.**

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**PURPOSE:** This study aimed to identify the relationship between the Y balance test - Lower Quarter (YBT-LQ) and hip isometric strength and to compare outcomes between preferred and non-preferred limbs in recreationally resistance-trained women.

**METHODS:** Twenty young college females (22.5 ± 2.1 years) with background in regular strength or plyometric training volunteered to participate in this study. Maximal reach distance in each of the three YBT-LQ reach directions (anterior, posteromedial, and posterolateral) and a composite reach score (sum of the three directions) were recorded for the preferred and non-preferred leg and normalized to leg length. A handheld dynamometer was used to measure the maximum voluntary isometric strength of each participant for the hip extensors, flexors, adductors, abductors, and internal and external rotators (N).

**RESULTS:** Significantly lower normalized scores were noted for the preferred (81.2 ± 11.7%) compared to the non-preferred leg (83.6 ± 12.4%) for anterior distance. For the composite score of the YBT-LQ and hip strength measures, associations were weak for hip flexion and external rotation; moderate for hip flexion, abduction, and adduction; and strong for hip external rotation (r=0.516, p<0.059).

**CONCLUSIONS:** The strong association between hip external rotator strength and composite score of the YBT-LQ suggest that strengthening this muscle group might be important for dynamic postural control and the reduction of injury risk factors in recreationally active females.
A recumbent cross trainer (RCT) relies on similar neural networks as gait. Therefore, neurologically impaired individuals may improve walking ability after exercise on the RCT.

**Purpose:** The purpose of this investigation was to compare the effects of the RCT and Treadmill (TM) on intra-exercise electromyography and post-exercise spatial-temporal gait parameters.

**Methods:** 34 participants were divided into two groups: stroke (CVA) (10 ± 5 years post-CVA) and age and sex-matched control. Participants completed two 5-minute exercise bouts on both the RCT and TM in an RPE based self-selected cadence. Intra-exercise Mean electromyography (mEMG) values were normalized to maximum voluntary contraction and were recorded bilaterally at the rectus femoris, vastus medialis oblique, semitendinosus, tibialis anterior, medial gastrocnemius, and soleus. Change in joint range of motion was calculated (maximum-minimum degree; ∆ROM) from wireless goniometer measures at the hip, knee, and ankle. Gait parameters were evaluated by the Wireless Gait Assessment Tool (WGAT) immediately following each exercise bout (3-10m walk). HR and BP were monitored to ensure the return to pre-exercise levels. Results:

Stroke: (n = 15) and healthy (n = 19) did not differ in age (Mdn: 66 years vs. 57 years, respectively) or BMI (Stroke: M = 27.02, SD = 4.57 vs. Healthy: M = 26.46, SD = 4.63). p > .05. Healthy participants were stronger at all joints, p < .025. Preferred TM speed was faster in the healthy condition compared to the stroke condition in the RCT. (χ2=1.076, p < .05). RCT average steps per minute did not differ between the conditions, p > .05. RPE did not differ between groups or across exercise modes. The TM elicited a higher mEMG on a majority of the studied muscles in both populations, p < .025. TM demonstrated an increased ∆ROM in the R knee and both ankles in the healthy population, p < .025. There were no statistical differences between the TM and RCT in the CVA’s ∆ROM. WGAT determined the RCT decreased the stance percentage (%) and increased swing % on the non-affected leg, p < .05. Neither exercise mode modulated the affected-side stance %, affected-side swing %, double support time or bilateral (affected vs. non-affected) stride length, p > .05. Conclusion: Five minute RCT intervention improved non-affected side gait parameters in a chronic CVA population.
and postero-lateral reach directions (4.96±5.49%, p<0.001, ES=0.90) but not in the anterior reach direction (2.11±5.77%, p=0.08, ES=0.37). Under eyes-open conditions, TTB improved in the mediolateral (0.27±0.43, p=0.004, ES=0.63) and anteroposterior (0.84±1.43, p=0.007, ES=0.59) directions. However, no significant changes were identified in any TTB measures with eyes closed (p>0.20). Conclusion: FL DN created immediate improvements in dynamic and static balance in individuals with CI. Future studies should examine the effects of multiple DN treatments and the mechanism behind this therapeutic effect.

1327 Board #89 May 30 10:30 AM - 12:00 PM
Postmenopausal Women: Body Composition x Postural Stability
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Several alterations of sensorimotor and motor performance processing occur during the process of normal aging. In women, aging is associated with the onset of menopause, which influences body composition with increased central adiposity, leading to changes in the gynoid to android fat distribution pattern. These changes may alter the center of gravity, compromising body stability and causing risk of falls. Purpose: The study aimed to analyze the influence of body mass on postural stability in postmenopausal women. Methods: Forty women (age: 71.2 ± 5.4 years, height: 158.6 ± 5.8 cm, weight: 72.0 ± 21.2 kg and BMI: 28.9 ± 4.5 kg/m²) were evaluated. According to the body mass, participants were divided into two groups: overweight group (OWG, n=23) and normal weight group (NWG, n=17). Body mass assessment was performed using multiple frequency bioimpedance analysis (MF-BIA) and postural stability was evaluated on the Biodex Balance System (BBS), using Postural Stability Test (PST) at levels of oscillation 8 and 4 at the anterior-posterior (AP) and mid-lateral (ML) directions. Statistical analysis were performed by Shapiro-Wilk normality-test; comparisons between groups by Mann Withney test and correlations by Spearman correlation coefficient. Statistical significance was set at p<0.05. Results: OWG presented significantly (p=0.05) lower postural stability (AP-PST-8: 0.71 ± 0.34; ML-PST-8: 0.70 ± 0.16) than NWG (AP-PST-8: 1.32 ± 0.49; ML-PST-8: 1.05 ± 0.50). AP-PST-8: 2.20 ± 0.89; ML-PST-4: 1.78 ± 0.91) to the NWG for all the variables determined in the BBS (AP-PST-8: 0.71 ± 0.34; ML-PST-8: 0.70 ± 1.06; AP-PST-4: 1.35 ± 0.81; ML-PST-4: 1.24 ± 0.84). Also, there was a positive and moderate correlation between BMI with AP-PST 8 (r=0.58), BMI with ML-PST 8 (r=0.45), BMI with AP-PST 4 (r=0.51) and BMI with ML-PST 4 (r=0.46). Conclusion: These data suggest that overweight predisposes postmenopausal women to greater postural instability.

1328 Board #90 May 30 10:30 AM - 12:00 PM
Diurnal Influence On The Modified Test Of Sensory Integration And Balance (mCTSIB)
Brandon Doan, Kade Carrigan, Sarah Camp, Jeff Pasley. 

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(No relevant relationships reported)

Purpose: The mCTSIB evaluates sensory integration and balance, which have been shown to degrade due to brain injury and neurological disease. Time-of-day affects sensory integration and balance. The purpose of this research was to investigate diurnal effects on the mCTSIB diagnostic protocol. Methods: The Georgia Gwinnett College Institutional Review Board approved this research protocol. The research participants were 21 healthy women (12) and men (9) with an average age of 22.4 (± 3.5) years, height of 165.9 (± 15) cm, and weight of 69.3 (± 8.2) kg. Participants completed morning mCTSIB trials between 7:00 AM and 10:00 AM and evening trials between 4:00 PM and 7:00 PM. Treatment order was randomized and balanced. Participants were instructed to get a normal night’s sleep prior to testing and refrain from caffeine use on the day of testing. Participant sleep, physical activity, and concussion history were recorded by survey. Results: No statistically significant mCTSIB differences were detected between time-of-day conditions. See chart below for a summary of average postural sway velocities by balance condition and time of day.

CONCLUSION: Based on this investigation, there appears to be no difference in morning compared to afternoon tests of sensory integration and balance among healthy young adults. This is an important finding; possibly informing clinicians that time-of-day is not an important factor to consider when conducting mCTSIB repeated measures or normative comparisons.

1329 Board #91 May 30 10:30 AM - 12:00 PM
The Effects of Cognitive Load and Postural Demand on Static Balance
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A growing body of research indicates that measures of static balance (e.g., postural sway) are influenced under cognitive demands. Similar measures are also impacted under different balance demands (e.g., stable vs unstable stances). However, to date, there is little known about how the difficulty of postural demands impact the relationship between balance and cognition. Purpose: Within the same individuals, we parametrically compared balance demands and cognitive demands on static balance ability using state-of-the-art inertial sensors. Methods: 34 healthy young adults completed tasks of static balance with and without a cognitive demand (CD). Six wireless inertial sensors (APDM Opals) were attached to the wrists, feet, chest and lower back. The static balance task involved the participants standing for 30 seconds on a firm surface with their eyes closed in three different postural demand (PD) positions: feet apart (Low PD), feet together (Moderate PD), and feet in tandem (High PD). After completing these tasks alone (Low CD), participants were asked to complete these tasks while doing serial seven subtractions from a randomly presented three-digit number (High CD). Results: We conducted repeated measures ANOVAs with Cognitive Demand (High vs Low) and Postural Demand (High vs Moderate vs Low) on measures of Path Length and Jerk. For Path Length, there was a main effect of CD [F(1,12)=33.19, p<0.001, High=32.39, Low=18.42] and a main effect of PD [F(2,64)=9.69, p<0.001, High=62.32, Moderate=8.19, Low=5.71]; however, there was no interaction between these factors. Path Length was longer under High CD relative to Low CD, and for Tandem PD relative to Likewise, for Jerk, there was a main effect of CD [F(1,12)=8.24, p=0.01, High=22.92, Low=17.36] and a main effect of PD [F(2,64)=28.65, p<0.001, High=37.08, Moderate=14.07, Low=9.27], but there was no interaction between these factors. Conclusion: Using two precise measurements of static balance, we observed that performance was impacted by separate cognitive and postural demands. Since these factors did not interact, our results suggest that adding a cognitive task to a balance assessment may have an impact independent of the balance demands.
PURPOSE: The objective of this study was to identify the effects of aerobic rumba training of static balance and power in the lower limbs in elderly women. METHODS: Twelve healthy older women were randomly assigned to one intervention group (INT, n = 6, 67.16 ± 5.34 years), body weight (64.88 ± 9.79 kg), average lean muscle weight (24 ± 83 ± 2.38%), body fat (38.15 ± 65.6%) and a control group (CON, n = 6, 67.66 ± 5.98 years), body height (153.2 ± 12.90 ± 0.155 sec; MVC: 4.56 ± 1.46 deg/sec; EPE: 69.41 ± 10.6%; MXE: 87.24 ± 9.24%; and DCL: 70 ± 8.85%). Significant partial correlations were determined using partial correlations (controlling for age and sex). Statistical significance was set at p<0.05. RESULTS: Subjects (16 female, 4 male) were 64.2 ± 4.77 years old and had a body mass of 95.34 ± 15.55 kg, a body mass index of 34.7 ± 4.68 27 kg/m2, and a maximal cycle ergometer VO2 of 15.4 ± 2.26 ml/kg/min. Average (± 5.98% component values were RT: 0.784 ± 0.155 sec; MVC: 4.56 ± 1.46 deg/sec; EPE: 69.41 ± 10.6%; MXE: 87.24 ± 9.24%; and DCL: 70 ± 8.85%. Significant partial correlations were found for DCL and gait speed, r = 0.19, p = 0.039 as well as MVC and height, r = -0.60, p = 0.008. CONCLUSION: Height and gait speed from a standard 4-meter walk test were both significantly correlated to postural limits of stability. Prospective studies are needed to examine the influence of gait speed, DCL and lifestyle interventions on fall risk. Supported by a grant from the National Institute on Aging: 1R15AG055923-01.

Aerobic Rumba Training Effects on Static Balance and Lower Limb Power in Older Female Adults

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PURPOSE: the neuromuscular effect in the lower limbs through the simple movements of different musical genres. The variables to reinforce visual input. These findings could be used to optimize VR-based training protocols to improve postural control.

Seventy to eighty percent of the population will experience one episode of neck and low back pain in their lifetime, respectively. Deviations in posture can contribute to this onset of spinal pain. One subgroup of the population that is known to experience similar pain is eSports athletes. It has been shown that 34% of forty recently polled eSports athletes experience neck and back pain when competitively gaming. Concerns have been raised over their sustained aberrant postural positioning during play and its contribution to their pain. PURPOSE: To examine postural changes in collegiate eSports athletes while playing in eSports gaming chairs compared to non-gaming chairs. METHODS: Four collegiate eSports athletes (21.75 ± 2.06 years old) were recruited to participate in this observational study. Measurements of three joint angles were performed over four days with sessions lasting one hour. Each day the athletes were randomly assigned to a different chair before the gaming session. The chairs included two commercial gaming chairs from different vendors (chairs 1 and 2), an office chair (chair 3), and a standard chair (chair 4). Reflective markers were placed at specific body prominences to capture both sagittal and coronal postures during play. Motion capture was recorded using two GoPros™ and later analyzed with Kinovea™ software. RESULTS: There was a significant difference within group (t -3.38, p = 0.03) between the pre and posttest neck angle measure for chair 1 of the commercial brands. Using an ANOVA, significant differences were found between chairs 1 and 2 (F(3,28) = 2.6, p = 0.028) and chairs 2 and 3 (F(3,28) = 2.6, p = 0.023).

Competition and Virtual Reality: The Effect of Music on Virtual Reality Induced Postural sway

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CONCLUSION: The differences found in posture during gaming and non-gaming chairs may impact upon injuries in eSports players. These preliminary results warrant further testing to possibly help reduce injury in eSports athletes.

1334  Board #96  May 30 10:30 AM - 12:00 PM  
Effects of Ankle Bracing on Postural Sway  
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Ankle bracing can alter postural control strategies during static and dynamic tasks, theoretically through mechanical constraint of the ankle joint and/or sensorimotor reorganization. While a majority of studies have focused on center of pressure (COP) characteristics or clinical tests of balance to explore this theory, fewer studies have investigated sway characteristics of the center of mass (COM). Additionally, the effects of various styles of ankle braces on postural sway remains inconclusive. Assessing the effects of ankle bracing on postural sway could provide additional insight into potential systemic motor adaptations that occur in response to ankle constraint.

PURPOSE: Examine effects of lace-up and semi-rigid bracing on postural sway characteristics during a quiet-standing task. METHODS: Thirty-five adults between the ages of 18-30yrs (height: 1.72 ± 0.1m; mass: 75.49 ± 18kg) participated in the study. Participants performed a single one-minute trial of quiet-standing during each of the following conditions: No brace (NB), lace-up brace (LB), and semi-rigid brace (SRB). A ten-camera motion capture system was utilized to capture lower extremity position. To assess postural sway, mediolateral (ML) and anteroposterior (AP) lower extremity COM trajectories were extracted, and root-mean-square deviation (RMSx, RMSy) and velocity (RMSxv, RMSvy) of the COM were calculated. Repeated-measures ANOVAs were employed to assess differences in postural sway measures across all conditions. RESULTS: Analysis revealed a significant main effect for RMSy (F = 7.061; p < .01). Pairwise comparisons indicated that RMSy was significantly lower in the SRB condition (1.770 ± 1.698mm) compared to C (2.182 ± 1.515mm) (p < .01). CONCLUSION: Results from study indicate that subjects exhibited an altered AP postural sway pattern when a semi-rigid brace is applied. These findings align with previous research reporting reduced AP COP excursions with ankle bracing during quiet-standing. Altered sway patterns with ankle bracing appears to support the presence of sensorimotor reorganization, possibly due to altered proprioceptive and/or haptic feedback stemming from greater mechanical constraint of the ankle joint.

1335  Board #97  May 30 10:30 AM - 12:00 PM  
Minimal Detectable Change Scores For Measures of Functional Balance in Adolescents With Chronic Ankle Instability  
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(No relevant relationships reported)

Chronic Ankle Instability (CAI) is an issue that affects individuals with a history of ankle sprains. Improving functional balance is one of the key goals in ankle rehabilitation programs. However, the threshold for defining a meaningful level of improvement for certain assessments has not been determined.

PURPOSE: To establish the minimal detectable change (MDC) values for 2 different functional balance assessments in an active adolescent population with CAI.

METHODS: Forty-three active adolescents with CAI (20 males and 23 females, 16.1±1 years, 171.7±5.120.5cm, 69.38±18.36kg). CAI inclusion criteria consisted of ankle sprain history, current symptoms of pain, weakness and instability and repeated episodes of giving-way. Participants completed 4-weeks of either strength training, balance board training, combination training (completion of both strength and balance board exercises) or no intervention. Dependent variables were pre- and post-intervention scores for two measures of functional balance: side-hop test required participants to hop 30-centimeters medially/laterally for 10 repetitions and figure-of-8 hop test required participants to hop in a figure-of-8 pattern over a 5-meter distance for 2 repetitions. Both tests were completed twice on the involved leg. Hopping ability was measured in centimeters (complete seconds). A positive change score indicated improvement by a decrease in time needed to perform each test. The MDC with 95% confidence intervals was calculated for each variable (MDC = 1.96SD x (1-ICC)1/2 x (2)1/2). RESULTS: Average pre and post-intervention scores were 12.55±4.51sec and 10.06±2.45sec for side-hop and 14.60±7.06sec and 13.00±8.10sec for figure-of-8 hop respectively. MDC was 2.60sec for both side-hop and figure-of-8 hop. These values reflect the minimal score necessary to be 95% confident that any measured change surpasses the statistical error associated with the test. Approximately 34.38% of the intervention participants had a clinically meaningful change of >2.60 seconds for side-hop test and 31.25% for figure-of-8 hop test. CONCLUSIONS: When these functional balance tests are used to detect beneficial changes from rehabilitation interventions, these MDC scores should be used as a minimum threshold to detect a true and clinically meaningful change.

1336  Board #98  May 30 10:30 AM - 12:00 PM  
Relationship Between Balance And Anterior Talofibular Ligament And Superior Extensor Ankle Retinaculum Thickness  
Brooke Malloy, Adrian Aron, David Furrow, Haley Cook, Elizabeth Smoot, Lindsey Cash, Kristen Jagger, Brent Harper, Radford University, Radford, VA. (Sponsor: Lynn Millar, FACSM)  
(No relevant relationships reported)

Ankle sprains are a common injury, with affected individuals often experiencing recurrent symptoms that can progress to chronic ankle instability (CAI). Balance impairments are routinely present in subjects with CAI. Changes in tissue structure of the anterior talofibular ligament (ATFL) and superior extensor ankle retinaculum (SEAR) may occur after an ankle sprain, and may contribute to impaired balance through altered proprioception. PURPOSE: To determine if ATFL/SEAR thicknesses were related to dynamic balance in individuals with CAI. METHODS: Subjects were 14 males and 15 females (Age= 24.52 ± 3.46 years). Ankle instability was assessed using the Cumberland Ankle Instability Tool (CAIT), with a cut-off score of 25 to define two groups: those with and without CAI. Real-time ultrasound was used to assess ATFL and SEAR thicknesses. Dynamic balance was measured with the Y Balance Test (YBT) and the NeuroCom® motor control and adaptation tests. For subjects with CAI, we analyzed stable versus unstable ankles; for those without CAI, we analyzed right versus left ankles.

RESULTS: There was no difference in mean ATFL thickness (0.24 ± 0.03 vs. 0.22 ± 0.04 cm, respectively, p=0.36) or in SEAR thickness (0.09 ± 0.01 vs. 0.10 ± 0.02 cm, respectively, p=0.19) between the stable and unstable ankles in participants with CAI. For those without CAI, there was also no difference between the right and left ATFL thickness (0.22 ± 0.06 vs. 0.20 ± 0.04 cm, p=0.14) or SEAR thickness (0.09 ± 0.01 vs. 0.09 ± 0.01 cm, p=0.95). There was no difference in YBT scores in those with or without CAI (p=0.21, p=0.89 respectively). Additionally, sway energy for upward or downward forces was comparable between those with and without CAI, (p=0.15, p=0.36). Similarly, composite latencies were also no different (p=0.68).

CONCLUSIONS: There was no relationship between ligament thickness and balance, supporting a multifactorial CAI rather than dependency upon tissue changes alone. Central nervous system sensory integration, neuromuscular control compensations, or psychosomatic reactions may be the ones affecting the balance more. Likewise, subject perception of ankle instability may not coincide with impaired dynamic balance.

Finally, tests used to assess dynamic balance may not be sensitive enough to identify differences caused by CAI.

1337  Board #99  May 30 10:30 AM - 12:00 PM  
Lower Limb Impairments In Patients With Knee Osteoarthritis  
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(No relevant relationships reported)

PURPOSE: Self-reported knee pain is a frequent reason of consulting medical doctors. In the setting of knee osteoarthritis (KOA) care, although it has been shown that muscle function is more closely associated with joint pain that the grade of joint space narrowing, its assessment is generally neglected. In addition, knee malalignment and foot imbalance which are recognized potential risk factor for KOA are not systematically considered. The aim of our study was to determine the frequency of foot imbalance and quadriceps strength and activations disorders and their relationship with knee pain.

METHODS: 150 patients suffering from knee pain (64 men and 88 women) aged 45-74 years (mean age 58.9, SD = 8.9) were tested for: 3D foot scan, quadriceps strength, surface electromyography foot balance during maximal isometric, squat and walking exercises. Inclusion criteria included: radiographic K-L (Kellgren and Lawrence) grades less than 2. Exclusion criteria included: (1) a history of lower limb surgery; and (2) a history of arthrocentesis and acorticosteroid or hyaluronic acid injection within 3 months of study commencement.

RESULTS: 3D foot scan showed that 28% of patients had asymmetrical foot print shape during static position (normal stance) in both feet, 32% in the painful leg and 21% in the
non-painful leg. 44% of the subjects had quadriceps weakness (during isometric test, painful limb was significantly weaker). 28% and 17% unequal vastus medialis versus vastus lateralis ratio activation and 18% and 11% delay in Vastus medialis activation during squatting and walking respectively. When analysed by multiple logistic regression, quadriceps strength, vastus medialis /vastus lateralis ratio activation and foot pronation were independently associated with knee pain. Quadriceps strength and vastus medialis/vastus lateralis ratio activation were not associated with foot misbalance.

CONCLUSIONS: The findings indicate that, knee pain is a multifactorial process in which several mechanical factors could be associated— but both weakness of the quadriceps muscles and misbalance in the foot are often altered. We may recommend lower limb biomechanics analysis, muscle activation and 3D foot print to optimise both diagnosis and treatment in patients with knee pain.

1338 Board #100 May 30 10:30 AM - 12:00 PM
Obesity and Falls in Older Women: Mediating Effects of Muscle Quality, Foot Loads and Balance
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PURPOSE: Obesity is associated with risk of falls in older women. However, it is not certain whether factors commonly associated with obesity and/or falls mediate this risk. This study examined whether muscle quality, foot loads and postural balance mediate the relationship between obesity and falls. METHODS: At baseline, 246 female participants underwent obesity screening (BMI≥30kg/m²), and had muscle quality (isokinetic dynamometer and DXA), foot loads (pressure platform) and postural balance (force platform) evaluated. Incident falls were recorded at the end of the 18-month follow-up period. To identify mediating factors of obesity and falls, a series of modified Poisson regression analyses were conducted as per Baron and Kenny’s 3 step criteria. Each potential mediator was individually assessed for its association with obesity (step 1), and if this association was significant, then each potential mediator was assessed for its association with falls (step 2). If the potential mediator was significantly and independently associated with both obesity and falls, the potential mediator and obesity were both included as independent variables in a model to assess their association with falls (step 3). If the 3 mediating conditions were all met, the intervening variable effect was examined using Freedman and Schatzkin test. Significance level was set at p<.05. RESULTS: 204 volunteers (83%) completed the follow-up. Obese participants had an increased risk of falls during the 18-month period (RR= 2.13, 95% CI= 1.39-3.27). The table below presents the mediation analysis of the relationship between obesity and falls. Of the variables analysed, only muscle quality (specific torque) was a significant mediator (t= 4.026, p<.001).

<table>
<thead>
<tr>
<th>Potential mediators</th>
<th>Step 1</th>
<th>Step 2</th>
<th>Step 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knee extensors peak torque (&lt; 88.1 Nm)</td>
<td>1.34 (0.81-2.23)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Leg lean mass (&lt; 5.0 kg)</td>
<td>0.21 (0.08-0.56)</td>
<td>0.83 (0.47-1.44)</td>
<td>-</td>
</tr>
<tr>
<td>Specific torque (&lt; 16.1 Nm.kg^-1)</td>
<td>2.48 (1.54-3.98)</td>
<td>2.75 (1.78-4.26)</td>
<td>2.37 (1.48-3.79)</td>
</tr>
</tbody>
</table>

The findings indicate that, knee pain is a multifactorial process in which several mechanical factors could be associated— but both weakness of the quadriceps muscles and misbalance in the foot are often altered. We may recommend lower limb biomechanics analysis, muscle activation and 3D foot print to optimise both diagnosis and treatment in patients with knee pain.

1339 Board #101 May 30 10:30 AM - 12:00 PM
Does Movement Strategy Change Directional Balance Reach Test Performance Variability?
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The Directional Balance Reach Test (DBRT) outcome measurement is a composite score (CS) based on the maximum reach distances of three trials in each of three testing directions: anterior (ANT), posterior-medial (PM), and posterior-lateral (PL). Movement strategy, with and without specific movement cues, may alter within trial reach distance performance variability. It may provide different clinical information about individual movement control during DBRT. PURPOSE: The purpose of this study was to determine whether movement strategy impacted CS and performance variability in DBRT. METHODS: Sixteen subjects (eight males and eight females) were randomly assigned to two groups. Each group performed DBRT on the dominate support (DS) and dominate kick (DK) legs by using personal (P) and specific (S) strategies in different orders (P-S, S-P). The ANT, PM, and PL reach directions were randomized during nine reaching trials. Reach distance was normalized to the subject’s leg length. Performance variability of reach distance in each direction was defined by measuring absolute error (AE=[Y_i]-3Xi)/3. Two-way mixed ANOVAs, strategy(2) x order(2), were used in a preliminary analysis to rule out an order effect in CS. Two-way repeated ANOVAs, strategy (2) x reach direction (3), were used to determine whether these independent variables affected performance variability. RESULTS: For CS, there was no main order effect (p>.05). However, there was a significant strategy effect for both legs (p<.001; DS: P=90.016.98%, S=82.92±5.97%; DK: P=89.53±7.93%, S=82.82±7.80%). For AE in DS, there was no significant strategy effect, but there was a main direction effect (p = .001, η²=376, Power=.953; ANT=3.48±2.02%, PM=5.18±4.15%, PL=6.05±4.12%). For AE in DK, there was a significant strategy by direction interaction (p=.044, η²=.189, Power=.606). Post-Hoc tests revealed a significant strategy effect (p<.05) for PL only (P= .047, S=7.33±5.15). CONCLUSION: The movement strategy used impacted CS. However, AE was only altered in the PL direction in DK. The DBRT, a closed chain dynamic balance test, may be a novel task for assessing DK leg performance variability.
Machine learning is a branch of artificial intelligence that enables computer systems to learn from data and analyze data without being explicitly programmed. Interest in machine learning has grown rapidly in clinical settings because the diagnosis of diseases or disorders can be automated by computer systems with high accuracy and minimum human intervention. However, the use of machine learning to identify postural control patterns for people with Parkinson's disease (PD) is not well established.

**PURPOSE:** The purpose of the study was to develop and validate an automated identification of PD postural control patterns using a machine learning approach.

**METHODS:** 12 participants with PD (age = 75.3 ± 6.6 yr, height = 1.71 ± 0.12 m, mass = 83.1 ± 12.4 kg) and 18 healthy controls (age = 83.3 ± 5.5 yr, height = 1.62 ± 0.08 m, mass = 73.1 ± 16.2 kg) were recruited. Participants were instructed to stand on a force plate and maintain still for 2 minutes during open-eyes and eyes-closed conditions. The center of pressure (COP) data were collected at 50 Hz, sway area, linear displacement, total sway distance, standard deviations of COP positions and average velocities were calculated. 3 supervised machine learning algorithms (i.e., logistic regression (LR), k-nearest neighbors (KNN) and naïve Bayes (NB)) were used to identify PD postural control patterns. All participants were divided into two datasets: 70% for training and 30% for testing.

**RESULTS:** KNN achieved the highest overall accuracy rate (0.90) to identify PD postural control. LR and NB also exhibited satisfactory performance. The overall accuracy of LR ranged was 0.86; and the overall accuracy of NB was 0.81. Though all three models are capable of analyzing small-sample data, model performance to identify PD postural control could be potentially improved by recruiting a larger sample size and exploring other machine learning models in future research.

**CONCLUSIONS:** Computer-aided machine learning models successfully identified postural control patterns of PD patients with high accuracy. The use of machine learning may provide a valid and efficient approach to better understand PD postural control features and thus, could be beneficial for the early diagnosis and early intervention in individuals with PD.
with a CD4 count of >200 cells/μl to enroll in the study. After signing the informed consent and collecting demographic data, a member of the research team placed a lumbar accelerometer on each subject. Each participant was instructed to quiet stand in a static bi-pedal posture on a firm surface or a thick foam pad. Each task took 15 seconds to be performed. The first task was to stand on a firm surface (baseline), the eight remaining tasks were performed with a thick balance foam mat (four single and four dual cognitive tasks). For the cognitive dual tasks participants were instructed to count backward 3 numbers at a rate of 2 numbers per second. 

RESULTS: Postural control was measured with Body-worn accelerometers (ACC). The two variables of interest in this study were jerk sway acceleration in an anterior-posterior (A-P) and mediolateral direction (M-L), m²/s². A MANOVA analysis was used to compare the variables of interest, between baseline (BL) (firm surface eyes open) and single/dual tasks. AP sway increased significantly during single (BL 0.020 ± 0.01 m²/s² versus single task 0.20 ± 0.02 m²/s², p < 0.005) and dual tasks (BL 0.020 ± 0.01 m²/s² versus dual task 0.23 ± 0.03 m²/s², p < 0.005) when visual input was canceled. 

CONCLUSIONS: Single and dual tasks showed a similar challenge and results regarding increased acceleration and instability. It appears that the vestibular and proprioceptive systems could be impaired in HIV diagnosed people. Because there is no fall history among the participants of this study and these findings, it seems that patients with HIV rely on the visual system to a higher degree to attain postural control.

Individuals diagnosed with HIV often experience balance impairments caused by the virus or medication. These deficiencies due to compensation of the postural control systems might be unperceived for years until the impairments are to advance. PURPOSE: Assess perceived balance confidence in people with HIV compared to a group of older adults without an HIV diagnosis. METHODS: The study was conducted in San Juan, Puerto Rico at an HIV Rehabilitation Clinic (La Perla de Gran Precio) for the HIV group (HIVG). 24 subjects (13 male and 11 female) participated in the study (age 59.2± 1.7 years). To enroll in the study, participants needed an HIV diagnosis with a CD4 count of > 200 cells/μl. The control group (CG) was recruited from the Community Center Complejo Deportivo Caracillo Aliece, Bayamón, Puerto Rico. A total of 25 subjects in the control group (5 males and 20 females) with an age average of 71.5 ± 3.6 years old participated in the study. A member of the research team verbally asked the subjects 16 questions that involved a variety of daily functional activities from the Activities-specific Balance Confidence (ABC) Scale. Each participant was instructed to give a percentage (0-100%) on how confident their balance is while attempting to do these specific functional activities. 

RESULTS: A MANOVA analysis was used to compare ABC scale data between groups. HIVG exhibited significantly reduced balance confidence in six out of sixteen subsets of the ABC scale. Chair and Reach (CG 81.20 +/- 22.651, HIVG group 55.67 +/- 15.880, P ≤ 0.05), Icy Sidewalks (CG 74.40 +/- 23.722, HIVG group 52.40 +/- 11.995, P ≤ 0.05), and Icy Sidewalks (CG 74.40 +/- 23.722, HIVG group 52.40 +/- 11.995, P ≤ 0.05), and Icy Sidewalks (CG 74.40 +/- 23.722, HIVG group 52.40 +/- 11.995, P ≤ 0.05). 

CONCLUSIONS: These results indicate that adults with HIV are likely to have less confidence in their balance with those tasks, which may result from decreased proprioception and also may result in increased fall risk. Clinicians should make an effort to identify perceived balance confidence in early stages of the condition to reduce the risk of fall in these population.

With a CD4 count of >200 cells/μl to enroll in the study. After signing the informed consent and collecting demographic data, a member of the research team placed a lumbar accelerometer on each subject. Each participant was instructed to quiet stand in a static bi-pedal posture on a firm surface or a thick foam pad. Each task took 15 seconds to be performed. The first task was to stand on a firm surface (baseline), the eight remaining tasks were performed with a thick balance foam mat (four single and four dual cognitive tasks). For the cognitive dual tasks participants were instructed to count backward 3 numbers at a rate of 2 numbers per second. 

RESULTS: Postural control was measured with Body-worn accelerometers (ACC). The two variables of interest in this study were jerk sway acceleration in an anterior-posterior (A-P) and mediolateral direction (M-L), m²/s². A MANOVA analysis was used to compare the variables of interest, between baseline (BL) (firm surface eyes open) and single/dual tasks. AP sway increased significantly during single (BL 0.020 ± 0.01 m²/s² versus single task 0.20 ± 0.02 m²/s², p < 0.005) and dual tasks (BL 0.020 ± 0.01 m²/s² versus dual task 0.23 ± 0.03 m²/s², p < 0.005) when visual input was canceled. 

CONCLUSIONS: Single and dual tasks showed a similar challenge and results regarding increased acceleration and instability. It appears that the vestibular and proprioceptive systems could be impaired in HIV diagnosed people. Because there is no fall history among the participants of this study and these findings, it seems that patients with HIV rely on the visual system to a higher degree to attain postural control.

Individuals diagnosed with HIV often experience balance impairments caused by the virus or medication. These deficiencies due to compensation of the postural control systems might be unperceived for years until the impairments are to advance. PURPOSE: Assess perceived balance confidence in people with HIV compared to a group of older adults without an HIV diagnosis. METHODS: The study was conducted in San Juan, Puerto Rico at an HIV Rehabilitation Clinic (La Perla de Gran Precio) for the HIV group (HIVG). 24 subjects (13 male and 11 female) participated in the study (age 59.2± 1.7 years). To enroll in the study, participants needed an HIV diagnosis with a CD4 count of > 200 cells/μl. The control group (CG) was recruited from the Community Center Complejo Deportivo Caracillo Aliece, Bayamón, Puerto Rico. A total of 25 subjects in the control group (5 males and 20 females) with an age average of 71.5 ± 3.6 years old participated in the study. A member of the research team verbally asked the subjects 16 questions that involved a variety of daily functional activities from the Activities-specific Balance Confidence (ABC) Scale. Each participant was instructed to give a percentage (0-100%) on how confident their balance is while attempting to do these specific functional activities. 

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inferior extensor retinaculum. There is a lack of research regarding objective outcome measures for balance following this procedure. The purpose of this report was to assess changes in static and dynamic balance for an individual who underwent the modified Broström-Gould surgery.

**Methods:** A 28-year-old female with right CAI completed pre-testing (two weeks prior to surgery) and post-testing (two months following surgery). Outcome measures included the modified STAR Excursion Balance Test (mSEBT), the Balance Error Scoring System (BESS), and Single Leg Hop Down Test for time to stabilization (TTS) using force plate testing.

**Summary of Results:** Postoperatively, the patient showed improvements in all directions on the mSEBT for the affected and unaffected lower extremities (LE), with greater improvement seen on the affected LE by 22–30%. The patient improved her overall score for the BESS, demonstrating a reduced number of errors on the affected LE from 20 to 15. The Single Leg Hop Down Test revealed a decrease in the average TTS on the affected LE from 1.88 seconds to 1.01 seconds.

**Conclusion:** After completion of the modified Broström-Gould surgery and in conjunction with rehabilitation, the patient showed an improvement in dynamic balance measures, possibly due to increased strength and reduced pain levels following rehabilitation after surgery. Future studies should examine the role of exercise interventions and fitness level in determining patient outcomes following the modified Broström-Gould surgery.

**Disclaimer:** The views expressed herein are those of the author(s) and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense or the United States Government.

**1348 Board #110 May 30 10:30 AM - 12:00 PM**

**Validation Of The Tekscan Strideway Plantar Pressure Mat Compared To A Force Platform**

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(No relevant relationships reported)

Force platforms represent the criterion method of assessing external force applied to an athlete during a given task. However, force platforms have several characteristics that may limit their use in sport and clinical environments including limited portability. Therefore, a need exists for portable equipment with high validity to measure load-related variables such as vertical force. **PURPOSE:** To validate vertical force measured using the Tekscan Strideway Plantar Pressure Mat compared to a force platform.

**METHODS:** Five participants performed three 10-second quiet standing trials in each of eight weighting conditions. Increased weight was achieved by increasing load during a deadlift. Vertical ground reaction force was measured independently using a plantar pressure mat (PPM, 500 Hz, Tekscan Strideway Plantar Pressure Mat, Boston, MA) and a force platform (FP, 1000 Hz, AMTI, Watertown, MA). Custom software (MATLAB, MathWorks, Natick, MA) was used to analyze vertical force data from the PPM and FP. FP data were downsampled to 500 Hz and the average force across the final 5 seconds of each trial was calculated. A correlation analysis was conducted to determine the strength of agreement between the PPM and FP. A paired samples t-test was conducted to compare mean force values measured using the PPM and FP. Cohen’s d effect sizes were calculated to determine the meaningfulness of differences between the FP and PPM.

**RESULTS:** No differences in vertical force were observed between the PPM and FP were observed (p = 0.483; PPM: 227.9±64.7 N/kg; FP: 237.5±57.9). A small effect size (d = 0.15) suggests the small differences were likely not meaningful. A high level of agreement (r = 0.959) was observed between the PPM and FP.

**CONCLUSIONS:** These data demonstrate that vertical force measured using the Tekscan Strideway plantar pressure system are comparable to the more expensive criterion method of a strain gauge-based force platform measures. Moreover, the Strideway platform is mobile providing a solution for non-laboratory based assessments of vertical forces. Further research should evaluate the validity of the Strideway plantar pressure system during more dynamic activities such as jumping and landing and for different force-related variables.
CONCLUSION: Structured exercise-based intervention efficiently manage weights, prompts speech and communication skills, enhances sensory ability, and improves health behaviors through whole environmental construction. It is a feasible alternative intervention for ASDs. Supported by the Natural Science Fund for Colleges and Universities in Jiangsu Province (17KJA330001).

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PURPOSE: The purpose of this study was to examine if improvements in training-induced fitness levels are related to the severity of autistic symptoms in children with autism.

METHODS: A total of 26 children (7.88 years ± 2.27) with a diagnosis of autism, were recruited for this study. Prior to and on completion of the exercise intervention, the children’s fitness levels were assessed using the Modified Eurofit Physical Fitness Battery, which included a 20m Sprint, Stork Balance test, Standing Broad Jump, Sit & Reach and a Hand Grip Strength Test. The exercise intervention was 8 weeks duration with three 1-hour sessions per week. The exercises included push and pull upper and lower body exercises, incorporating fundamental movement skills, through games aimed at the interests of the children. The severity of autism symptoms was assessed using the Gilliam Autism Rating Scale (GARS), completed by their teacher. Based on this rating, the children were divided into low, moderate or high groups, in terms of their autism symptoms. A spearman’s correlation was undertaken between the GARS score and the overall percentage change in fitness levels for each child within the 3 categories.

RESULTS: The results of the study demonstrated that children who had the greatest symptoms of autism (high group) demonstrated the greatest correlation to change in fitness levels (r=1.0, p < 0.01) with a mean percentage change in fitness levels of 285.93% ± 322.16. In comparison the moderate and low groups only had a correlation of 0.35 (p >0.05) and r=0.592 (p < 0.05) and their overall mean percentage changes in fitness levels were 26.87% ± 33.79 and 65.93% ± 114.79.

CONCLUSIONS: The results of this study suggest that exercise programs for children with autism appear to be most effective for participants with more severe autistic symptoms.

METHODS: Thirty-one subjects with SCI who use a manual wheelchair for primary mobility wore an accelerometer-based ActiGraph device on their wrist and performed 18 activities of daily living and exercise at different intensities for 10 minutes each. The criterion intensity was obtained from a portable metabolic cart. Activity counts from the ActiGraph was correlated with the criterion to derive cut-points using linear regression. Data from 80% of the subjects was used to derive cut-points using an iterative process with 1000 iterations while the derived cut-points were tested for accuracy on the remaining 20% of the subjects. Cut-points were also tested on data from 14 subjects in a separate study following a similar protocol.

RESULTS: Accelerometer cut-points derived for people with SCI yielded an overall accuracy of 84.3% with 98.4% and 65.8% accuracy for classifying sedentary, light and MVPA activities, respectively, when tested on the 20% subjects, and an overall accuracy of 86.9% with 94.7%, 86.6% and 74.7% for the three intensities, respectively, when tested on the 14 subjects in the other study.

CONCLUSION: The high accuracy of the cut-points particularly for classifying sedentary behavior may be very useful tool for interventions aiming at reducing sedentary behavior in this population. Supported by a VA Merit Review Grant.

Purpose: Does The Severity Of Autistic Symptoms Influence The Effects Of An Exercise Intervention Program?

Procedures: The exercise intervention was 8 weeks duration (SCI). Many of these individuals use wheelchairs for mobility and rely on their upper extremities for almost all PA.

CONCLUSION: Structured exercise-based intervention efficiently manage weights, prompts speech and communication skills, enhances sensory ability, and improves health behaviors through whole environmental construction. It is a feasible alternative intervention for ASDs. Supported by the Natural Science Fund for Colleges and Universities in Jiangsu Province (17KJA330001).
1354 Board #116 May 30 9:30 AM - 11:00 AM

Differences in Exercise Effects from Static versus Dynamic Standing in Non-Ambulatory Children with Cerebral Palsy

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(No relevant relationships reported)

PURPOSE: To compare the metabolic adaptive effects to four months of two types of structured training regimes, static standing (StS) versus dynamic standing (DyS), on cardiopulmonary and metabolic parameters among non-ambulatory children with cerebral palsy (Na-CP).

METHODS: Eighteen Na-CP participated in an exercise intervention study with a crossover design, comparing four months of StS to four months of DyS. During StS, the Na-CP were encouraged to exercise according to standard care recommendations in Sweden including daily supported StS for 30-90 minutes. During DyS, daily exercise for at least 30 minutes at a speed between 30 to 50 rpm in an Innowalk (Made for movement, Norway) was recommended. We assessed adaptive effects from the exercise programs through indirect calorimetry during 30 minutes of StS and DyS. Exercise test to evaluate StS was performed in a standing frame and to evaluate DyS using an Innowalk (Made for movement, Norway). An airtight mask covering the mouth and nose was worn in order to measure breath-by-breath VO2, VCO2, and VE (Oxycon Mobile, Jaeger, Germany). Heart rate was recorded continuously throughout the test (Polar T1, Polar, Finland).

As many of the variables were linearly correlated, we used robust Principal Component Analysis (rPCA) to determine the components carrying most information. A multidimensional Shapiro-Wilk test indicates that the data can be well described as being multivariate normal distributed, allowing the use of a Hotelling T2 test.

RESULTS: In a multidimensional statistical analysis of metabolic exercise effects, oxygen consumption, carbon dioxide production, and ventilation were concluded to carry most information and additionally, seen to be statistical different between StS and DyS. Exercise test to evaluate StS versus DyS revealed a p-value for the two groups having different means of 4.6 *10^-5.

CONCLUSIONS: A highly statically significant difference was found in the metabolic adaptation, described as VO2, VCO2, and VE, to StS versus DyS.

1355 Board #117 May 30 9:30 AM - 11:00 AM

Effects of Inpatient Multicomponent Occupational Rehabilitation on Physical Activity Levels

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(No relevant relationships reported)

PURPOSE: To assess whether inpatient multicomponent occupational rehabilitation, including physical activity (PA), increases the PA level of participants more than an outpatient program without PA, and whether changes in PA are associated with future work outcomes.

METHODS: 265 participants were included in one of two randomized clinical trials. Participants had been sick listed 2 to 12 months with a musculoskeletal, psychological or general/unspecified diagnosis. We measured PA by questionnaires at the start of the programs, and at 3, 6 and 12 months of follow-up. Between-group differences in PA were assessed using linear mixed models. Associations between change in PA and future work outcomes were assessed by logistic and linear regression. RESULTS: There was no difference in change in PA between the inpatient and outpatient programs during 12 months of follow-up. We did not find any associations between the amount of PA and future work outcomes. However, intensity of PA was positively associated with return to work (RTW); participants reporting increased vigorous PA had an odds ratio (OR) for RTW of 4.1 (95% confidence interval [CI] 1.1 to 15.7) whereas participants reporting consistently high intensity of PA had an OR of 3.1 (95% CI 1.0 to 9.7), compared to participants reporting low intensity PA.

CONCLUSION: Inpatient occupational rehabilitation, including PA, did not increase PA-level in the follow up period more than a less comprehensive program without PA. The amount of PA was not associated with future work outcomes. However, vigorous PA showed a positive association with RTW.

1356 Board #118 May 30 9:30 AM - 11:00 AM

Sedentary And Physical Activity Patterns In Adults With Intellectual Disability

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(No relevant relationships reported)

Introduction: Adults with intellectual disabilities (ID) present higher health risks due to their extremely low physical activity (PA) levels. It is important to enhance our knowledge about PA levels and sedentary time (ST) among this specific population.

Purpose: This study describes and compares PA levels and ST of active (AG) and a non-active (NAG) groups of adults with ID versus a group of adults without ID (AWID).

Method: Thirty-seven participants from an AG with ID, 29 participants from a NAG with ID and 31 adults AWID participated in this study. An informed consent and a health screening questionnaire were completed by each participant and each legal guardian. Height and weight were obtained to calculate BMI. PA and ST levels were assessed with ActiGraph accelerometers for 7 consecutive days. A chi-square test of independence was performed to examine the relation between groups and ID levels.

Variables of age and anthropometry were analyzed by using a one-way analysis of variance (ANOVA). Total PA and PA levels of each group were compared by using a one-way analysis of covariance (ANCOVA).

Results: The AG performed higher values of moderate to vigorous PA compared to the NAG (p < 0.018), but, similar to the group of AWID. The group of AWID spent less time in ST and more time in light PA than both groups of adults with ID (all p < 0.001).

The participants of the AG did not demonstrate less ST than the NAG.

Conclusion: When assessing PA levels in ID participants, it was observed that participants presented large amounts of sedentary behaviors in both groups. The participants of the AG, despite participating in PA programmes did not demonstrate less ST. We believe that, by including well designed and structured PA programmes into their workdays, as well as incorporating breaks to reduce bouts in ST and total ST, could be of great help to increase daily PA levels in adults with ID.

Partially supported by: MEC (DEP2017-86862-C2-1-R)
The Fitness Effects Of A School-based Exercise Program On Children With Autism.

Craig Coffey, Sharon Kinsella, Damien Sheehan. Institute of Technology Carlow, Carlow, Ireland. (Sponsor: Avery Faigenbaum, FACSM)

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(No relevant relationships reported)

PURPOSE: To examine the effects of a school-based exercise program on the fitness level of elementary school children who attend an autism class.

METHODS: A total of 35 (7.66 years ± 2.1) children with a diagnosis of autism were recruited for this study. Prior to and on completion of the exercise intervention the fitness levels of the children was assessed using the Modified Eurofit Physical Fitness Battery, including a 20m Sprint, Stork Balance test, Standing Broad Jump, Sit & Reach and a Hand Grip Strength Test. The exercise program was 8 weeks duration, with the children partaking in 3, 1-hour supervised sessions per week. The intervention was comprised of push and pull upper and lower body exercises and incorporated fundamental movement skills. These movements were achieved through games aimed at the interests of the children and were adapted to each child’s specific needs through the use of visual aids using an iPad. The data were analysed using paired t-tested.

RESULTS: All variables except Hand Grip strength significantly improved (p<0.05) over the eight-week period. 20m sprint times improved (p=0.05) by 0.46s ± 1.36. The Stork balance test significantly improved (p=0.05) by 17.82± 38.86. The standing broad jump significantly increased (p<0.05) by 14.54±m 20.29. The Sit and Reach score significantly increased (p<0.05) by 3.05cm ± 4.51. No significant (p>0.05) change was noted in the Hand Grip strength which increased by 0.38psi ± 1.38.

CONCLUSIONS: These preliminary findings indicate that an 8-week school-based exercise intervention can significantly improve selected fitness variables in children with autism.

1357
Board #119
May 30 9:30 AM - 11:00 AM
The Fitness Effects Of A School-based Exercise Program On Children With Autism.

1358
Board #120
May 30 9:30 AM - 11:00 AM
The Examination of Judo on Physical Activity and Sleep in Children with Autism Spectrum Disorder

Paola M. Rivera1, Justine Renziehausen1, Kayla Baker2, Nicholas Leahy1, Jeanette Garcia1, Lei Xu3, University of Central Florida, Orlando, FL. 2East Carolina University, Greenville, SC. (No relevant relationships reported)

PURPOSE: The aim of this study was to examine the effects of an 8-week judo program on moderate-to-vigorous physical activity (MVPA), sedentary behavior (SB), and sleep quality in children with Autism Spectrum Disorder (ASD).

METHODS: Participants included 15 children (ages 8–17, with a formal diagnosis of ASD). The sample participated in an 8-week judo program (45 minutes, 1X week), with measures taken at baseline and at the end of the 8-weeks. In order to assess activity levels and sleep quality, participants were instructed to wear ActiGraph GT3X Accelerometers for 7 days and nights, only removing the device during water-based activities. Non-parametric paired t-tests were conducted to compare differences in MVPA, SB, and sleep quality (i.e. sleep efficiency, total sleep time, number of awakenings, and wake after sleep onset) pre and post judo. Chi-square tests compared the number of participants who met sedentary and MVPA recommendations.

RESULTS: Results indicate participants spent a significantly greater percentage of time in daily MVPA (8% vs 4%, p=0.05) following the program, however, actual MVPA minutes per day did not reach statistical significance (74.46 vs. 48.58 minutes per day, p=0.1). There was a significant increase in total sleep duration (572.56 vs 338.30, p<0.008) following the program, and although not statistically significant, a trend existed for improved sleep efficiency (92% vs 88%, p=0.1). There was an increase in the number of participants meeting MVPA (53% vs 27%) and sleep recommendations (40% vs 7%), although results were not statistically significant.

CONCLUSIONS: Improvements in MVPA and sleep quality were observed following the 8-week judo program, although statistically significant findings were limited due to the small sample size. Future studies should include larger samples of youth with ASD over a longer intervention period.

1359
Board #121
May 30 9:30 AM - 11:00 AM
A Community-based Running Program Enhances Gait Parameters in Children and Young Adults with Developmental Disabilities

Jilda Vargas-Adams, Jennifer Angeli, Micah Garcia, Ana Livecchi, Jason Long, Madison Peck, Sarah Schwab. Cincinnati Children’s Hospital Medical Center, Cincinnati, OH. (Sponsor: Kevin Ford, FACSM)

(No relevant relationships reported)

PURPOSE: This study aimed to substantiate the efficacy of a voluntary 10-week running program for children and young adults with developmental disabilities. We hypothesized that the running intervention would positively influence temporal-spatial parameters (TSPs) of gait. METHODS: Sixteen children and young adults with developmental disabilities, ages 7-24 years (M=15.3 ± 4.4 years) enrolled in a “Sit to Fit” training program. Participants engaged in group running practices in an outdoor community setting, twice weekly for 10 weeks. Training sessions followed a time-based progression of walk-run intervals with a gradual increase (~15%) in total outdoor community setting, twice weekly for 10 weeks. Training sessions followed a

Abstracts were prepared by the authors and printed as submitted.
length (mean difference 8.16 cm, p<0.05) increased significantly following the 10-week training period. We calculated a moderate effect size for stride length (d=0.50), small to moderate effect sizes for cadence (d=0.35) and walking velocity (d=0.26), and negligible effect size for step width (d=0.06). CONCLUSION: A community-based running program contributed to improved gait mechanics in a cohort of children with mobility impairments. Others have shown that walking ability gains are associated with improved bipedal gross motor skills like running. The results of this study indicate that the reverse may also be true: running was associated with gains in walking ability in children and young adults with developmental disabilities.

1360 Board #122 May 30 9:30 AM - 11:00 AM Flourishing and Physical Activity in Adolescents With and Without Autism Spectrum Disorder
Stephanie M. McCoy, Kristen Morgan. University of Southern Mississippi, Hattiesburg, MS. (No relevant relationships reported)

Autism spectrum disorder (ASD) is characterized by behaviors that can negatively affect daily life. However, little is known about the effects of physical activity (PA) participation on measures of flourishing (i.e., resilience in functioning) as well as excessive arguing and behavioral conduct problems in those with ASD vs. typically developing (TD) youth. PURPOSE: To compare measures of flourishing, excessive arguing, and behavioral conduct problems in youth with ASD compared to TD peers and determine if physical activity participation mediates these differences. METHODS: Analyses included 22,873 youth aged 10 to 17 years (mean 13.8 ± 2.3 yrs) from the 2016 National Survey of Children’s Health. Youth were grouped into those with ASD (n=656), and TD (n=22,217). Outcome variables included measures of flourishing (finishing tasks, staying calm, showing interest in new things), excessive arguing, and behavioral conduct problems. Logistic regression models, adjusted for age, sex, education, SES, and medication assessed the odds of each outcome comparing ASD to TD. Further analyses examined whether participation in PA (≥4 d/wk) mediated the relationships between ASD and outcome variables. RESULTS: Within youth with ASD, only 31% engaged in regular PA (≥4 d/wk) vs. 51% of TD youth. In adjusted models, those with ASD were 58% less likely to finish tasks (OR=0.42; p<0.001), and 65% less likely to stay calm when faced with a challenge (OR=0.35; p=0.009) compared to TD youth. Additionally, those with ASD were 3.48 times more likely to argue excessively (OR=2.98; p<0.001), and 5.54 times more likely to experience behavioral conduct problems (OR=5.54; p=0.001) compared to TD youth. After adjustment for PA, relationships were slightly attenuated for flourishing (OR=0.46; p=0.001; OR=0.38; p=0.014), excessive arguing (OR=2.80; p=0.001), and behavioral conduct problems (OR=5.10; p<0.001). ASD was not associated with showing interest in learning new things. CONCLUSIONS: Those with ASD were significantly less likely to flourish, and more likely to experience behavioral conduct problems and argue excessively compared to TD youth. However, PA attenuated these relationships. These findings suggest that regular PA may increase positive flourishing behaviors and decrease negative behaviors.

1361 Board #123 May 30 9:30 AM - 11:00 AM Age-related Changes In Para-athletes And Racing Wheelchair Performance
Julien Schipman, Pasquale Gallo, Andy Marc, Juliana Antero, Jean-françois Toussaint, Adrien Sedaoud, Adrien Marc. INSEP, France. (No relevant relationships reported)

PURPOSE: How aging affects para-athletes performance? During the last decades, following the motto of “Citius, Altius, Fortius”, all the para-athletic categories have significantly increased their performance levels. Such an improvement is not only reached by highly optimized prosthetics, but also by a gradual improvement on training, of nutrition, and recovery methods. Few studies have investigated the performance determinants in para-athletics. We studied the effect of age on maximal performance for wheelchair and para-athletes (51% male) aged 17 to 35 years. We collected data on the 53,554 results from previous international competitions between 2009 and 2017 for women and men para-athletics and racing wheelchair disciplines for a total of 472 sport disciplines (considering impairment types for each discipline). We fitted maximal performance by age through the validated Moore equation for each para-athletes and racing wheelchair disciplines. RESULTS: We found a similar age-related pattern in maximal performance between able-bodied, para-athletes and wheelchair athletes. However, the age of peak performance varies according to sex, impairment type and discipline. The top 100 best performances include a large age range (from 15 years to 55 years) in each discipline suggesting that performance haven’t probably been optimized with age for younger wheelchair and para-athletes. Maximal performance differences appear for running disciplines between the two categories: in sprinting disciplines para-athletes are faster than wheelchair athletes. To the contrary, para-athletes are slower than wheelchair athletes in endurance discipline, and the difference increases with distance CONCLUSIONS: Data reveal that only a few disabilities classes contributed to the maximal performance both in para-athletes and racing wheelchair discipline. Further studies will contribute to increase knowledge about age-related changes in para-athletes and racing wheelchair athletes.

1362 Board #124 May 30 9:30 AM - 11:00 AM Comparison Of Physical Activity Levels During Therapeutic Camp Activities In Youth With Disabilities
Vincenzo G. Nocera, Tyler J. Kybartas, Angela J. Wozencraft, Dawn P. Coe, FACSM. The University of Tennessee, Knoxville, TN. Email: vnocera@vols.utk.edu (No relevant relationships reported)

Youth with disabilities have limited opportunities to engage in leisure time physical activity (PA). Outdoor therapeutic recreation (TR) camps provide diverse PA opportunities that include structured (dramatic, functional, game, constructive) and unstructured (free time) activities that have the potential to benefit these individuals cognitively and physically. However, little is known about the PA levels during these activities. PURPOSE: To compare the PA levels of youth attending an outdoor TR camp, across various activity contexts. METHODS: Youth (n=25, 14±3.9 yrs) with disabilities attending an overnight TR camp, participated in the study. PA was assessed using ActiGraph GT3X or GT3X+ accelerometers worn on the wrist during camp activities. Participants engaged in 14 activities of varying contexts based on the primary skill addressed, creating five distinct areas. Gross/Functional activity involves simple movements (e.g., yoga, ropes course). Game play is activity that involves set rules (e.g., sports, games). Dramatic play includes pretend play (e.g., theatre, team building activities). Fine/constructive play involves manipulation of objects for creative purposes (e.g., science experiments, cooking). During free time, the youth choose their activities (e.g., playground activity, hang out in cabin). The mean vector magnitude [VM, counts per minute (counts·min⁻¹)] of individual activities was used to calculate the PA level of each area. One-way ANOVAs were used to determine differences in VM for each area as well among individual activities within an area. RESULTS: There were no differences (p>0.999) in the mean VM for any area: Gross/Functional (2601.4±1689.9 counts·min⁻¹), Game (2593.3±1515.9 counts·min⁻¹), Drama (2569.3±1420.9 counts·min⁻¹), Fine/Constructive (2061.3±1552.9 counts·min⁻¹), and Free Time (2557.9±1398.8 counts·min⁻¹). Additionally, there were no differences (p>0.999) among activities within each domain. CONCLUSION: The results revealed a consistent level of PA across all areas of activity. These findings suggest the activities offered in this outdoor TR program provide an opportunity for youth with disabilities to accumulate PA that may also benefit them cognitively and physically.

1363 Board #125 May 30 9:30 AM - 11:00 AM Recreational Ballroom Dance and Multiple Sclerosis
Linda B. Piacenti1, Alice F. Yan2, Alexander V. Ng, FACSM1. 1Marquette University, Milwaukee, WI. 2University of Wisconsin-Milwaukee, Milwaukee, WI. Email: linda.piacenti@marquette.edu (No relevant relationships reported)

Multiple Sclerosis (MS) symptoms include fatigue, pain, spasticity, sensory changes, motor dysfunctions, postural instability, sexual and bladder dysfunctions, and visual cognitive impairments. Despite advancements in exercise mitigating symptoms in persons with MS, adherence to physical activity recommendations is low and often MS patients are sedentary. Recreational ballroom dancing is a fun form of exercise, or physical activity, in which partners can support each other while learning basic to more complex dance steps. This study investigated the physical and psychological changes perceived by persons with MS who participated in a novel structured ballroom dance intervention. A secondary purpose was to gather suggested improvements for the intervention with the aim of promoting physical activity among persons with MS. METHODS: Community-dwelling persons with MS (n=13) participated in a ballroom dance pilot intervention which met twice/week for 8 weeks. Dances included rumba, foxtrot, waltz, salsa, swing, and tango. One week after program completion, participants were invited to one-hour focus group sessions. The focus groups were audio taped and transcribed verbatim. Thematic analysis was completed using NVivo qualitative analysis software. RESULTS: Four major themes emerged, which identified several benefits of ballroom dance: (1) Physical and Psychological Benefits: Ballroom dance improved their perceived symptoms including improved strength, endurance, coordination, and balance, along with less fatigue and depression; (2) Positive Social Support: Ballroom dance provided positive social support and was a fun date night activity with their partners; (3) Improved Confidence: The dance intervention built confidence in future exercise and lifestyle change; and (4) Barriers to Exercise Removed: Ballroom dancing removed barriers for exercise specific to MS patients. Participants noted difficulty with classes late in day and at inconvenient times. CONCLUSIONS: Recreational ballroom dancing was well-tolerated and
was perceived to be beneficial for promoting positive physical and psychological changes in people with MS. Future interventions could be improved regarding times and locations.

C-36 Free Communication/Poster - Physical Activity Assessment and Measurement Methods
Thursday, May 30, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

1364 Board #126 May 30 9:30 AM - 11:00 AM
Accelerometer-Based Activity Classification Algorithm for Toddlers: Machine Learning Approach
Soyang Kwon1, Pinky Sindu2, Katherine Nickole1, Patricia Zavos1, Albert Sugianto2, Mark V. Albert1.
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PURPOSE: To develop activity classifiers based on accelerometer data to recognize toddler’s eight distinct activities: walking/running, climbing up/down, standing, crawling, sitting, lying down, being carried, and riding a stroller/wagon.

METHODS: Twenty-four toddlers aged 13 to 35 months (50% girls) performed various prescribed activities during free play in a commercial indoor playground, while wearing Actigraph wGT3X-BT accelerometers on the hip and wrist. Their activities were video recorded. The video data were annotated and synchronized with accelerometer data. Five machine learning classifiers, including random forest, support vector machine, decision tree, K-nearest neighbors, and logistic regression, were trained and tested. Classifier performance was evaluated using subject-wise cross-validation.

RESULTS: Activity classifiers were developed based on 1,011 two-second window accelerometer signal clips from the 24 participants. Of the five classifiers tested, the random forest classifier presented the highest overall accuracy (69% for hip and 55% for wrist). Overall, hip data showed higher accuracy than wrist data. Based on the hip random forest classifier, 91% of “walking/running” activities and 84% of “sitting” activities were correctly identified. However, 35% of “being carried” activities and 30% of “standing still” activities were misclassified as “walking/running”. Only 8% of “stroller/wagon ride” activities were misclassified as “walking/running”.

CONCLUSIONS: This pilot study demonstrates that the machine learning approach can be used to detect toddler’s “walking/running” activities at a high level of sensitivity. However, the algorithm developed in this pilot study often misclassified “standing still” or “being carried” as “walking/running”. “Stroller/wagon ride” was less frequently misclassified as “walking/running”. Overall, hip data demonstrated higher accuracy than wrist data in detecting key activities for toddlers. Future research should focus to refine the algorithms and test external validity.

1365 Board #127 May 30 9:30 AM - 11:00 AM
Thresholds of Sedentary Behavior in Children Based on Various Measures
Email: ying.gao@jyu.fi

PURPOSE: To investigate the classification accuracy of estimates of energy expenditure (EE), accelerometer (ACC), muscle EMG, and heart rate (HR) for sedentary and non-sedentary activities in children. The agreement of directly measured value of metabolic equivalent of task (MET) with commonly used adult MET value was assessed.

METHODS: VO2, HR, triaxial ACC and thigh muscle EMG were simultaneously recorded from 35 healthy 7-12 year-old children, who performed 3 pre-determined sedentary and 5 non-sedentary tasks in a random order. Mean values of the concurrent 2 minutes epochs from the measures for each activity were analyzed. Resting EE (REE) was determined during 30 minutes rest in supine position. Adult-estimated MET (METa, VO2rest/VO2max) and calculated MET (METc, VO2cl/VO2max) were calculated. Mean amplitude deviation (MAD) was computed for ACC and EMG was normalized to mean muscle activity during self-paced walking. The classification accuracy of METc, METa, HR, ACC and EMG for SB was investigated by receiver operating characteristic (ROC) curves, the area under the ROC curve (AUC) with (95% confidence interval (CI) and optimal cut-points with sensitivity (Se) and specificity (Sp) for METc, METa, HR, ACC, and EMG were computed.

RESULTS: METa was 28.5% lower than METc in any activity (p<0.001). Measured REE in children was 5.0±0.8 ml/kg/min. Figure 1 shows the ROC curves with AUC and its 95% CI for METc, METa, HR, MAD and EMG. The optimal cut-points for SB was 1.3 for METc (Se=80% Sp=80%), 1.9 for METa (Se=80% Sp=82%), 104 beats/ min for HR (Se=78% Sp=82%), 0.003g for MAD (Se=83% Sp=89%) and 13% for EMG (Se=81% Sp=94%).

CONCLUSIONS: The SB threshold based on adult METs (≤1.5 METs) did not appear to be appropriate for children. All of the used indicators had reasonable classification accuracy with appropriate sensitivity and specificity for sedentary and non-sedentary activities in children.
Sedentary behavior (SED), low intensity behavior in a seated, reclining, or lying posture, is a potential risk factor for poor pregnancy outcomes. We evaluated the validity of commonly used methods to assess SED across three trimesters of pregnancy. METHODS: This cohort study of pregnant women measured objective and self-reported SED during each trimester including: 7 days (valid if ≥4 days with ≥10 hr) of thigh-worn activPAL micro3 (criterion) and waist-worn Actigraph GT3X and self-report from the Global Physical Activity Questionnaire (GPAQ; modified SED question in hr/day and relative Likert scale) and the Pregnancy Physical Activity Questionnaire (PPAQ) – SED subscale, hr/day only. SED hr/day and percent time in SED (SED%) from activPAL were compared to GT3X, GPAQ, and PPAQ using paired t-tests and Pearson’s r. Correlations were rated as: <0.5 poor; 0.5-0.69 moderate, 0.7-0.89 good, and ≥0.9 excellent. RESULTS: Fifty-eight women (mean age 32 ± 5 yr; pre-pregnancy BMI 25 ± 6 kg/m²; 76% white) provided three trimesters of valid activPAL data. Compared to activPAL, GT3X SED was similar in the 1st and 2nd trimester, slightly lower in the 3rd (p<0.03), and moderately correlated (Table). Self-reported SED was systematically lower by GPAQ and higher by PPAQ (all p<0.001); correlations with activPAL were poor-to-moderate (GPAQ) or poor (PPAQ). SED% was slightly higher by GT3X vs. activPAL in the 1st trimester (p=0.04), but otherwise similar, with moderate correlations throughout pregnancy. GPAQ (Likert) underestimated %SED (p<0.01) from activPAL in the 1st and 2nd trimesters, but not the 3rd, and had poor-to-moderate correlations. CONCLUSIONS: Compared to activPAL, waist-worn GT3X resulted in only moderate correlations with SED and SED% across pregnancy, though differences in mean estimates were minimal. Self-report questionnaires had large absolute error and were poorly correlated to SED hr/day across pregnancy, though differences in mean estimates were minimal. Approximately half of American households own a dog, and dog ownership is associated with higher levels of physical activity (PA). These increased PA levels are assumed to be dog-related, but there is limited scientific evidence to support this assumption. Although dog walking is classified as moderate intensity PA (3 METS) in the PA compendium, few studies have used objective PA measures to track intensity during dog walking bouts. PURPOSE: To 1) determine the % of daily accelerometer-estimated moderate-to-vigorous PA (MVPA) minutes that are accumulated during self-reported dog walking bouts, and 2) quantify the % of dog walking minutes that qualify as MVPA. METHODS: Thirty-three healthy dog owners (30 female; BMI 27.2±5.3; age 45.2±15.3) wore an Actigraph GT3X+ accelerometer on their right hip for 7 days. Dogs were a mean age of 5.85±3.7 (size: 11 small, 12 medium, 9 large). Participants were asked to maintain their normal routine, log leisure-time activity with and without their dog, and ActiGraph on/off periods. T-tests were used to compare differences in MVPA for dog age (<7 vs. >7) and size (med/large vs. small). RESULTS: Thirty-three participants averaged 56.62 ±31.1 min/day in MVPA. An average 42.12 ±25.25% of this time was spent dog walking. Of time spent dog walking, 65.19 ±26% was MVPA. There was no significant difference in % of MVPA min/day attributable to dog walking or % of dog walking in MVPA based on dog age or size (p>0.4). Combined ActiGraph and self-report data provides context for participants’ PA, and further insight for investigation (Figure 1). CONCLUSION: The sample demonstrated large variability, with some participants accumulating almost all MVPA from dog walking, and others accumulating little or none. Two-thirds of dog walking minutes were MVPA, but also varied by individual. Variations were not explained by dog size or age. Given the prevalence of dog ownership in America, further investigation into how dog ownership affects PA is warranted.
CONCLUSIONS: The Arabic version of the Rapid Assessment of Physical Activity (RAPA) for Arabic speaking people and the English version of the RAPA were found to be acceptable and reliable for use in the clinical setting. This study has provided a multilingual version of the RAPA which can be used to assess physical activity levels across different cultural and linguistic groups.

Acknowledgments: This study was funded by the British Academy and the British Columbia Ministry of Health. The authors would like to thank all the participants for their time and effort in completing the study.

References:
A Comparison of Two Algorithms for Generating ActiLife Equivalent Activity Counts

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No relevant relationships reported

Previous algorithms have been developed to approximately replicate ActiLife software’s activity counts when used with raw acceleration data from physical activity accelerometers.

PURPOSE: To compare a new algorithm based upon two cascaded infinite impulse response filters (ALG1) to an existing algorithm (ALG2; Brond, Andersen, & Arvidsson [2017]) for generating activity counts from raw acceleration data.

METHODS: Sixteen adult participants (19±1 yrs; 56.5±8.5 kg) completed a series of simulated free-living activities (e.g., walking, climbing stairs, eating, sitting down, brushing teeth, etc.) while wearing an accelerometer on their right wrist initialized at a sampling frequency of 32 Hz. These activity data are publicly available (https://archive.ics.uci.edu/ml/machine-learning-databases/00283/) within the UCI Machine Learning Repository. Activities varied in duration but averaged 155 seconds each. Vector magnitude activity counts/second (cps) were calculated using ALG1, ALG2, and ActiLife for each participant. Equivalence testing (equivalence margin: ±5% error from ActiLife cps) was used to compare mean cps values from ALG1 and ALG2 with those from ActiLife (criteria). Correlations and mean absolute errors for ALG1 and ActiLife were also calculated. Correlation coefficients were compared between algorithms using Meng’s z-test.

RESULTS: Mean error (% error from ActiLife [M = 65.4 cps] for ALG1 (1.7%; 99%CI: 0.8 to 2.7%) and ALG2 (-1.0%; 99%CI: -2.2 to -0.2%) was small and indicates both algorithms provided equivalent estimates to those obtained from ActiLife. Correlations for ALG1 (r = 0.992) and ALG2 (r = 0.987) with ActiLife were both strong; however, the ALG1 correlation was of a significantly greater magnitude than the ALG2 correlation (p = 0.025). Moreover, mean absolute error was smaller for ALG1 (4.9 cps) than for ALG2 (6.4 cps).

CONCLUSION: Mean vector magnitude cps values from ALG1 and ALG2 were comparable to those generated by ActiLife. Estimates from ALG1 appear to be more strongly correlated with ActiLife cps and have smaller absolute errors than ALG2. Additional research is needed to evaluate the performance of each algorithm for generating estimated ActiLife activity counts with acceleration data collected from body locations (e.g., waist, chest, ankle, etc.).

Validity Of Self-report Methods For Measuring Physical Activity And Sitting Time In Chilean Workers

Pia Martino, Nicolas Aguilar, Universidad de La Frontera, Temuco, Chile. (Sponsor: Wendy J Brown, FACSVM) Email: pia.martino@ufrontera.cl

No relevant relationships reported

PURPOSE: To test the validity of a single question (SQ) for measuring sitting time (ST) and the GPAQ for measuring physical activity (PA) and ST in workers using the ActiPAL, µ (AP) as reference.

METHODS: Workers wore an AP for 7 days to measure ST, standing and walking time (WT). The volunteers answered the SQ: How many hours each day do you typically spend sitting down while doing things like visiting friends, driving, reading, watching television, or working at a desk or computer on (a) an usual weekday, (b) usual weekend day? They also answered the GPAQ that measures PA (at work, leisure and travel) and ST. Reliability of the SQ was tested with intraclass correlation (ICC). Validity was tested using correlation, mean bias, and limits of agreement (LoA), and kappa to assess agreement between AP and both the SQ and GPAQ.

RESULTS: 91 workers (50.6% male) provided valid data. For AP, mean wear time was 16.2±1.17 h/day; on average, participants spent 9.0±1.87 h/day in ST, with no difference by sex (p>0.05) for week or weekend days (p=0.066). Mean standing time was 5.1±1.47 h/day, with women standing more than men (5.4±1.33 vs 4.8±1.55, p=0.044). WT was 2.1±0.71 h/day on average, with no differences by sex (p=0.96), but more WT on week than weekend days (2.2±0.82 vs 1.9±0.88 h/day, p=0.001). For the SQ, the ICC for ST was 0.53 for a usual day, 0.36 for weekdays and 0.45 for weekend days. The SQ showed fair correlation with AP on a usual day (r=0.20 and week days (r=0.23), but poor for weekend days (p=0.17), with mean biases of about -2.9 h/day when compared with AP. When ST was categorized into tertiles, agreement was significant but poor between the SQ and AP (46.1%, k=0.19, p=0.019). The GPAQ showed fair correlation with AP for measuring PA (r=0.39 with mean bias of -5.7 h/day (LoA: -14.5, 3.0 h/day). Moderate correlation was observed between the GPAQ and AP for PA at work (r=0.41, mean bias: -4.3 h/day; LoA: -11.1, 2.6 h/day). The GPAQ question for ST showed fair correlation with AP (r=0.37, mean bias: -2.7 h/day), LoA: -10.2, 4.8 h/day. When categorized into tertiles, agreement between GPAQ and AP was fair for both ST (k=0.22) and PA (k=0.22).

Validation of Apple Watch for Measuring Moderate-to-Vigorous Physical Activity in Children

Sunku Kwon, Youngwon Kim, Wonwoo Byun. The University of Utah, Salt Lake City, UT. Email: sunkukwon@gmail.com

No relevant relationships reported

RESULTS: There was sufficient validity between the AP and GPAQ questionnaires, but with relatively weak strength of association. Further research should be conducted to validate each measure with an instrumented criterion, such as accelerometry, among cancer survivors.

Validation of Apple Watch for Measuring Moderate-to-Vigorous Physical Activity in Children

Sunku Kwon, Youngwon Kim, Wonwoo Byun, The University of Utah, Salt Lake City, UT. Email: sunkukwon@gmail.com

No relevant relationships reported

RESULTS: Both instruments showed fair to moderate validity and poor ability for correctly classifying individuals into tertiles of ST and PA when compared with the AP.

Funded by DIUFRO14-003

PURPOSE: The Rapid Assessment of Physical Activity (RAPA), a simple physical activity survey containing nine questions with accompanying images, may be a valid method for assessing underserved populations. The purpose of this study was to evaluate the convergent validity of the RAPA and Yale Physical Activity Survey (YPAS) for socioculturally diverse endometrial cancer survivors.

METHODS: Fifty-nine endometrial cancer survivors were approached during their gynecologic oncology follow-up appointments. The 52 survivors who agreed to participate were administered the nine-item RAPA, which requires approximately 3 minutes to complete, and 35-item YPAS, which requires approximately 15 minutes to complete. The RAPA was scored when responding to one of five groups, 1-3, 4-9, 10-15, 16-29, and 30 or more. The YPAS was scored by entering the total time minutes to complete, and 35-item YPAS, which requires approximately 15 minutes to complete. The RAPA was scored when responding to one of five groups, 1-3, 4-9, 10-15, 16-29, and 30 or more. The YPAS was scored by entering the total time of activity. The YPAS provided Energy Expenditure (EE) and Summary Indices. Kendall Rank Correlation Coefficients (r) were analyzed to evaluate the convergent validity between the RAPA and YPAS. Data are presented as mean ± standard deviation. Statistical significance was set a priori at p<0.05.

RESULTS: Mean age (64 ± 10 yrs) and Body Mass Index (34 ± 8 kg•m-2) indicated an older, mostly overweight and obese sample. Mean time since diagnosis was 2.6 ± 1.7 years. The sample was socioculturally diverse, with 31% non-Hispanic black, 33% Mexican Hispanic, and 36% other race/ethnicity. Forty-two percent reported having earned a college degree, and 11% reported not having graduated high school. According to the RAPA results, 4% of the participants were sedentary, 44% were insufficient active, and 52% were active (27 out of 52). The five RAPA categories were significantly correlated to the YPAS Summary Index (r=0.34, p=0.001) and the YPAS Energy Expenditure Index (r=0.23, p=0.016). Although there were significant correlations between measures, the strength of the associations was not large.

CONCLUSIONS: There was convergent validity between the RAPA and YPAS questionnaires, but with relatively weak strength of association. Further research should be conducted to validate each measure with an instrumented criterion, such as accelerometry, among cancer survivors.

Identifying accurate instruments for assessing physical activity (PA) is crucial for surveillance and promotions of PA in children. Apple Watch has been appeared as one of the most popular wearable devices that are designed to monitor individual’s PA. However, little knowledge is available whether it provides an accurate estimate of time spent in moderate-to-vigorous PA (MVPA) in children. PURPOSE: To examine the validity of Apple Watch 3 in measuring MVPA in children using a portable indirect calorimetry system (Cosmed K5) as a criterion measure. We hypothesized the estimate of MVPA from Apple Watch would be comparable with that from Cosmed K5 for simulated free-living activities. METHODS: 20 school-age children (girls: 45%; age: 9.7 ± 2.0 yrs, BMI: 16.3 ± 3.2 kg•m-2) were fitted with an Apple Watch 3 on their dominant wrist and Cosmed K5 portable indirect calorimetry. All participants performed sedentary (i.e., sitting, watching TV), light PA (i.e., walking, playing with toys), and MVPA (i.e., brisk walking) over a 45-minute period. We calculated METs by dividing obtained VO2 values from Cosmed K5 by child’s predicted resting metabolic rates using the age- and sex-specific Schofield equations. We used ≥ 3 METs as a cut-off value to define a criterion measure of MVPA time (i.e. Cosmed K5) against which Exercise Time from Apple Watch was compared. Pearson’s correlation coefficient and mean absolute percent error (MAPE) between the two methods were calculated. We performed a paired t-test and equivalence test using SAS Proc Mixed procedure was performed to examine whether the Apple Watch’s Exercise Time is comparable to MVPA time from Cosmed K5.

RESULTS: The Exercise Time from Apple Watch showed a moderate correlation (r
Purpose: To test a multi-phased, signal pattern-specific step detection (SD) algorithm for a wrist-worn triaxial accelerometer

Methods: Adults [N=30; age: 37(11); female: 65%; BMI: 25.4(3.8)] wore accelerometers while engaged in 5-minute activity bouts (see Table 1), and hand-tallied steps were simultaneously recorded as the ground truth. Phase 1—Raw signals sampled at 60Hz were downloaded and preprocessed by: 1) low-pass filtering, 2) calculating the bandpass filtered vertical accelerations (VA) in gravity seconds (gs), and 3) calculating the integrated area under the curve for the VA time series. For all activities, the VA peak heights (VAPH) that minimized SD error relative to the ground truth were determined by brute force. Phase 2—Signal features for each activity (triaxial vector magnitude, signal variability, and device angle) were passed to a k-means clustering algorithm, which grouped all activities into 3 clusters. Phase 3—A Random Forest (RF) algorithm was used to estimate VAPH for each cluster using activity signal features as inputs, and the cross-validated root-mean-square (RMS) error was used to check for significant bias (p < 0.05), as determined by a two-sided sign test. Negative values indicate underestimation of steps/min relative to the observed algorithm-derived values for step detection [observed; estimated]

Table 1. Bias (mean difference) and accuracy (MdAPE) for the hand-counted (observed) algorithm-determined (estimated) steps/minute. Abbreviations: gravity seconds (gs), median absolute percentage error (MdAPE), min (minute).

<table>
<thead>
<tr>
<th>Activity</th>
<th>Observed Steps (steps/ min)</th>
<th>Estimated Steps (steps/ min)</th>
<th>Vertical Acceleration Peak Heights (gs)</th>
<th>Bias (steps/ min)</th>
<th>MdAPE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rest</td>
<td>0(0)</td>
<td>0(0)</td>
<td>[0.059; 0.057]</td>
<td>&lt;1</td>
<td>-</td>
</tr>
<tr>
<td>Computer Work</td>
<td>0(0)</td>
<td>0(0)</td>
<td>[0.059; 0.059]</td>
<td>&lt;1</td>
<td>-</td>
</tr>
<tr>
<td>Movie Viewing</td>
<td>0(0)</td>
<td>0(0)</td>
<td>[0.071; 0.070]</td>
<td>&lt;1</td>
<td>-</td>
</tr>
<tr>
<td>Standing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laundry</td>
<td>6(8)</td>
<td>29(19)</td>
<td>[0.085; 0.059]</td>
<td>23*</td>
<td>633</td>
</tr>
<tr>
<td>Vacuuming</td>
<td>48(13)</td>
<td>33(22)</td>
<td>[0.017; 0.025]</td>
<td>-15*</td>
<td>39</td>
</tr>
<tr>
<td>Stair Stepping</td>
<td>93(15)</td>
<td>94(20)</td>
<td>[0.035; 0.036]</td>
<td>&lt;1</td>
<td>11</td>
</tr>
<tr>
<td>Self-paced corridor walking</td>
<td>112(16)</td>
<td>104(34)</td>
<td>[0.033; 0.036]</td>
<td>-7</td>
<td>19</td>
</tr>
<tr>
<td>Treadmill</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5mph</td>
<td>52(19)</td>
<td>151(24)</td>
<td>[0.012; 0.017]</td>
<td>-37*</td>
<td>86</td>
</tr>
<tr>
<td>1.0mph</td>
<td>72(15)</td>
<td>60(37)</td>
<td>[0.022; 0.023]</td>
<td>-12</td>
<td>38</td>
</tr>
<tr>
<td>1.5mph</td>
<td>87(13)</td>
<td>78(39)</td>
<td>[0.029; 0.029]</td>
<td>-8</td>
<td>34</td>
</tr>
<tr>
<td>2.0mph</td>
<td>97(9)</td>
<td>110(31)</td>
<td>[0.034; 0.032]</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>2.5mph</td>
<td>107(8)</td>
<td>110(37)</td>
<td>[0.034; 0.033]</td>
<td>3</td>
<td>24</td>
</tr>
<tr>
<td>3.0mph</td>
<td>115(7)</td>
<td>122(27)</td>
<td>[0.033; 0.032]</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>3.5mph</td>
<td>123(7)</td>
<td>116(18)</td>
<td>[0.029; 0.031]</td>
<td>-7*</td>
<td>5</td>
</tr>
<tr>
<td>4.0mph</td>
<td>132(7)</td>
<td>118(16)</td>
<td>[0.024; 0.026]</td>
<td>-14*</td>
<td>5</td>
</tr>
<tr>
<td>4.5mph</td>
<td>143(8)</td>
<td>129(10)</td>
<td>[0.028; 0.026]</td>
<td>-13*</td>
<td>8</td>
</tr>
</tbody>
</table>

Result: The validity generalization using heart rate to predict PAEE is demonstrated by the correlation coefficients and the percentage of variance accounted for. The results indicate that the predicted PAEE values are not available for conditions wherein the observed step counts are equal to zero.

Purpose: To examine the validity generalization of heart rate prediction equations for PAEE. METHODS: Key words such as “energy metabolism,” “energy expenditure,” “heart rate,” “heart rate determination,” “prediction,” and “equation,” were searched in the scientific databases including PubMed, Web of Science, Google Scholar etc. Eligibility criteria was restricted to studies that predict PAEE using heart rate. The validity generalization model (Pearlman, Schmidt, & Hunter, 1980) was utilized for the analysis. Four components including sample size, observed validity coefficients, test reliability coefficients, and criterion reliability coefficients were summarized and examined from each study. When test and criterion reliability coefficients were not reported, the information was derived from the literature. The percentages of variance accounted for by “artifacts” were computed. RESULT: 96 validity studies were screened and 27 studies (Me/SD: Sample size = 45±13, Validity coefficients = .70±.13; Test reliability coefficients = .83±.03; & Criterion reliability coefficients = .95±.02) were analyzed to determine the degree of validity generalization using heart rate to predict PAEE. The percentage of variance accounted for by “artifacts” was .35±.13 (p = .13) and relatively high MdAPE (30.2 ± 4.9%) in relation to MVPA time from Cosmed K5. The 90% confidence interval of the Apple Watch’s Exercise Time was from 16.7 to 22.9 min, which was not completely included within the zone of equivalence defined as ± 10% of the values of Cosmed K5 (22.8 to 27.9 min); this indicates non-equivalence between Apple Watch and Cosmed K5.

Conclusions: Apple Watch showed poor agreement with Cosmed K5 for estimating MVPA time in this convenient sample of children. Subsequent research is needed to further examine the validity of Apple Watch monitor for quantifying various intensities of PA under free-living conditions.
for “by the artifacts” was only at 65%. Thus, the needed “75% decision rule” was no met. The estimated “90% credibility value” for the true validities was at .55, and the estimated average true validity was at .69. CONCLUSION: The validity to use heart rate predicting PAEE did not appear to be generalizable and these heart rate prediction equations should be used with caution, especially when it is used for another population.

### 1379 Board #141  May 30 9:30 AM - 11:00 AM

**Aerobic Exercise Training and Blood Lipids-Lipoproteins Among Healthy Adults: A Methodological Umbrella Review**

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(No relevant relationships reported)

**PURPOSE:** Meta-analyses (MA) that have examined whether aerobic exercise training (AET) affects blood lipids-lipoproteins have yielded conflicting findings. Since methodological characteristics and completeness of reporting may influence interpretation and generalizability of MA results, we sought to assess the quality of these parameters in published MA that examined the blood lipids-lipoproteins response to AET. METHODS: We used search terms related to AET and blood lipids-lipoproteins in six databases to find MA published in English, Portuguese, or Spanish. The MA included trials that: (1) enrolled adults with no established disease; (2) measured blood lipids-lipoproteins at baseline and post-AET; and (3) compared AEF to a non-exercising, non-dieting arm (CONTROL). RESULTS: Seven MA qualified for our umbrella review, with a total of 8,721 subjects (mean 1,245.8±602.2, range 393 to 2,024). Of these, five reported the number of AET groups for lipids-lipoproteins analysis (mean 10.3±8.3, range 2 to 35). Effect sizes (ES) for AEF versus CONTROL ranged from +0.9mg/dL to -8.5mg/dL for total cholesterol, 0 to +4.6mg/dL for high-density lipoprotein, 0 to -10.5mg/dL for low-density lipoprotein, and 0 to +13.7mg/dL for triglycerides. Only one of 20 items on the modified AMSTAR2 was fully satisfied by all MA which was the reporting of the Population, Intervention, Comparator, and Timing (PICOT). Meanwhile, most MA lacked a priori study design (n=6, 85.6%), failed to explore the relationship between features of the exercise interventions and ES (n=4, 57.1%), and interpreted results without discussing risk of bias (n=5, 71.4%). CONCLUSION: Overall, included MA showed low adherence to current methodological standards, which may partially explain the disparate findings of the effects of AET on blood lipids-lipoproteins. Future MA following current methodological standards that explore possible effect modifiers are needed to more precisely estimate the influence of AET on lipids-lipoproteins.

### 1380 Board #142  May 30 9:30 AM - 11:00 AM

**Regression Equation To Predict Body Fat In Elderly Women Using Body Circumference Measures**

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(No relevant relationships reported)

**Purpose:** The purpose of this study was to develop and validate an equation to estimate body composition in elderly women above 60 years of age using body circumference measures. METHODS: The sample consisted of 60 women individuals with an average age of 68.23±5.84 years, 63,97±10.65% 1,542±0.52m from the Vitoria metropolitan area. The group was split into two subgroups: a regression group (n=50) used to develop the equations and a validation group (n=10) used for cross reference. A multiple linear regression was used to develop the equation. Both equations included trials that: (1) enrolled adults with no established disease; (2) measured %BF obtained from the IB2 did not exceed estimates from O306c. Overall the residuals obtained from multiple linear regression indicated there was not a statistical difference between the measurements of the IB2 and O306c (t = -1.5) The one-way residual analysis using the Student’s t test for paired samples. The reliability of the equations was analyzed by the Blant and Altman method. RESULTS: The regression group had the following descriptive metrics: age 67.62±5.87 years, body weight 64.27±11.1kg, height 1.53±0.11m, and percent body fat 41.73±5.69%. The validation group had the following descriptive metrics: 71.3±4.8years, body weight 62.49±8.34kg, 1.55±0.53m, and percent body fat 41.75±4.04%. Body circumference variables were used to develop equations to predict body fat. Using the stepwise selection criteria, the following equation was developed: %body fat = 0.343 (hip) + 0.289 (waist) - 0.071 (handle)². Several parameters validated the strength of the equation: R² = 0.997; EPE = 3.2%; PFE ≤ 3.5%; and validation of the model based on the partial significance (F) of the subset of variables that showed the strongest effect. CONCLUSION: It is possible to develop an accurate and specific equation to estimate of body fat percent in elderly women using circumference measurements. The more important is that is easy to use by health professionals.

### 1381 Board #143  May 30 9:30 AM - 11:00 AM

**Is Cadence A Better Predictor Of The Walk-to-run Transition Than Speed And/or The Froude Number?**

Colleen J. Sands, Scott W. Ducharme, Elroy J. Aguilar, Christopher C. Moore, Zachary R. Gould, Catrine Tudor-Locke, FACSM. University of Massachusetts Amherst, Amherst, MA. (Sponsor: Catrine Tudor-Locke, FACSM)

(No relevant relationships reported)

Preliminary evidence suggests that a cadence of 140 steps/min is associated with the walk to run transition (W2R). However, this cadence threshold does not take into consideration leg length. Alternatively, the Froude number is used to compare the similarities of locomotion across individuals by incorporating leg length, and provides a theoretical prediction of the W2R at a value of 0.5. Additionally, the W2R has been shown to occur at an estimated speed of 2.09 m/s. If supported, a W2R cadence value could be used to identify running in free-living accelerometer-based data sets.

**PURPOSE:** To examine whether 140 steps/min is a more accurate predictor of the W2R than a Froude number of 0.5 or a speed of 2.09m/sec. METHODS: Twenty-eight healthy adults (20 men, 8 women; age=22.6±1.9 years, height=172.5±11.8 cm, weight=79.3±18.8 kg) completed a treadmill protocol consisting of 5-minute bouts during which speed increased by 0.5 mph per trial from 0.5-6.0 mph. Participants could choose to run or walk each bout, and the protocol was terminated following the first bout at which the participant chose to run. The analytic sample consisted of two bouts for each participant (the running bout, and the bout immediately preceding walking) to identify the W2R transition. Cadence was derived by dividing directly-observed step counts (hand-tall) by 5 minutes. Froude numbers were calculated as Froude=V/ld, where v=walking velocity, g=gravity, and d=leg length. W2R sensitivity, specificity and overall accuracy were calculated. RESULTS: 140 steps/min predicted the W2R with a sensitivity of 85.7%, a specificity of 100%, and an overall accuracy of 92.9%. A Froude number of 0.5 predicted the W2R with a sensitivity of 35.7%, a specificity of 96.4%, and an overall accuracy of 66.0%. A speed of 2.09 m/s predicted the W2R with a sensitivity of 14.3%, a specificity of 96.4%, and an overall accuracy of 55.4%. CONCLUSION: A cadence of 140 steps/min was a more accurate predictor of the W2R than the traditionally supported Froude or speed values. Given the high sensitivity, specificity and overall accuracy values, 140 steps/min may be used to identify running behaviors in free-living accelerometer-based data.

### 1382 Board #144  May 30 9:30 AM - 11:00 AM

**Validation Study of Inbody Band2 and Agreement Between Inbody Band2 and Omron 306 in Adults**

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(No relevant relationships reported)

Activity trackers (AT) continue to be one of the top fitness trends as the wearable market continues to diversify. As new features of AT’s emerge, the need for evidence-based research is needed for reporting the reliability and validity of existing devices. **Purpose:** The purpose of this study was to assess the validity and reliability of the single frequency bio-impedance analysis (SF-BIA) device, InBody Band2 (IB2) compared to the Omron HBF-306c (O306c). **Methods:** A total of 54 adults participated in the reliability and validation study (23 males and 31 females; average age 45.27 years). Each instrument provided percent body fat (%BF). The Pearson correlation, Blant-Altman analysis, t-test and one-way ANOVA were used to determine significance of relationship between the two SF-BIA devices and reliability of the IB2. RESULTS: A Pearson’s product-moment correlation was run to assess the relationship between measurements of %BF in adults using the IB2 and O306c. Analysis showed a statistically significant and a strong positive correlation between the instruments, r(49) = 0.91, p<0.01. The mean difference (i.e., IB2 - O306c) was -0.11 with a 5.85 upper confidence limit and a lower confidence limit of -2.92. No proportional bias or statistical difference between the IB2 and O306c was found. Examination of the residuals obtained from multiple linear regression indicated there was not a statistical difference between the measurements of the IB2 and O306c (t = -1.5) The one-way repeated measures ANOVA determined that the IB2 measurements of %BF did not result in statistically significant changes, F(1,63) = 4.141) = 1.690, p = 0.195, partial w² = 0.04. The IB2 showed excellent reliability with repeat measurements differing by 0.125 (95% CI, 0.14 to 0.39). **Conclusions:** Findings indicate that the estimates of %BF obtained from the IB2 did not exceed estimates from O306c. Overall the measurements were equivalent. IB2 showed excellent reliability.
Accuracy of Activity Trackers during Treadmill Walking versus Outdoor Walking

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Establishing the accuracy of devices that measure daily activity is important in controlled lab settings and in real-life settings. PURPOSE: To assess the accuracy of a pedometer and 6 popular activity trackers at measuring steps while walking on a treadmill and walking outside. METHODS: Twenty-three college students (Mean±SD: 22.2±3.7yrs; 24.9±4.1kg/m², 11 males) walked 500 steps at 3mph on a treadmill while wearing 7 different activity trackers (Pedometer (PED), Blaza (BLA), Charge HR (CHIR), Alta (ALT), Flex (FLX), Zip (ZIP), One (ONE)). During a second visit, participants wore the devices while walking 400 meters at 3mph outside. Step counts were manually counted (MC) and EE was measured using indirect calorimetry (IC). The estimates of PA parameters from the smartphone and accelerometer were compared to each other and to the gold standard measures (MC and IC) using the concordance correlation coefficient (CCC) with the thresholds: almost perfect >0.90; substantial >0.8 - 0.9; moderate 0.65 - 0.8; poor <0.65. Levels of agreement are expressed as mean bias with 95% limits of agreement (LOA). RESULTS: Compared to MC (700 ± 98 steps), the smartphone (703 ± 97 steps; CCC 0.990; mean bias -2 steps, LOA -28 to 24 steps) and accelerometer (675 ± 133 steps; CCC 0.976; mean bias -25 steps, LOA -197 to 129 steps) provided accurate measurements of step count. Compared to IC (8 ± 3 kcal·min⁻¹), the smartphone (6 ± 1 kcal·min⁻¹) underestimated EE with poor agreement between methods (CCC = 0.49; mean bias -1.9 kcal·min⁻¹, LOA -5.6 to 1.8 kcal·min⁻¹). During free-living, the smartphone (7990 ± 4673 steps·day⁻¹) substantially underestimated step count compared to the accelerometer (9085 ± 4674 steps·day⁻¹; mean bias -1095 steps·day⁻¹, LOA -4780 to 2591 steps·day⁻¹). CONCLUSION: The smartphone provided accurate measurements of step count during a controlled laboratory walking trial but substantially underestimated PA in comparison to an accelerometer during a period of free-living. Supported by a grant from the Digital Health and Care Institute.
SWA and ACT24 were correlated, and the mean absolute percent error (MAPE) of the ACT24 estimate was calculated relative to the SWA values. To assess the potential for contextualizing monitor data, data from Act24 were temporally matched with the SWA files and similar correlation and descriptive analyses were performed and averaged across individuals.

RESULTS: The daily estimates were highly correlated (r = 0.88, p<0.0001) and similar in magnitude for total daily EE (SWA: 2929 +/- 1106kcal; ACT24: 2902 +/- 950kcal) and for the lab activities and free-living (FL) conditions of college students. METHODS: 30 college students (15 females and 15 males) completed 7 lab tasks including shooting a basketball (BB), relaxing on a couch (Relax), hitting a racquetball (RB), walking up and down stairs (WUS), walking on an inclined surface (WUI), walking while using a smart phone (WSP), and using a laptop (COM). An accelerometer was placed on each wrist and the right hip. After the tasks, the students completed one week of FL conditions wearing an accelerometer on each wrist. Accelerometer counts from the P and NP wrists were compared using signed-rank tests for the FL conditions with paired t-tests for the lab activities.

CONCLUSION: Previous-day recalls such as ACT24 may be useful alternatives to questionnaires or wearable devices for assessment of daily activities over 24-h periods. The robust export options also enable data to be temporally matched with other data sources to provide contextual information to be merged with monitor data. The results reveal good overall agreement between the two methods at both the group and individual level and provides a promising way to investigate PA context; however, additional research is needed to understand the factors influencing error between report-based and monitor-based methods.

| Tab. 1 | May 30:9:30 AM - 11:00 AM | The Comparison of Using the Preferred or Non-Preferred Wrist When Measuring Physical Activity | Bryce T. Daniels, Kaitlyn M. Gallagher, Michelle Gray, Erin K. Howie. | University of Arkansas, Fayetteville, AR. | Email: bx0013@uark.edu | (No relevant relationships reported) |

People who participate in regular physical activity (PA) have a decreased risk of chronic diseases and premature death. A dramatic decrease of PA occurs from adolescence to young adulthood. With serious implications on health, PA is a critical behavior to measure. However, inconsistencies exist on how to measure PA. When using accelerometers, differences between the preferred (arm most commonly used to perform daily tasks of living) and non-preferred (NP) wrist may result in different estimates of PA. PURPOSE: The purpose of this study was to compare the P and NP wrist measured PA using commonly used research accelerometers during structured daily college activities and free-living (FL) conditions of college students. METHODS: 30 college students (15 females and 15 males) completed 7 lab tasks including shooting a basketball (BB), relaxing on a couch (Relax), hitting a racquetball (RB), walking up and down stairs (WUS), walking on an inclined surface (WUI), walking while using a smart phone (WSP), and using a laptop (COM). An accelerometer was placed on each wrist and the right hip. After the tasks, the students completed one week of FL conditions wearing an accelerometer on each wrist. Accelerometer counts from the P and NP wrists were compared using signed-rank tests for the lab activities and a paired t-tests for the FL conditions with a p<0.05. RESULTS: P and NP total counts per minute (tCPM) from the respective accelerometer were significantly different for BB, COM, RB, Relax, WSP, and WUS. All accelerometer counts from the P and NP wrists were compared using signed-rank tests for the FL conditions with paired t-tests for the lab activities. However, there is limited information regarding device-specific cadence thresholds provided for guidance. PURPOSE: To estimate device-specific cadence thresholds for MOD and VIG in 61-85 year old adults. METHODS: Thirty-seven healthy older adults (62.3% women; age=68.5±4.6 years; BMI=26.3±3.8 kg/m²) walked on a treadmill for 5-min bouts. The first bout was conducted at a 0.5 mph. Speed increased in 0.5 mph increments until participants reached 75% of their age-predicted maximum heart rate, started to run, or reported a Borg Rate of Perceived Exertion > 13. Cadence (steps/min) was measured across all speeds with multiple devices: ActiGraph GT9x (hip and wrist), activPAL (thigh), StepWatch (ankle), Fitbit Zip (wrist), and Garmin vivosmart® 3 (wrist). Oxygen uptake was measured with indirect calorimetry and converted to METs. Receiver Operator Characteristic (ROC) analysis was used to determine optimal cadence thresholds associated with MOD and VIG intensity using Youden’s index. RESULTS: Device-specific cadence thresholds for MOD and VIG intensity are presented in Table 1. The optimal device-specific cadence thresholds were associated with very good to excellent classification accuracy for both intensities (AUC > 0.8). Except for the wrist-worn ActiGraph, which had relatively lower specificity for identifying thresholds, optimal cadence thresholds for all devices ranged from 86-104 steps/min for MOD and 125-140 steps/min for VIG intensity. CONCLUSION: Device-specific cadence thresholds appear to be acceptable indicators of MOD and VIG walking intensities. FUNDING: NIH-NIA-5R01AG049024

Table 1: Device-specific cadence thresholds by intensity

<table>
<thead>
<tr>
<th>Device</th>
<th>Absolutely-defined Intensity</th>
<th>Cadence (steps/min)</th>
<th>Specificity (%)</th>
<th>Sensitivity (%)</th>
<th>AUC</th>
<th>CI (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ActiGraph (Wrist)</td>
<td>MOD</td>
<td>86</td>
<td>86</td>
<td>83</td>
<td>0.98</td>
<td>0.86-0.94</td>
</tr>
<tr>
<td></td>
<td>VIG</td>
<td>140</td>
<td>100</td>
<td>75</td>
<td>0.89</td>
<td>0.68-1.00</td>
</tr>
<tr>
<td>Fitbit Zip (Wrist)</td>
<td>MOD</td>
<td>93</td>
<td>77</td>
<td>93</td>
<td>0.91</td>
<td>0.87-0.95</td>
</tr>
<tr>
<td></td>
<td>VIG</td>
<td>136</td>
<td>97</td>
<td>100</td>
<td>0.98</td>
<td>0.96-1.00</td>
</tr>
<tr>
<td>ActiGraph (Wrist)</td>
<td>MOD</td>
<td>39</td>
<td>77</td>
<td>82</td>
<td>0.83</td>
<td>0.78-0.89</td>
</tr>
<tr>
<td></td>
<td>VIG</td>
<td>63</td>
<td>86</td>
<td>100</td>
<td>0.94</td>
<td>0.88-1.00</td>
</tr>
<tr>
<td>vivaactive® 3 (Wrist)</td>
<td>MOD</td>
<td>96</td>
<td>82</td>
<td>90</td>
<td>0.92</td>
<td>0.88-0.96</td>
</tr>
<tr>
<td></td>
<td>VIG</td>
<td>133</td>
<td>97</td>
<td>100</td>
<td>0.97</td>
<td>0.95-0.99</td>
</tr>
<tr>
<td>StepWatch (Ankle)</td>
<td>MOD</td>
<td>104</td>
<td>93</td>
<td>79</td>
<td>0.92</td>
<td>0.89-0.96</td>
</tr>
<tr>
<td></td>
<td>VIG</td>
<td>125</td>
<td>91</td>
<td>75</td>
<td>0.87</td>
<td>0.70-1.00</td>
</tr>
<tr>
<td>activPAL (Thigh)</td>
<td>MOD</td>
<td>101</td>
<td>85</td>
<td>85</td>
<td>0.92</td>
<td>0.89-0.96</td>
</tr>
<tr>
<td></td>
<td>VIG</td>
<td>138</td>
<td>99</td>
<td>75</td>
<td>0.99</td>
<td>0.72-1.00</td>
</tr>
</tbody>
</table>

AUC = Area Under the Curve
CI = Confidence interval
PURPOSE: Activity trackers are becoming increasingly popular worldwide. As a result, the market has expanded with different brands that produce a variety of activity trackers varying in function and ability. Consumers who purchase these devices rely on the functions that are advertised, especially when cost, exercise, and lifestyle choices are considered. The purpose of this study was to assess the accuracy of the energy expenditure function of three popular activity trackers (1, 2, and 3).

METHODS: A sample was drawn from students attending Indiana Wesleyan University. Of those eligible, a total of 35 participants completed the study. Each participant wore the three devices and walked on a treadmill for 10 minutes at 3.0 mph with no incline. To assess accuracy, a test was used to compare the total energy expenditure measurement obtained from each device to the indirect calorimetry measurement obtained, which is considered the gold standard of energy expenditure.

Correlations were calculated to analyze the relationships between the activity trackers.

RESULTS: All three activity trackers overestimated energy expenditure (p≤.05) when compared to the indirect calorimetry measurement. Activity tracker 1, 2, and 3 overestimated by 37, 22, and 4 kcalories, respectively. Activity tracker 1 (r = 0.667), 2 (r = 0.570), and 3 (r = 0.568) had a moderate correlation to the indirect calorimetry measurement.

CONCLUSIONS: Based on the findings of this study, consumers who purchase one of these devices will read an overestimated energy expenditure. Purchasing activity trackers can be expensive so doing research on which one is the most accurate is essential for consumers.
1393 Board #155 May 30 10:30 AM - 12:00 PM
Effects of Breaking-up Prolonged Sitting with Three Different Walking Break Conditions on Glucose Metabolism
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(No relevant relationships reported)

PURPOSE: To compare the metabolic effects of interrupting prolonged sitting with three different walking break conditions in healthy adults.

METHODS: In a randomized crossover trial, 16 inactive healthy adults (male: n = 7) aged 21-30 years (body mass index: 22.2 ± 2.3 kg/m²) completed four 26-h (from 8:00 AM on day 1 to 10:00 AM on day 2) laboratory conditions that included a 9-h intervention phase as follows: 9-h continuous sitting (SIT), 3-min brisk walking (60% VO2peak) every 35 min during 9-h sitting (WALK3), 5-min brisk walking every 50 min during 9-h sitting (WALK5), and 8-min brisk walking every 70 min during 9-h sitting (WALK8). Continuous intrinsitual glucose monitoring (CGM) was performed during the 26-h intervention period. Four 2-h postprandial periods were also analyzed. Four meals and one meal time were standardized across the conditions for all the participants.

RESULTS: Compared with that in SIT (mean ± SD: 5.66 ± 0.44 mmol/L), the 26-h mean glucose level during WALK3 (5.42 ± 0.42 mmol/L), WALK5 (5.44 ± 0.46 mmol/L), and WALK8 (5.44 ± 0.50 mmol/L) were significantly lower (all P < 0.01), with similar results for glucose total areas under the curve (iAUC; attenuated by 3%-4%; all P < 0.01), but no significant differences were found among the three intervention conditions. The 2-h breakfast postprandial glucose incremental area under the curve (iAUC) was significantly lower for WALK3 (33%) and WALK8 (25%) than for SIT (all P < 0.05) on day 1, whereas 2-h dinner postprandial glucose iAUC was significantly higher for WALKS (25%) than for SIT (P = 0.038). No significant treatment effects on both lunch (day 1) and breakfast (day 2) postprandial glucose were observed.

CONCLUSIONS: Three kinds of regular walking breaks attenuated 26-h glucose responses. WALK8 most likely influenced the 2-h postprandial glucose metabolism of the healthy young adults in this study.

1394 Board #156 May 30 10:30 AM - 12:00 PM
Does Pattern of Drink Intake Affect Exogenous Carbohydrate Oxidation During Prolonged Submaximal Running?
Stephen A. Mears, Benjamin Boxer, David Sheldon, Hannah Wardley, Caroline Tarnowski, Lewis J. James, Carl J. Hulston. Loughborough University, Loughborough, United Kingdom.
Email: s.a.mears@lboro.ac.uk
(No relevant relationships reported)

Marathons and half-marathons usually present drink stations every 5 km, providing opportunity for fast runners to consume fluid and carbohydrate approximately every 15-20 min. In recent attempts to break the marathon world record, drinks have been provided at more frequent intervals, often in smaller volumes. PURPOSE: To determine how the pattern of carbohydrate ingestion during running affects exogenous carbohydrate oxidation rates and measures of gastrointestinal (GI) comfort.

METHODS: Twelve well-trained male runners (27 ± 7 y; 67.9 ± 6.7 kg, VO2peak: 68 ± 7 mL/kg/min) completed three exercise trials of 100 min steady state running at 70% VO2peak. During the first trial, 200 mL water was consumed every 20 min and results were used for background correction of 13CO2 breath enrichment. In the final two trials a 1 L volume of a 10% dextrose solution, enriched with [U-13C] glucose, was consumed at a rate of either 200 mL every 20 min (CHO-20) or 50 mL every 5 min (CHO-5).Expired breath and venous blood samples were collected at rest and every 20 min during exercise. Subjective scales of GI comfort were recorded at regular intervals.

RESULTS: Exogenous carbohydrate oxidation rates were higher after 80 (0.58 ± 0.16 v 0.48 ± 0.16 g/min; P = 0.020) and 100 min (0.67 ± 0.14 v 0.58 ± 0.15 g/min; P = 0.016) of running in CHO-20 compared to CHO-5. During exercise, total carbohydrate oxidation rates were similar between trials and remained within a range of 2.0 to 2.5 g/min (P = 0.168). Oxidation of endogenous carbohydrate was lower in CHO-20 (1.87 ± 0.27 g/min) than CHO-5 (2.34 ± 0.44 g/min; P < 0.05). Serum glucose concentration increased above 5 mmol/L after drink ingestion, remaining elevated throughout exercise with no difference between trials (P = 0.095). There were no differences in reported symptoms of GI comfort (P > 0.05), with no subject reporting severe symptoms (all ≤ 6) in either trial.

CONCLUSIONS: Ingestion of a larger volume of carbohydrate solution at less frequent intervals increased exogenous carbohydrate oxidation rates, resulting in similar rates of total carbohydrate oxidation but with reduced contribution from endogenous carbohydrate stores.

1395 Board #157 May 30 10:30 AM - 12:00 PM
Acute Effects of Rotating Shift Work Paradigm on Activity and Metabolism
Vasavi Shabirish. University of Texas at Austin, Austin, TX
(No relevant relationships reported)

Shift work, which involves working during normal sleeping periods, results in asynchrony between central and peripheral molecular circadian clocks and is associated with increased risk for metabolic disease. Catecholamines released during physical activity act as entrainers of the circadian clock, and disruption of physical activity patterns may contribute to the negative effects of shift work.

PURPOSE: The purpose of this study was to investigate the acute effects of rotating shift work on physical activity patterns, glucose tolerance, and body composition.

METHODS: Eleven-week-old male mice on a FVB/N background were individually housed and randomly assigned to either a control group or a rotating shift work group. Control group mice were exposed to a normal 12:12 light/dark cycle, while the shift work mice were exposed to alternating 12:12 light/dark and dark/dark light inversions to simulate a rotating shift work pattern of 3 days “on shift”/4 days “off shift” for one week, followed by 4 days “on shift”/3 days “off shift” during the following week. Shift work conditions were maintained for two-weeks, followed by a 4-week period on normal light cycles and then another 3 weeks of alternating light cycles. Both groups received ad-libitum access to wireless running wheels, normal chow, and water. Glucose tolerance tests and body composition were measured at baseline, after two weeks, and the study end.

RESULTS: Acute exposure to rotating shift work resulted in the shift work group being significantly more active between zt0-zt12 (5 vs 28 km, p<0.001; 11.8 vs 61 km, p<0.001) and during lights on (15.9 ± 24.5 km, p<0.001; 11.8 ± 51 km, p<0.001) and significantly less active between zt12-zt24 (23.7 ± 49.9 km, p<0.01) compared to the control group. Activity in the shift work group was more distributed throughout the 24-hour period compared to the control group. Acute exposure demonstrated significant differences between groups for fasting glucose (p<0.05) indicating dysregulation in carbohydrate metabolism. No significant differences were observed in body weight and body composition between groups at any time point.

CONCLUSIONS: Acute exposure to a rotating shift work paradigm disrupts normal activity patterns and dysregulates carbohydrate metabolism.

1396 Board #158 May 30 10:30 AM - 12:00 PM
Acute Resistance Exercise Fails to Alter Post-Exercise Glycemic Control
William A. Braun, FACSM, Zach Rollan, Dar Hauck. Shippensburg University, Shippensburg, PA.
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(No relevant relationships reported)

Acute exercise has commonly been found to transiently enhance glycemic control during recovery from the exercise. This effect has more commonly been observed following aerobic exercise. PURPOSE: This study combined results from two recent smaller investigations to gauge the effects of resistance exercise on post-exercise blood glucose (BG) response to an oral glucose tolerance test (OGTT). METHODS: Data from seventeen resistance-trained volunteers were used: All subjects completed a resting control trial consisting of a 75-min OGTT following consumption of a 25% glucose solution dosed at 1 g/kg body mass. On a separate day, subjects completed either 30 repetitions of squat only exercise (at 10-RM); 30 repetitions each of squat, bench press and biceps curl (at 10-RM); or ~30 repetitions each of biceps curl and knee extension (at 10-RM). BG was assessed via fingertip sampling prior to exercise, post-exercise and during the OGTT (every 15 min). Blood lactate was collected at rest and upon completion of exercise. RESULTS: Resistance exercise resulted in significantly increased blood lactate vs. resting state (8.58±0.87 vs. 1.39±0.22 mmol/L). OGTT response following acute exercise was not significantly different (P>0.05) from the resting OGTT condition. BG area under the curve was smaller (p<0.05) following resistance exercise compared to resting control (11330.6±320 vs. 11551.3±405 arbitrary units). CONCLUSIONS: Based on the results of this investigation, acute resistance exercise was not found to elicit enhanced glycemic control. The volume of working muscle, the overall energy deficit induced by exercise and the magnitude of the body’s glycogen depletion may be important factors to consider when examining post-exercise blood glucose response to an OGTT challenge.
THE EFFECTS OF HIGH-VERSUS LOW-INTENSITY RESISTANCE EXERCISE ON ACUTE HYPERGLYCEMIA IN YOUNG HEALTHY MALES

Luis E. Segura, Brandon Beimborn, Shayan Emamjomeh, Josh A. Cotter, PhD, Evan E. Schick, PhD

Nearly one-third of Americans older than 18 years of age are pre-diabetic, yet much remains to be understood about this condition. Regular exercise can help control prolonged hyperglycemia, a hallmark symptom of type 2 diabetes, however, the nature in which exercise can alleviate periods of acute hyperglycemia, a common symptom of pre-diabetes, is unclear. Purpose: The purpose of this study was to examine the effect of high-intensity (HI) versus low-intensity (LO) resistance exercise (RE) on acute hyperglycemia in resistance-trained males. Methods: Thirteen recreationally trained males (age, 23.43 ± 2.18 yrs.; height, 175.16 ± 10.44 cm; mass, 77.02 ± 8.91 kg) completed three randomized testing sessions separated by 96 hours: 1) no exercise control (CON), 2) HI (5x4, 90% 1-RM), and 3) LO (3x14, 65% 1-RM). Following overnight fast, all three-testing session commenced with oral ingestion of a high glucose drink (2 g glucose/kg body weight). HI and LO protocols began 30 mins post-glucose ingestion. Capillary blood samples obtained via finger stick occurred immediately pre- and 30, 60, 90 and 120-mins post-glucose ingestion. Results: A two-way ANOVA revealed a significant p(0.015) time main effect for plasma glucose and insulin concentrations throughout the 120 min testing duration, however neither glucose nor insulin differed between conditions at any of the individual time points. One-way ANOVA showed that total glucose response in the HI condition, as assessed by AUC, was significantly greater (p=0.012) than in both CON and LO. Strong negative correlations existed between total body mass and lean body mass (r= -0.78) as well as lean body mass and LO glucose AUC (r= -0.78). High intensity resistance exercise may exacerbate acute episodes of hyperglycemia, thus combining high intensity with lower intensity resistance exercise may optimally manage skeletal muscle health and glycemic control.

EXERCISE ON ACUTE HYPERGLYCEMIA

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PURPOSE: We observed in previous studies that incremental running tests to exhaustion and continuous aerobic running leads to significant increases of cell-free DNA (cfDNA) in capillary blood, which showed a high positive correlation with total energy expenditure. Here we investigated the increases of cfDNA during different interval loads with a focus on metabolic rates, heart rate (HR), and TRIMP. We hypothesized that cfDNA shows a high association with carbohydrate energy expenditure.

METHODS: 14 male subjects were subjected to a stepwise incremental exercise test until exhaustion to determine the individual anaerobic threshold (IAT; as LT + 1.5 mmol/l) and subsequently participated in three different interval training sessions. cfDNA and lactate were taken after each step and metabolic data were monitored continuously after a 10min warmup phase on the treadmill (+1.5%) during 6 x 400m intervals at 18km/h with 2min pauses, 6 x 400m intervals at 18km/h with 5min pauses, and 6 x 1000m intervals at IAT with 2min pauses. The order of the first two tests that only differed in duration of pause was randomized. Heart rate and subsequent calculation of TRIMP was done based on ECG Monitoring.

RESULTS: cfDNA analysis showed a significantly higher increase in the 400m interval setting with short pause time (8.2-fold; 95% CI: 6.2-10.6; p<0.0001) compared to 4000m interval setting with long pause time (3.4-fold; 95% CI: 2.6-4.4; p<0.0001). In contrast to cfDNA TRIMP showed a significantly higher increase in the 400m interval setting with a long pause time (4.8-fold; 95% CI: 4.4-5.2; p<0.0001) compared to 4000m interval setting with short pause time (4.3-fold; 95% CI: 4.0-4.7; p<0.0001). In a global analysis across all interval tests and points in time cfDNA increased 7.0-fold (95% CI: 5.4-9.1; p<0.0001) and the highest correlation of this increase with all other physiological parameters was with carbohydrate energy expenditure (r=0.87; p<0.0001).

CONCLUSIONS: cfDNA appeared to reflect training load of the 4000m interval settings more properly than TRIMP. Here we report for the first time a high correlation between cfDNA and carbohydrate energy expenditure. Further studies will have to investigate the validity of cfDNA releases during exercise as a marker for carbohydrate energy expenditure.
Several studies have examined the metabolic responses of pre-exercise carbohydrate (CHO) ingestion in cycling and running, however, none of the existing studies compared directly cycling and running on the same individuals. PURPOSE: To examine the metabolic responses of pre-exercise CHO ingestion in cycling and running on the same individuals. METHODS: Eleven males (25.5 ± 3.2 years old, 175.7 ± 2.0 cm, body fat percentage 12.4 ± 4.2%, mean ± SE), following an overnight fast, cycled or ran for 30 min at 77-83% maximal heart rate (HR max) after ingestion of either 1g/kg body weight maltodextrin (CHO-Cycle and CHO-Run respectively) or placebo (PL-Cycle and PL-Run) solutions. Fluids were ingested 30 min before exercise in a double-blind and random way. Data were analyzed using three-way ANOVA, whereas pre-post exercise changes were compared by two-way ANOVA. RESULTS: Blood glucose and serum insulin responses were higher before exercise in CHO (mean CHO-Cycle+CHO-Run) (Glucose: 7.3 ± 0.4 mmol/l; Insulin: 59 ± 10 μU/l) compared to placebo trials (mean PL-Cycle+PL-Run) (Glucose: 4.7 ± 0.1 mmol/l; Insulin: 8 ± 1 μU/l) (p<0.01). No differences were observed during exercise among the 4 conditions, while blood glucose did not drop below 4.1 mmol/l in any trial. Blood lactate increased with exercise (post- pre difference) more in cycling (CHO-Cycle-PL-Cycle: 3.4 ± 0.4 mmol/l) compared to running (CHO-Run+PL-Run: 0.7 ± 0.2 mmol/l) (p<0.01). At the end of exercise plasma free fatty acids (FFA) were higher in placebo compared to CHO irrespective of exercise mode (PL-Cycle-PL-Run: 0.36 ± 0.03 vs. CHO-Cycle-CHO-Run: 0.14 ± 0.03 mmol/l), while at the same time plasma glycerol levels in PL-Cycle (137 ± 8 mmol/l) compared to PL-Cycle (87 ± 8 mmol/l) (p<0.01). CONCLUSIONS: During 30 min exercise at 77.83% HR max, lactate was higher in cycling compared to running irrespective of fluid ingestion, whereas glycerol and insulin responses were not affected when running. The ingestion of CHO reduced FFA concentrations independently of the mode of exercise, while glucose and insulin responses were not affected by the exercise mode.

Aerobic exercise with progressively higher workload stages done in succession challenges a person’s cardiorespiratory system as their VO2 max is estimated. Higher heart rates (HR) at the end of stages lowers a person’s estimated VO2 max. Adding electrolytes to a carbohydrate-based drink may raise VO2 max values if ingested before exercise. PURPOSE: Compare the merits of added electrolytes, in two otherwise similar beverages, when consumed before VO2 max tests that entail progressively higher workload stages. METHODS: In a randomized double-blind study subjects (13 men, 21 women) first gave written informed consent, followed by two stationary cycle ergometer workouts to estimate their VO2 max. Workouts were preceded by intake of a 2% sucrose solution, one of which was an electrolyte-rich (500 mg of vitamin C, 1 mg of Ca, 12 mg of B, 12, 100 mg of Mg2+, 400 mg of K+, 200 mg of Na+, 1 g of Cr) beverage, while the other was devoid of added electrolytes and served as a placebo. HR were recorded before, four times during, and after workouts. Ratings of perceived exertion (RPE) were provided at the end of workouts. HR were compared with a three-way (gender, treatment, time) ANOVA, with repeated measures for treatment and time. Estimated VO2 max and RPE were assessed with two-way (gender, treatment) ANCOVAs, with repeated measures for treatment and time. Body mass and body fat percentage were examined as covariates. Scheffe’s served as our post-hoc and a α= 0.05 denoted significance. RESULTS: There were significant inter-time differences for HR. RPE and VO2 max each had inter-gender differences. Yet there were no inter-treatment differences. CONCLUSIONS: Little research exists on the ergogenic effects on electrolyte formulations added to carbohydrate beverages, yet our results concur with studies that also saw a lack of inter-treatment differences.
Carbohydrate (CHO) consumption is a common practice during variable-intensity exercise (VIE) such as team sports. The effects of CHO on performance during VIE have been studied in adults; however, the effects are less defined in children and apparently not at all in prepubescent girls. **PURPOSE:** To investigate the effects of a 6% CHO drink on a one-minute performance test following 30-minutes of VIE in prepubescent girls. **METHODS:** Ten girls (10.4±0.7 yrs.) participated in this study. During the initial visit, maximal aerobic power was determined following a familiarization of the protocol used during the next two visits in which the child consumed either a CHO drink or an electrolyte-matched placebo (PL). The experimental protocol involved two 15-minute bouts of VIE (20, 55% maximal aerobic power and 6-second maximal sprint), beverages were consumed prior to exercise and after each 15-minute segment. A one-minute performance trial was then completed at maximal effort. Measurements during VIE included heart rate (HR), rating of perceived exertion (RPE), sprint mean power (MP) and sprint peak power (PP). During the one-minute performance bout, HR, RPE, total work (TW), and fatigue index (FI) were assessed. Data were analyzed using a 2-way ANOVA and paired t-tests. **RESULTS:** VO$_2$ max was 39.7±5.5 mL kg$^{-1}$ min$^{-1}$ and HRmax was 196±11 bpm. During VIE, there were no interaction effects, no trial effects (p>0.05) for HR, %HRmax, RPE, sprint MP, ERP and PP and no time effects (p>0.05) for HR, %HRmax, or MP. However, there were time effects (p<0.05) for RPE (VIE<PL) and PP (VIE=VIE). No differences were found between trials (CHO vs. PL) for one-minute performance for HR (190.8 ± 189.9 bpm), %HRmax (97.0±3.2 vs. 96.6±3.0 %), RPE (7.8±2.3 vs. 8.1±1.9), PP (238±70 vs. 235±60 W), FI (54.7±10.0 vs. 55.9±12.8 %), and TW (0.97±2.6 vs. 9.37±2.1 kJ). **CONCLUSION:** A 6% CHO drink is ineffective at improving one-minute performance following 30-minutes of VIE in pre-pubertal girls. Based upon the current findings, CHO supplementation does not appear to be beneficial with respect to improving performance for prepubescent children completing VIE activity lasting 30-minutes.
throughout recovery. CI was elevated acutely and decreased throughout recovery, but macronutrient intake ratios did not drastically change. Further investigations of these measures with a larger sample size is warranted given our preliminary data.

### Table 1: Demographic, Substrate Utilization, and Food Preference Descriptors' 

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<th>T1 Males</th>
<th>T1 Females</th>
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<th>T2 Females</th>
<th>T3 Males</th>
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<td>26.52±3.2</td>
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<td>28.29±3.1</td>
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<tr>
<td>JAM (GPA)</td>
<td>3.07±0.79</td>
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Presented in subgroup

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**CONCLUSION:** 

A significant difference between the pre-test (123.9±30.1 watts) and TRF (98.8±30.1 watts; p=0.010). Substrate utilization crossover showed a significant difference between the pre-test and TRF (p=0.012). Also, there was a significant difference between non-TRF and TRF resting RQ (p=0.012). The non-TRF resting RQ had a mean of 0.736±0.082 and the TRF resting RQ was 0.802±0.097. There was a significant difference between non-TRF and TRF resting RQ was 0.802±0.097 and the TRF resting RQ was 0.716±0.071. Non-TRF resting RQ had a mean of 0.736±0.082 and the TRF resting RQ was 0.802±0.097. There was a significant difference between non-TRF and TRF resting RQ was 0.012.

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### RESULTS:

The current study aimed to further investigate the metabolic impact of TRF. METHODS: Twenty one participants, ages 18-60, completed an eleven week study was to evaluate the relationship between energy status, sleep quality, recovery and training satisfaction in Division II female lacrosse players. METHODS: Twenty-one participants, ages 18-60, completed an eleven week sample and were randomized into two groups: TRAD and THSL. The intervention period lasted for 11 weeks and included a glycogen-depleting protocol on a cycle ergometer. Afterwards, participants were separated into two groups: THSL and TRAD. The THSL group consumed CHO beverages containing 1.2 g·kg⁻¹·h⁻¹ CHO, whereas the TRAD group consumed water. A maximal exercise test and a resting metabolic test were performed three times, four weeks apart from each other. At each time point, participants completed a questionnaire to assess dietary habits, sleep quality, training satisfaction, and recovery. The questionnaire included a sleep diary, a food diary, and a training satisfaction questionnaire. RESULTS: There was a significant decrease in the peak volume of oxygen uptake (VO₂peak) due to minimization of the carbohydrate intake during THSL compared to TRAD at every exercise stage. CONCLUSION: The results of the current study suggest that the low CHO intake during THSL may have negative implications on performance during exercise and recovery.
were related to reduced energy availability in EAD sportspersons (carb., r=0.60; prot., r=0.35; fat, r=0.66; p<0.05). Interestingly, the magnitude of its reductions was greater in carbohydrate, analysed by slope curves (carb, 25 ± 3; prot, 9 ± 2; fat, 16 ± 2; p<0.001). In addition, only carbohydrate intake was independently associated to hypometabolism in EAD population (OR, 2.91; IC 95%, 1.08 - 7.82; p<0.05).

**CONCLUSION:** Low carbohydrate intake is the major diet contributors to energy deficiency and hypometabolism development in physically active people. It may impair the weight loss protocols.

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**1413 Board #175 May 30 10:30 AM - 12:00 PM Acute Carbohydrate Restriction During Recovery From Prolonged Exercise Enhances Intramuscular Triglyceride Resynthesis**

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(No relevant relationships reported)

**Intramuscular triglyceride (IMTG) is an important substrate during moderate-intensity exercise, but providing a high carbohydrate (CHO) diet following exercise impairs IMTG resynthesis. Restricting CHO intake in the post-exercise period may augment the adaptive response to exercise, but whether this strategy enhances IMTG resynthesis is not known. Furthermore, because the lipid droplet (LD)-associated perilipin (PLIN) proteins promote IMTG storage, their distribution and interaction with LD may determine their role in post-exercise IMTG resynthesis.**

**Purpose:** To determine the effect of acutely restricting CHO during recovery from prolonged exercise on IMTG resynthesis and PLIN protein dynamics.

**Methods:** 14 male triathletes (27±1 y, 66±1.3 kg, 55±11.4% body fat) completed 4 h of cycling at ~56% VO2max. In the initial 4 h period following exercise 7 participants consumed a high CHO (carbohydrate) diet (CHO condition), while the other 7 consumed a low CHO (prot) diet (prot condition). During recovery, 4 and 24 h post-exercise were analysed using confocal microscopy. IMTG content and perilipin isoform contents were measured using a custom-made antibody cocktail Approach to a high purity antibody cocktail. In the initial 4 h period following exercise 7 participants consumed a high CHO (carbohydrate) diet (CHO condition), while the other 7 consumed a low CHO (prot) diet (prot condition). During recovery, 4 and 24 h post-exercise were analysed using confocal microscopy. IMTG content and perilipin isoform contents were measured using a custom-made antibody cocktail.

**RESULTS:** Intramuscular triglyceride (IMTG) content in type I fibres was lower at 24 h post-exercise in prot condition compared to CHO condition (−63%, P<0.001). In addition, PLIN2 and PLIN3 were lower in prot condition compared to CHO condition (−61%, P<0.001). However, PLIN5 was lower in CHO condition compared to prot condition (−33%, P<0.001).

**CONCLUSION:** Acute restriction of CHO during recovery from prolonged exercise has a tendency to initially enhance IMTG resynthesis, while the predominant PLIN isoform supporting post-exercise IMTG storage may be PLIN5.

**ACSM Scientific Abstract**

**Introduction:** Prolonged exercise on IMTG resynthesis and PLIN protein dynamics.

**Purpose:** Acute restriction of CHO during recovery from prolonged exercise has a tendency to initially enhance IMTG resynthesis, but the predominant PLIN isoform supporting post-exercise IMTG storage may be PLIN5.

**Conclusion:** The predominant PLIN isoform supporting post-exercise IMTG storage may be PLIN5.

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**1415 Board #177 May 30 10:30 AM - 12:00 PM The Effects of Endurance Training Under Low Energy Availability on Muscle Glycogen Contents**

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(No relevant relationships reported)

**PURPOSE:** Some previous studies demonstrated that acute bout of exercise suppressed appetite and reduced energy intake among athletes. However, the accumulative effects of reduced energy intake during consecutive days of training period remains unclear. The purpose of the present study was to investigate the influences of 3 days of endurance training under low energy availability on muscle glycogen content, endocrine responses and endurance capacity. **METHODS:** Seven male long distance runners (19.9 ± 0.4 years, 75.6 ± 1.8 cm, 69 ± 1.0 kg, 67.5 ± 1.6 ml/kg/min) completed 3 consecutive days of endurance training under low energy availability trial (LEA, 18 ± 0.7 kcal/kg FFM/day) and normal energy availability trial (NEA, 52.9 ± 1.9 kcal/kg FFM/day). The order of two trials was randomized with two weeks interval between trials. The experiment consisted of 3 consecutive days of endurance training (days 1-3) and exercise performance test on the following morning (day 4). The endurance training consisted of 75 min of treadmill running at 70% of maximal oxygen uptake (V02max) in both trials. Muscle glycogen contents, respiratory gas variables, subjective parameters, blood and urinary variables were evaluated in the morning during 3 days of training periods (day 1-day 3) and on the following morning after the training (day 4). As an indication of endurance capacity, time to exhaustion during submaximal running test was determined on day 4. **RESULTS:** LEA trial showed that body weight, free fat mass and skeletal muscle volume were significantly reduced during training period (P < 0.05). Also, muscle glycogen contents were significantly decreased in LEA (P < 0.001) with significant lower values than those in NEA trial (P < 0.001). Blood glucose, serum free testosterone and insulin like growth factor-1 concentrations were significantly lower with training under LEA (P < 0.05). On the other hand, serum leptin concentration did not change significantly in LEA trial during training period (P > 0.05). Time to exhaustion during submaximal running tested evaluated on day 4 was not significantly different between LEA trial (1170 ± 127 s) and NEA trial (1361 ± 196 s; P > 0.05). **CONCLUSION:** Three consecutive days of endurance training under Low EA reduced muscle glycogen content. However, endurance capacity was not attenuated.
It has been well documented that exercise of sufficient energy expenditure can elicit an increase in fat oxidation that persists following exercise. However, whether and how this exercise-induced metabolic benefit would be affected by replacing the energy expended during exercise remains unclear. **Purpose:** To compare energy expenditure and substrate utilization between exercise with and without energy replacement at rest and during exercise. **Methods:** Fourteen healthy and recreationally trained subjects including 7 men and 7 women volunteered to participate in this study. Each subject underwent three 2-day experimental protocols in a random order. Each protocol consisted of no exercise (NE), exercise only (E0), or exercise with energy replacement (ER) on day 1 that was followed by metabolic assessment that took place in a fasted condition on day 2. The exercise in EO and ER was a treadmill running at 60% VO2max that induced an energy expenditure of 500 kilocalories. The replacement meal used in ER contained 500 kilocalories made up by 45% carbohydrate, 30% fat, and 25% protein. During the metabolic assessment, oxygen uptake (VO2), heart rate (HR), respiratory exchange ratio (RER), and rates of carbohydrate (CHO) and fat oxidation (FOX) were determined in three successive 10-min periods that included rest, exercise at 50% VO2max and exercise at 70% VO2max. **Results:** No differences in VO2 and HR were found at rest between NE, EO, and ER. However, RER was lower in EO than NE (0.840±0.014 vs. 0.889±0.012, p>0.05), COX (g/min‘) was lower in ER than NE (0.144±0.016 vs. 0.197±0.019, p>0.05), and FOX (g/min‘) was higher in either EO or ER than NE (0.054±0.010 or 0.057±0.009 vs. 0.034±0.007, p<0.05). When these variables were compared under the exercise conditions, no treatment effects were noted for all variables at either intensity. **Conclusion:** Our results demonstrate that an acute bout of aerobic exercise can elicit an increase in fat oxidation even when the exercise-induced energy deficit is replaced by energy intake. These findings suggest that factors other than caloric deficit mediate the exercise-induced lipolytic effect.

**PURPOSE:** We determined the effects of acute and chronic calorie restriction on hepatic and skeletal muscle insulin sensitivity. **METHODS:** Twenty-three obese subjects (body mass index, 36.3±3.0 kg/m2) followed an energy-deficit diet (1,200 kcal/day). Magnetic resonance spectroscopy, muscle biopsies, and a euglycemic-hyperinsulinemic clamp were used to determine insulin action, cellular insulin signaling and intrahepatic triglyceride content before, after high-fat, and after ~12 wks (~7% weight loss) of diet therapy. **RESULTS:** Intrahepatic triglyceride content significantly decreased at both 48hrs (-16.6±2.3%, p<0.001) and 7% weight loss (-40.7 ± 6.2%, p<0.001) compared to baseline. Basal glucose production rate significantly decreased at 48hrs (-21.8±3.2%, p<0.001) and after 7% weight loss (26.1±4.3%, p<0.05). Insulin-stimulated phosphorylation of Jun N-terminal kinase did not change at 48hrs (-0.03±0.01, p>0.05) but did significantly increase at 7% weight loss (29.9±18.7, p<0.05) and phosphorylation of Akt increased by 15.2 ± 4.6% (p<0.05) and 36.2 ± 8.8% (p<0.05), after 48hrs and 7% weight loss, respectively. **CONCLUSION:** A low calorie diet acutely reduced intrahepatic triglyceride content and improved insulin sensitivity whereas moderate weight loss is necessary to improve insulin signaling and intrahepatic triglyceride content before, after 48hrs, and after ~12 wks (7% weight loss) of diet therapy.

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Obesity and associated comorbidities remain a significant health crisis. Exercise mitigates many of these pathologies, however, controversy remains on optimal exercise types for favorable adaptations. More so, mechanisms underlying these adaptations are not fully understood. Evidence suggests autophagy (cellular degradation and recycling of proteins) may be an important mediator for adaptations, however, the necessity of autophagy, specifically autophagosome formation, on exercise adaptations during obesity has yet to be investigated. **PURPOSE:** To investigate the individual and combined effects of different exercise interventions and autophagy inhibition on glucose handling and exercise capacity after high fat feeding. **METHODS:** C57BL/6J male mice initiated 45% high fat diet at 8 wks of age. After 6 wks of high fat diet, animals were divided into moderate intensity (MOD) or high intensity interval training interventions (HITT), animals were further subdivided into autophagy inhibition (AI) or control (CON) conditions. Animals exercised their respective protocols 3X wks/ wk, work and average intensity were matched between exercise groups. Autophagy was inhibited with 3X wk injections of NCS185058 at 100mg/kg of bodyweight, to block autophagosome formation, CON animals received vehicle injections. Animals continued interventions for 4 wks. Glucose tolerance tests (GTTs) and graded exercise tests (GXTs) were completed pre-high fat diet, pre-interventions, and post-interventions. **RESULTS:** High fat diet resulted in impaired glucose handling (~20% increase in glucose area under the curve (AUC)), while exercise interventions normalized glucose handling to pre-exercise levels, without any differences between groups. Additionally, high fat diet induced a ~20% lower aerobic capacity, which were normalized to baseline values after exercise interventions. AI animals had ~2.5g of weight loss from pre-to post-exercise interventions with no differences noted in CON animals. **CONCLUSIONS:** When exercise intensities and total work are matched, HIIT and MOD confer similar adaptations on exercise capacity and glucose tolerance in high fat fed mice. Also, late stage autophagy inhibition does not influence exercise adaptations, but does appear to influence body weight, which warrants further investigation.

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Time restricted feeding (TRF) is a form of dietary intake which limits the feeding time in a day. Researchers have observed weight loss and improved body composition as the original motivators for investigation of TRF. With a variation in energy intake during TRF, resting energy expenditure (REE) has been shown to increase with high caloric consumption. An increase in REE is also associated with an increase in fat mass and physical activity. Respiratory quotient (RQ) demonstrates the ratio between CO2 production and O2 uptake, determining substrate utilization at rest. RQ has been shown to change through altered macronutrient intake. Studies indicate, a diet high in carbohydrate intake increases RQ whereas diets high in fat intake have been shown to lower RQ. RQ has also been found to decrease when subjects partake in endurance training. **Purpose:** The intent of this study was to determine the impact TRF may have on RQ and REE. **METHODS:** Thirty-four apparently healthy adults ages 19-51 participated in 4 weeks non-TRF and 4 weeks of TRF. The feeding window for the TRF was a nine-hour period. Participants were provided journals over the course of the study to self-record caloric intake, exercise type, and duration. REE and RQ were measured using a metabolic cart initially, after 4 weeks of non-TRF, and after 4 weeks of TRF. Data was analyzed using IBM SPSS statistics. **Results:** RQ increased significantly between pretest (0.721±0.015) and TRF testing (0.808±0.02) (p<0.01). No significance was found between non-TRF and TRF. RQ had no significant difference between any of the three testing periods (p>0.23). There was no significant change in caloric intake throughout the testing (p=0.94). A significant decrease was found in total exercise days between non-TRF and TRF periods (p=0.023). **Conclusion:** This study did not find a significant change in RQ during TRF. The increase in RQ may have been attributed to increases in carbohydrate intake. Caloric intake was hypothesized to increase the first couple of days due to the time-restricted nature, but overall was not.
hypothesized to have a significant impact on energy intake or REE. Future studies should investigate the impact of TRF on macronutrient intake and carbohydrate utilization at rest.

**Board #182**

**May 30 10:30 AM - 12:00 PM**

**Resistance Exercise-mediated Improvements In Post-metabolic Response Are Related To Exercise Volume And Muscle Mass**

Patrick M. Tomko, Ryan J. Colquhoun, Nile F. Banks, Christina M. Sciarrillo, Nicholas A. Koemel, Sam R. Emerson, Nathaniel D.M. Jenkins, Oklahoma State University, Stillwater, OK. (No relevant relationships reported)

**PURPOSE:** To examine the effects of full-body resistance exercise on the post-metabolic response to a high-fat meal (HFM) in healthy men. **METHODS:** Ten males (mean ± SD, age = 24 ± 3 y, BMI = 26.8 ± 2.9 kg/m²) participated in this randomized, repeated measures, crossover study. Participants visited the laboratory for familiarization, and baseline strength and body composition testing. They then returned to the laboratory and completed either a session of resistance exercise (RE), consisting of three sets of 8 exercises using a 12 repetition maximum load, or no exercise (NE) and consumed a protein shake (300 - 400 kcas; protein = 0.6 kg) as their last meal. After a 12-h overnight fast, participants consumed a HFM (12 kcal/kg, 63% fat, 34% carbohydrate). Blood draws were performed prior to, and 1-, 3-, and 5-h post-meal to determine triglyceride (TG), glucose (GLU), and total metabolic load index (MLI; sum of TG and GLU) responses. Three separate, 2 (Condition) × 2 (Time) repeated measures ANOVAs were used to examine the TG, GLU, and MLI responses. Zero order correlations and stepwise multiple regression analyses were used to examine the relationships and relative contributions of RE volume (VOL) and skeletal muscle mass (SMM) to the change in MLI from NE to RE (ΔMLI). **RESULTS:** There were a significant condition × time interactions for TG (F3,27 = 3.5; p < 0.05) and MLI (F3,27 = 3.0; p < 0.05). There were condition (F1,9 = 8.9; p = 0.018) and between the two diet interventions. At the end of each diet intervention, a single bout of exercise was performed. **RESULTS:** Excessive load carriage is a major contributor to high energy expenditure. The reported loads carried by SOF Soldiers exceeded the recommendations in Army doctrine. Additionally, their high energy expenditure, if not managed by an equally high energy intake, has been shown to result in performance decrements and may compromise mission success. Special attention must be given to pack weights during pre-mission planning and nutrition strategies aimed at meeting mission demands and recovery from strenuous activity.

**Board #184**

**May 30 10:30 AM - 12:00 PM**

**Effects Of Menstrual Cycle On Energy Utilization And Endurance Performance In Eumenorrheic Women**

Tomoka Matsuda1, Mizuki Yamada2, Hazuki Ogata2, Kayoko Kamenoto1, Mikako Sakamaki-Sunaga1, 1Graduate School, Nippon Sport Science University, Tokyo, Japan. 2Nippon Sport Science University, Tokyo, Japan. (No relevant relationships reported)

The blood concentrations of estrogen and progesterone change during various phases of the menstrual cycle. The levels of estrogen and progesterone are lower during the menstrual period (MP) and higher during the luteal phase (LP) in eumenorrheic women. Previous studies have indicated that the menstrual cycle influences energy utilization during endurance exercises. Alterations in energy utilization that may occur during the different phases of the menstrual cycle in eumenorrheic women may also influence endurance performance. **PURPOSE:** The purpose of this study was to compare energy utilization and endurance performance between the MP and LP of the menstrual cycle during cycling performance. **METHODS:** The subjects were 16 eumenorrheic women (age = 22.1 ± 1.0 yrs) with regular menstrual cycle. Subjects exercised on a cycle ergometer at 60% VO₂peak for 45 min, and then exercise intensity was increased to 80% VO₂peak until exhaustion during the two phases of the menstrual cycle (MP and LP). Blood samples were collected at rest, 45 min during exercise, immediately after exercise, and 30 min after completion of exercise. Blood levels of estradiol, progesterone, glucose, and free fatty acid (FFA) were assessed. The duration of each menstrual cycle phase was estimated by assessing the levels of the estradiol and progesterone. **RESULTS:** The menstrual cycle of the subjects was 30.9 ± 1.9 days. MP was 4 ± 1.4 days, and LP was 24.8 ± 2.2 days. Blood concentrations of estradiol (MP, rest; 35.14 ± 6 pg/mL; LP, rest, 1641.58 ± 3 pg/mL, p < 0.001) and progesterone (MP, rest, 3.0 ± 2 ng/mL; LP, rest, 13.1 ± 5.0 ng/mL, p < 0.001) were significantly higher in LP than in MP. No significant differences were observed in the levels of glucose (p = 0.36), FFA (p = 0.80), and respiratory exchange ratio (p = 0.34) at all time points. Carbohydrate oxidation (MP, 38.5 ± 7.7 g; LP, 39.2 ± 6.4 g, p = 0.66), fat oxidation (MP, 11.6 ± 3.4 g; LP, 13.1 ± 2.4 g, p = 0.64), and exercise time to exhaustion were not different between MP and LP (MP, 7.4 ± 7.9 min; LP, 6.8 ± 6.0 min, p = 0.55).

**CONCLUSION:** Our results reveal no effect of the menstrual cycle phase on substrate oxidation and prolonged endurance exercise performance during cycling ergometer exercise in eumenorrheic women.

**Board #183**

**May 30 10:30 AM - 12:00 PM**

**Energy Expenditure and Load Carriage Exceeded Military Recommendations in Special Operations Forces Deployed to Afghanistan**

William R. Conkright1, Nicholas D. Barringer1, 1University of Pittsburgh, Pittsburgh, PA. 2U.S. Army Research Institute of Environmental Medicine, Natick, MA. Email: wrc16@pitt.edu (No relevant relationships reported)

U.S. Army Special Operations Forces (SOFO) undergo difficult missions in extreme environments, oftentimes while carrying heavy loads, the combination of which results in a high energy output. Energy expenditure in excess of intake may result in weight loss and impaired performance. In a scenario where energy demands consistently exceed intake, SOF members are at risk of injury and mission compromise. **PURPOSE:** To determine the energy expenditure of SOF Soldiers based on present-day missions in the Central Command (CENTCOM) region. **METHODS:** Demographics of the participants were as follows: age (yrs) 30±3.3, height (m) 1.76±0.02, body weight (lbs) 195±32, enlisted (68%), officer (7%), warrant officer (7%), years in the Army 8.3±3.9, and total time deployed during career (yrs) 1.26±1.2. Surveys were collected from 46 SOF Soldiers operating in eight locations in the CENTCOM theater of operations. Information from the surveys revealed the mission energy requirements and difficulty of exertion pre-, during-, and post-mission. A physical activity factor was determined based on multiple aspects surrounding mission intensity and used to calculate estimated energy expenditure based on a SOF-specific equation. **RESULTS:** During a six-month deployment, participants underwent a multitude of missions (17.2±5.9 days). Ninety percent of respondents reported carrying a load 40% heavier than the recommended fighting load (32.9 ± 8.6% vs. 21.8% kg, respectively) based on military doctrine. Average estimated energy expenditure (4846±525 kcal·day⁻¹) far exceeded the military’s reference intake of 3400 kcal·day⁻¹. All but three respondents reported a rate of energy expenditure exceeding the benchmark of 300 kcal·day⁻¹ necessary to maintain adequate energy reserves upon enemy contact. **CONCLUSION:** Excessive load carriage is a major contributor to high energy expenditure. The reported loads carried by SOF Soldiers exceeded the recommendations in Army doctrine. Additionally, their high energy expenditure, if not managed by an equally high energy intake, has been shown to result in performance decrements and may compromise mission success. Special attention must be given to pack weights during pre-mission planning and nutrition strategies aimed at meeting mission demands and recovery from strenuous activity.

**Board #185**

**May 30 10:30 AM - 12:00 PM**

**A Short-term Calorie Restricted Diet with High-fat on Inflammatory Biomarkers and Plasma Lipids**

Yunsuk Koh, Baylor University, Waco, TX. Email: yunsuk.koh@baylor.edu (No relevant relationships reported)

A high-fat (HF) diet may play a positive role in weight management and body composition, yet its role in inflammation and blood lipids is not clearly understood. **PURPOSE:** To examine the effects of a short-term calorie restricted diet with HF or high-carbohydrate (HC) and an acute bout of exercise on plasma lipids and inflammatory biomarkers. **METHODS:** In a randomized, cross-over design, 9 physically inactive college-aged individuals were assigned to a calorie restricted diet (20% reduction of total calorie intake from their typical diet) with either HF or HC for 2 weeks. The HF diet consisted of 70% fat (mostly mono- and poly-unsaturated fatty acids) and 30% carbohydrate and protein, whereas the HC diet consisted of 70% carbohydrate and 30% fat and protein. There was a one-week wash-out period between the two diet interventions. At the end of each diet intervention, a single bout of aerobic exercise was performed at 70% heart rate reserve for 40 minutes. Overnight fasting blood samples were collected at pre- and 24-hours post-exercise at the end of each diet intervention (pre-intervention, HF, and HC) to analyze changes in the key biomarkers of inflammation and plasma lipids, including glucose and triglycerides. **RESULTS:** Either HF or HC did not change any inflammatory biomarkers or plasma lipids. However, a single bout of exercise significantly decreased B-cell activating factor (BAFF, 1619.37±446.57 to 1520.94±476.05 pg/mL, p = 0.019), matrix metalloproteinase-3 (MMP-3, 1782.21±1090.16 to 1227.33±976.38 pg/mL, p = 0.021), thymic stromal lymphopoietin (TSLP, 2.38±1.14 to 1.88±1.00 pg/mL, p = 0.048), and TNF-related weak inducer of apoptosis (TWEAK, 26.26±10.36 to 22.53±3.0 pg/mL, p = 0.048). **CONCLUSION:** A short-term calorie restricted diet with either HF or HC may not significantly influence soluble inflammatory markers or plasma lipids. However, a single bout of aerobic exercise, independent of dietary modification, can...
improve inflammatory responses in healthy, sedentary young adults. Future studies need to further examine the effects of a long-term diet intervention on the responses of inflammation markers in a variety of subject populations, including obese and patients with metabolic diseases in order to better understand the role of high-fat diet in inflammation.

1424 Board #186
May 30 10:30 AM - 12:00 PM
Impact of Time Restricted Feeding on Muscular Strength Within a Healthy Adult Population.
(No relevant relationships reported)

Time restricted feeding (TRF) is a feeding habit that restricts the amount of time during the day in which individuals consume calories. TRF has been shown to produce several health benefits, one of which may be an increase in force production. Muscular strength and nutritional intake have been strongly researched prior to this study. Though little research exists investigating the impacts of TRF on muscular strength in human subjects, PURPOSE: The purpose of this study was to identify the potential impacts of TRF on muscular strength. METHODS: Participants participated in two, four-week periods during which caloric intake, sleep duration, sleep quality, exercise, and medications were all documented. The first period, participants partook in non-TRF eating behavior. The second period participants were placed on a time window of TRF. To measure muscular strength, participants were tested using an isokinetic dynamometer. Resting metabolism was also measured. Statistical analyses quantifying within subject effects were performed with a repeated measures ANOVA. Post-hoc analyses were performed to elicit differences between testing periods. RESULTS: Both mean torque flexion at 60 degrees/second (MTF 60) (83.92 Nm ± 25.9 Nm vs. 75.55 Nm ± 23.9 Nm; F = 7.920 Nm) had a significant increase from pre-test to TRF, as well as non-TRF to TRF. Post-hoc testing revealed significant differences between pre-test and TRF MTF 60 increased (p-value=0.001). Similar results were found for MTF 180 as well (p-value=0.037). When observing respiratory quotient (RQ) at rest (0.716±0.077 vs. 0.716±0.077), the 64 initial participants, 38 participants who had no follow-up information were excluded and final analysis was performed in 26 (40.63%) participants. There was a significant reduction in resting energy expenditure (1402±255.7 vs 1087±303.3, pre and post, respectively, p<0.0001), resting oxygen consumption (203.6±36.91 vs 154.3±35.58, pre and post, respectively, p<0.0001) and resting heart rate (59.58±15.32 vs 51.46±13.73, pre and post, respectively, p=0.0001). Conclusion: The Whole 30 dietary program promoted resting energy expenditure, oxygen consumption and heart rate reduction in trained Crossfit individuals, which may be related to the lower carbohydrate consumption proposed by the program.

1426 Board #188
May 30 10:30 AM - 12:00 PM
A Short Term Paleolithic Dietary Intervention Does Not Alter Adipokines Implicated in Obesity
Rachel M. Graff, Kristopher Jennings2, Natalie A. Davies3, Andres E. Carrillo3, Emily C. LaVoy3, Edward J. Ryan3, Melissa M. Markočsik3. 1University of Houston, Houston, TX. 2University of Texas Medical Branch, Galveston, TX. 3Chatham University, Pittsburgh, PA.
(No relevant relationships reported)

The Paleo dietary intervention elicited reductions (p<0.05) in mean relative body fat (-4.4%), waist circumference (-5.9 cm), and sum of seven-site skinfolds (-36.8 mm). No changes were observed in waist to hip ratio (WHR) or any of the measured adipokines (p>0.05). CONCLUSIONS: It is possible that short-term modest fat loss will not induce changes in adiponectin, omentin, nesfatin, or vaspin in apparently healthy but physically inactive adults. Longer-term studies that examine paleo diet-induced changes across sex, body composition, and in populations with metabolic dysregulation are warranted in order to determine whether the Paleo diet is effective in improving biomarkers related to obesity, metabolism and overall health.

C-39 Free Communication/Poster - Pain, RPE, and Fatigue
Thursday, May 30, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

Widens cause arterial occlusion at lower pressures but may produce greater discomfort during blood flow restricted exercise compared to more narrow cuffs when applied to the same absolute pressure. Whether this is true at the same relative pressure or if this differs by sex is currently unknown. PURPOSE: To examine how cuff size and sex affect perceptual discomfort following blood flow restricted exercise. METHODS: Forty-nine participants (25 males and 24 females) completed two conditions in a random order with 10 minutes of rest prior to each condition (one on each arm). Participants performed 4 sets of unilateral elbow flexion to failure. Pressure was applied with either a narrow (5 cm) or a wide cuff (12 cm) with each cuff set to the same relative arterial occlusion pressure (40%). Discomfort was rated following the 4th set (0: no discomfort, 100: maximal discomfort). Following exercise the participants were asked to choose which condition they would prefer to use regularly. A repeated measures analysis with a between subject factor of sex was used to assess differences in discomfort. Default priors were used for fixed effects (r=0.5) and random effects (r=1). A contingency table with a default prior concentration of 1 was used to determine if cuff preference differed by sex. Bayes Factors (BF<sub>10</sub>) were used to quantify evidence for the null and alternative hypothesis. Data are presented as mean (SD) unless otherwise stated. RESULTS: There was evidence for an effect of cuff size (BF<sub>10</sub> = 6.752) but no evidence for an interaction or an effect of sex (BF<sub>10</sub> = 0.699). The narrow [42 (17 AU)] cuff had less discomfort than the wide [47 (18 AU)] cuff [median δ (95% credible interval) -5.3 (-9.28, -1.45)]. When participants rated which cuff they would prefer to exercise with, participants preferred the narrow cuff Adipokines, including adiponectin, omentin, nesfatin, and vaspin, are dysregulated with obesity and may respond favorably to diet-induced fat loss. The Paleolithic (Paleo) diet, characterized by an emphasis on hunter-gatherer type foods accompanied by an exclusion of grains, dairy products, and highly processed food items, is often promoted for weight loss and a reduction in cardiometabolic disease risk factors. The PURPOSE of this study was to evaluate the effects of an 8-week Paleo dietary intervention on serum adiponectin, omentin, nesfatin, and vaspin levels in a cohort of physically inactive but otherwise healthy adults. METHODS: Seven physically inactive adults participated in a Paleo diet intervention. Anthropometric measures, body composition data, and fasting blood samples were collected from each participant pre- and post-intervention. Serum adiponectin, omentin, nesfatin, and vaspin were measured with commercially available ELISA kits. RESULTS: The Paleo dietary intervention elicited reductions (p<0.05) in mean relative body fat (-4.4%), waist circumference (-5.9 cm), and sum of seven-site skinfolds (-36.8 mm). No changes were observed in waist to hip ratio (WHR) or any of the measured adipokines (p>0.05). CONCLUSIONS: It is possible that short-term modest fat loss will not induce changes in adiponectin, omentin, nesfatin, or vaspin in apparently healthy but physically inactive adults. Longer-term studies that examine Paleo diet-induced changes across sex, body composition, and in populations with metabolic dysregulation are warranted in order to determine whether the Paleo diet is effective in improving biomarkers related to obesity, metabolism and overall health.

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(No relevant relationships reported)
and this did not differ by sex (BFj, joint multinomial: 262). The lower discomfort and greater preference for the narrow cuff was found despite completing more repetitions with the narrow cuff [Narrow: 70 (25) vs. Wide: 59 (16) repetitions; BFj, 67.2].

**CONCLUSIONS:** A narrow cuff appear to cause less discomfort than a wider cuff when inflated to the same relative pressure with no difference between sexes. The use of a narrow cuff was preferred and may help increase the palatability of blood flow restricted exercise.

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**1428 Board #190**  
**May 30 9:30 AM - 11:00 AM**  
**Session RPE Following a Six-minute Bout of Cardiopulmonary Resuscitation Training**

Alex B. Shafer, Wyatt I. Witty, Dana A. Lubieniecki, Kasie D. Cooper. Montana State University Billings, Billings, MT. (Sponsor: Elizabeth Nagle, FACSM)

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(No relevant relationships reported)

Results of perceived exertion (RPE) are used to monitor intensity during exercise. A session RPE (S-RPE) provides an estimate of exercise intensity of a completed exercise session. S-RPE has demonstrated adequate validity and reliability for quantifying exercise intensity in traditional aerobic and anaerobic modalities. However, the efficacy of S-RPE during the physically demanding task of cardiopulmonary resuscitation (CPR) has yet to be explored. **Purpose:** The purpose of this investigation is to explore the relationship between RPE and S-RPE assessed during and after a 6-minute bout of CPR training. **METHODS:** Thirty healthy young adults (age 24.3±6.0 y; BMI 26.1±3.5 kg/m²) completed a 6-minute bout of CPR on a CPR manikin. RPE values were recorded during the last 15 seconds of each minute of exercise, and S-RPE was recorded 2 min post exercise using the Adult OMNI-RPE scale. Heart rate (HR) was recorded during each minute of activity. A repeated measures ANOVA was used to compare RPE values from minute 1-6 and S-RPE recorded during the CPR bout. A paired samples t-test compared the average RPE for the 6-minute bout to S-RPE. Statistical significance was accepted at p<0.05.

**RESULTS:** RPE values recorded during the CPR bout are reported in table 1. Participants obtained a peak HR of 132.3±25.7 bpm during the 6-minute bout of CPR. A paired samples t-test shows S-RPE was significantly higher than the average RPE for the 6-minute bout (4.71±1.9 vs. 4.11±1.7, p=0.0001). However, S-RPE did not differ from the RPE obtained from minutes 3-6 of the CPR bout. **CONCLUSION:** Current findings suggest that S-RPE for a bout of CPR may not represent the average RPE, but reflects the RPE reported during the later stages of exercise. In this case, S-RPE represented exertion levels reported during the final two-thirds of the exercise session. Similar findings have been reported during aerobic and resistance training studies, where S-RPE represents exertion of the later stages of activity.

<table>
<thead>
<tr>
<th>Table 1. S-RPE and RPE values for each minute of CPR</th>
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<tr>
<td>Min 1</td>
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<td>2.8±1.4*</td>
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*statistically less than S-RPE, p<0.05.

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**1429 Board #191**  
**May 30 9:30 AM - 11:00 AM**  
**Enjoyment In Low Intensity Continuous Training Versus High Intensity Interval Training In An Iso-caloric Design**

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(No relevant relationships reported)

**Purpose:** To examine the enjoyment during and after one exercise session of continuous aerobic exercise (CE) versus session of high intensity interval training (HIIT) in an iso-caloric design.

**Methods:** Seven young healthy participants (3 males, 4 females, age: 23.4±2 years) were recruited to undergo two different protocols. Either the CnCWI or InCWI protocol could be used as both had protocols are effective in reducing DOMS and improving perceived recovery all post exercise. Both were evaluated at pre, post-CW, and 24 hours post. A mixed ANOVA was used. Significance was accepted at p<0.05. Results: Statistically significant differences were found in DOMS (F(1,14)=5.15, p<0.001, ηp²=0.27) in post immersion CnCWI vs. CG (2.7±1.9 vs. 5.1±1.7, p<0.001) and InCWI vs. CG (2.7±1.9 vs. 5.1±1.7, p<0.001). In the post 24h CnCWI vs. CG (3.7±2.3 vs. 5.1±1.7, p<0.001) and InCWI vs. CG (3.2±1.8 vs. 5.1±1.7, p<0.01). In the post 48h testing, results showed CnCWI vs. CG (3.3±2.3 vs. 6.1±2.2, p<0.002) and InCWI vs. CG (3.1±1.9 vs. 6.1±2.2, p<0.001). In terms of perceived recovery (F(1,14)=2.49, p=0.07, ηp²=0.070), results indicated post immersion CnCWI vs. CG (15.9±2.1 vs. 14.1±2.2, p<0.001) and InCWI vs. CG (16.3±1.6 vs. 14.1±2.2, p<0.001). In the post 24h CnCWI vs. CG (16.3±2.4 vs. 12.8±1.1, p<0.001) and InCWI vs. CG (14.9±2.5 vs. 12.8±1.1, p<0.001). In the case of post 48h, results were CnCWI vs. CG (15.9±2.6 vs. 12.3±3.3, p<0.001) and InCWI vs. CG (15.3±2.6 vs. 12.3±3.3, p<0.001). **Conclusion:** CnCWI protocols are effective in reducing DOMS and improving perceived recovery all post fatigue measurements. Either the CnCWI or InCWI protocol could be used as both had similar effects on psychological variables of recovery.

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**1430 Board #193**  
**May 30 9:30 AM - 11:00 AM**  
**Time Courses of Changes In Perceptual, Respiratory, and Neuromuscular Responses in the Severe Intensity Domain**

Haley C. Bergstrom1, Terry J. Housh, FACSM2, Taylor K. Dinyer1, Travis Byrd1, Pasquale J. Succi1, Nathaniel D.M. Jenkins1, Kristen C. Cochrane-Snyman3, Richard J. Schmidt4, Glen O. Johnson, FACSM5. 1University of Kentucky, Lexington, KY. 2University of Nebraska-Lincoln, Lincoln, NE. 3Oklahoma State University, Stillwater, OK. 4California State University, Fresno, CA.

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(No relevant relationships reported)

The severe intensity domain zone 1 (SIZ1) includes intensities between critical velocity (CV) and 50%Δ (Δ= difference between CV and VO2peak), where exhaustion may occur below VO2peak. The severe intensity domain zone 2 (SIZ2) includes intensities

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**Abstracts were prepared by the authors and printed as submitted.**
study examined the time course of changes in ratings of perceived exertion (RPE), breathing frequency (fB), electromyographic (EMG) MPF, and EMG mean power frequency (MPF) during exhaustive treadmill runs within the SIZ, and SIZ.

METHODS: Ten runners (Age: 23 ± 3 yrs) performed an incremental treadmill test to determine the velocity at VO2peak (vVO2peak). The CV was determined from 4 constant velocity runs. The RPE, fB, EMG AMP, EMG MPF (from the vastus lateralis) and times to exhaustion (Tlim) were examined during SIZ, and SIZ, runs. Polynomial regression was used to examine the normalized (% change from the initial values) RPE, fB, EMG AMP, and EMG MPF versus %Tlim (10-100%) relationships for the SIZ1, SIZ2, and SIZ, runs. Repeated measures ANOVAs and Student Newman-Keuls tests were used to determine the time course of changes from the initial 10% of Tlim.

RESULTS: During the SIZ, 86 ± 5% vVO2peak, -33% fB, Tlim = 17.7 ± 2.6 min) runs, there was a quadratic increase for RPE (R²=0.99, p = 0.001), significant from 30 to 100% of Tlim, a cubic increase for fB (R²=0.99, p < 0.001), significant from 30% to 100% of Tlim, a linear increase for EMG AMP (r² = 0.85, p < 0.001), significant at 100% of Tlim, and a linear decrease for EMG MPF (r² = 0.66, p = 0.004), but no differences among time points. During the SIZ, (the race) and 2.6, at 10 miles increasing to 6.8 at the end of the race the increase for RPE (r²=0.99, p < 0.001), significant from 30% to 100% of Tlim, a quadratic increase for fB (R² = 0.68, p = 0.02), but no differences among time points, and a cubic decrease for EMG MPF (R² = 0.84, p = 0.01), significant at 100% of Tlim.

CONCLUSIONS: These findings indicated RPE was more closely related increases in fB, than to neuromuscular fatigue in both the SIZ, and SIZ, and it is possible feedback from group III and IV afferents in the respiratory muscles contributed to increased perceptions of effort to a greater degree than those in the leg muscles during severe exercise intensities.

PURPOSE: There is currently very little data available in literature on the effects of ultra-marathon training and competition regarding mood. Ultra-marathons are races with distances greater than the standard marathon distance of 26.2 miles. The purpose of this experiment was to examine differences in mood during an ultra-marathon competition. We speculated that perceived exertion (RPE) and mood would be affected by changes in heart rate and pain would be the predominant determinants of mood during the race.

METHODS: Pain, RPE, and mood were assessed using Visual Analog Scales (VAS) prior to the race, at predetermined ten-mile marker points, and immediately at the completion of the race. The support teams that would accompany each runner throughout the race were given instructions prior to the start on how to collect the data. They were instructed not to “coach” responses from the runners and not to assume their runner’s responses or answer for them. The mood scale started at 10 representing best mood and decreased to 0 as mood declined. Pain and RPE scales started at 0 for no pain and no exertion respectively, increasing to a maximum of 10 for maximum pain or maximum exertion. Data were analyzed using regression analyses with p<.05 as our accepted level of significance.

RESULTS: The regression analysis revealed a R² = 0.89. Mood steadily decreased from 9.6 one hour before the race to 9.4 ten miles into the race. At 90 miles, mood was 5.2, then 6.2 at the completion of the race. RPE and pain steadily increased throughout the race. Pain was 0 before the start, 0.6 at ten miles and 7 at 100 miles. RPE was 1.4 one hour before the race, 2.1 at 10 miles increasing to 2.6 at the end of the race. Subjective pain assessment was significantly correlated to mood throughout the race (p<.05), and RPE had no significant associations (p=.05). CONCLUSION: These data suggest that the increase in subjective pain assessment with runners completing a 100-mile ultra-marathon is directly related to a decrease in mood throughout the race. RPE was also correlated and is surely an important factor impacting mood throughout the race, but it did not reach statistical significance. This suggests that pain has greater association with mood compared to RPE during an ultra-marathon. Further analysis is needed to fully identify the primary factors impacting mood in ultra-endurance activities.

Delayed onset muscle soreness (DOMS) is a normal response to strenuous, unfamiliar exercise characterized by muscle swelling, tenderness and pain. Typically arising 24-72 hours following exercise, DOMS results in neuromuscular impairment such as decreased muscular strength and activation. Recently, the application of topical analgesics has been proposed as a possible means to mitigate the symptoms and negative outcomes of DOMS, though the mechanisms of action are not well-understood. It is currently unknown how the presence of DOMS with and without the application of topical analgesia influences central nervous system excitability.

PURPOSE: The purpose of this study was to investigate the interactive effects of DOMS and the application of a menthol-based topical analgesic on corticospinal excitability of the biceps brachii.

METHODS: A total of 32 participants completed two separate experiments; Experiment A (No DOMS; n = 16) and Experiment B (DOMS; n = 16). For each experiment, participants were randomly assigned to two groups: 1) topical analgesic gel (Topical Analgesic, n = 8) or 2) placebo gel (Placebo, n = 8). Prior to the application of gel (pre-gel), as well as 5, 15, 30, and 45 min post-gel, motor evoked potential (MEP) area, latency, and silent period, as well as cervicomedullary MEP (CMEP) and muscle compound motor unit action potential (MUP) areas and latencies were measured. In addition, pressure-pain threshold (PPT) was measured pre-DOMS and at the same time points in Experiment B.

RESULTS: In Experiment A, neither group showed a significant change for any outcome measure. In Experiment B, both groups exhibited a significant decrease in PPT for pre-DOMS to pre-gel (p < .05). Following the application of topical analgesic, but not placebo, there was a significant increase in PPT at 15, 30, and 45 min post-gel (p < .05), as well as in cervicomedullary MEP and CMEP areas and latencies. These findings suggest that DOMS reduced CSE to the biceps brachii, and that the application of a menthol-based topical analgesic reduced pain, which was accompanied by an increase in corticospinal inhibition.
Evidence suggests the prefrontal cortex (PFC) may play a role in interpreting afferent feedback during fatiguing tasks. Temperature changes are known to influence fatigability. It is unknown how changing the temperature of a limb influences PFC activation during a fatiguing task. PURPOSE: To examine changes in PFC oxygenation, psychological ratings, and muscular function in response to a fatiguing task, following thermal alterations of the exercising arm. METHODS: Nineteen healthy adults completed three experimental sessions. At baseline, participants performed maximum voluntary isometric contractions (MVIC) of the elbow flexors, at 20% of MVIC, for 5 minutes. Ratings of perceived exertion (RPE) and muscular discomfort were assessed. Functional near-infrared spectroscopy was used to measure oxygenation of the right PFC during the fatiguing task. Repeated measures ANOVAs were used to analyze changes in dependent variables. RESULTS: There was an increase in MVIC oxygenation throughout the fatiguing task, however, the increase in oxygenation was greater for the H (14.1 ± 4.9 μM) and N (12.7 ± 5.6 μM) conditions, compared to the C condition (11.1 ± 4.4 μM, time x temperature, p < 0.001). There was an increase in RPE throughout the fatiguing task, however, the increase in RPE was greater for the H (8.7 ± 0.91) and N (8.0 ± 0.9) conditions, compared to the C condition (7.2 ± 1.1, time x temperature, p < 0.001). Muscular discomfort at the end of the fatiguing task was lower in the C condition compared to the H condition (2.7 ± 0.1 vs. 3.7 ± 0.1, p < 0.001). There was a reduction in MVIC torque at the end of the fatiguing task, however, the reduction in MVIC torque was greater for the H (25.7 ± 8.4%) and N (22.2 ± 9.6%) conditions, compared to the C condition (17.5 ± 8.9%, temperature x fatigue, p < 0.05). CONCLUSION: Precooling before a fatiguing task attenuated the rise in PFC oxygenation, RPE, muscular discomfort, and muscular fatigue. These results have implications for reducing mental workload and improving performance in workers, athletes, and patients.

Purpose: Very little data is available concerning the influence of pre-pace mood and pain on ultra-marathon completion. This research was designed to answer questions such as how pain, mood and exertion affect ultramarathon race performance (defined as any race greater than 26.2 miles). METHODS: Data was collected at the 2018 Keys 100 and 2017 Saint Sebastian 100 (n=23). Each research participant was presented with visual analog scales, one for each Pain (0-low pain to 10-maximum pain), Mood (10=great mood to 0=bad mood) and exertion (RPE) (0=no exertion to 10-maximum exertion). Scores were collected prerace. Those participants who did not finish (DNF) were used to analyze changes in dependent variables. RESULTS: There was no significant difference in time to exhaustion between anodal (408 ± 121 s), cathodal (413 ± 168 s), and sham (440 ± 189 s) conditions (p=0.58). There was no significant difference in RPE from minutes 1-3 (collapsed across time) between anodal (12.9 ± 2.4 AU), cathodal (13.3 ± 2.2 AU) and sham (12.9 ± 2.1 AU) conditions (p>0.51). CONCLUSIONS: These data suggest tsDCS condition did not influence cycling performance or perception of effort during high-intensity cycling. Therefore, thoracic spine and lower abdominal montage delivering a current density of 0.071 mA/cm² for 20 minutes likely does not affect high-intensity cycling work capacity. Therefore, more research is needed to investigate the efficacy of tsDCS and which stimulation methods may and may not enhance human performance.

CONCLUSIONS: There was no significant difference in time to exhaustion between anodal (408 ± 121 s), cathodal (413 ± 168 s), and sham (440 ± 189 s) conditions (p=0.58). There was no significant difference in RPE from minutes 1-3 (collapsed across time) between anodal (12.9 ± 2.4 AU), cathodal (13.3 ± 2.2 AU) and sham (12.9 ± 2.1 AU) conditions (p>0.51). There was no significant difference in time to exhaustion between anodal (408 ± 121 s), cathodal (413 ± 168 s), and sham (440 ± 189 s) conditions (p=0.58). There was no significant difference in RPE from minutes 1-3 (collapsed across time) between anodal (12.9 ± 2.4 AU), cathodal (13.3 ± 2.2 AU) and sham (12.9 ± 2.1 AU) conditions (p>0.51).
Self-Efficacy for Changing Sedentary Behavior or Physical Activity: Comparisons in Healthy and Chronic Pain Populations

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Physical activity (PA) has well known health benefits, especially for clinical populations like individuals with chronic pain (CP). However, interventions aimed at increasing PA often report low adherence, possibly due to low self-efficacy (SE). Reducing sedentary time (SED) also has health benefits and may be perceived as more achievable than increasing PA. PURPOSE: To compare levels of SE for reducing SED to those for increasing PA in healthy adults (HA) and individuals with CP and to explore SE for overcoming barriers for each behavior. METHODS: Participants completed a survey assessing SE for changing PA and SED and common barriers. Questions were rated on a Likert scale from 1 (Not at all Confident) to 10 (100% Confident). T-tests and effect sizes (Cohen’s d) compared differences between behaviors. RESULTS: Participants were 1,240 HA (age = 26 ± 12, 61% female) and 273 individuals with CP (age = 34 ± 16, 70% female). Both HA and individuals with CP reported greater SE for reducing daily SED by 1 hour compared to increasing daily MVPA by 30 minutes, with moderate effects observed in both groups (p < 0.001, CP: d = 0.60, HA: d = 0.58). Additionally, SE was greater (p < 0.001) for overcoming barriers related to changing SED than PA, except social norms. In CP, the effect sizes between SE for overcoming barriers related to SED to barriers related to PA were small to moderate for fatigue (d = 0.46), time (d = 0.42), environment (d = 0.44), motivation (d = 0.37), pain (d = 0.27), and mood (d = 0.24). In HA, moderate effects for environment (d = 0.66) and fatigue (d = 0.50) and small effects for time (d = 0.44), motivation (d = 0.44), pain (d = 0.37) and mood (d = 0.24) were observed. However, SE for resisting social norms to sit was lower than SE for social norms surrounding exercise (p < 0.001, CP: d = −0.32, HA: d = −0.59). CONCLUSION: While the health effects of each behavior are not equivalent, both patients and HA may be more likely to change behavior when encouraged to sit less rather than exercise more, which may still result in substantial benefits. Individuals with CP had the lowest average SE for interrupting SED when feeling unwell or in pain, feeling sad or unhappy, or in social situations where others are sitting. Interventions targeting SE might benefit from discussing mental and physical benefits of reducing SED and strategies for overcoming social norms.

Evaluation Of Perception And Tolerance To Acute Pain Thru Typological Groups Of Gender Schemas

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Pain is defined as a physiological and psychological experience, composed of an interaction between emotional, cognitive and sensorial components. The cultural aspects associated with the individual experiences of pain, tend to influence the way that individual reaction to a painful stimulus. PURPOSE: to evaluate if typological groups of gender schemas, generate by the Interactive Model, differs on acute pain. METHODS: 137 athletes and 175 non-athletes, male and female (22.95 ± 4.29 years) were allocated into Masculine Heteroschematic (MH - Inventory of the Self-Concept’s Gender Schemas - IGFEMA), Isoschematic (ISO) and Feminine Heteroschematic (FH - Feminine Inventory of Self-Concept’s Gender Schemas- IFEGA), groups. A scale called Factor of Acute Pain (FSAP) was developed to evaluate the sensations of acute pain. Pain threshold, pain tolerance, and pain super tolerance were evaluated during some test where the pain was induced by immersing the hand on ice (0.1ºC to 0.3ºC). To FSAP validation and reliability were used Factorial Analysis and Cronbach’s Alpha, and for acute pain perception and tolerance analysis was used inferential analysis Three-Way MANOVA and post hoc Least Significant Differences (LSD). RESULTS: Significant differences in acute pain perception and tolerance between typological groups were found (p =0.03). At graph 1 is possible to observe that MH and ISO showed higher pain super tolerance than FH (0.018,16mm and 00.06:32mm respectively; p = 0.01). For acute pain sensations, athlete woman FH reported more unpleasant sensation of pain (Δ=00:55,05mm) than MH. CONCLUSIONS: gender schemas at typological groups support different high levels of acute pain, as well as different sensations of unpleasant caused by the cold thermal sensations. Groups with developed masculine schema tend to have a higher tolerance to maximum pain than the other groups.

Firefighter Turnout Suit Weight Influences Simulated Exercise Performance

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PURPOSE: To investigate how structural firefighter protective ensemble weight influences rate of perceived exertion (RPE) during firefighter simulated exercise (FFSE). METHODS: 10 active firefighters (age: 33 ± 6 years, Ht: 178.2 ± 3.1 cm, Wt: 82.1 ± 16.2 kg) were asked to wear, in a random order, two ensembles: 1) a single layer (SL) outer shell (2.45 kg) and 2) a traditional turnout suit (4.57 kg). On each laboratory visit, the firefighters performed the FFSE that consisted of two rounds of an 15.24m hose advance, a 15.24m weighted (40.83 kg) carry, sledge hammer exercise, a 15.24m tire flip, a 15.24m dummy drag, rope pull, and unweighted stair climb, with a 1-minute rest period between rounds. The FFSE included a 5-minute acclimation period in the ensemble, a warm up (10 pushups, 10 squats, 20 jumping jacks). Subjects were asked to complete the FFSE as fast as possible. The traditional turnout suit consisted of an outer shell, moisture barrier, and thermal barrier typically found in most turnout suits. The Borg rating of perceived exertion scale was asked immediately at the end of each round of FFSE and ensemble weights were measured pre-FFSE.

Grit, Fitness, And Goal Setting

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Grit is a measure of passion and perseverance and has been associated with academic and career success. However, the role of grit in physical fitness goal setting and core function during endurance fitness testing is unknown. PURPOSE: This research attempted to examine whether grit and additional variables such as self-control and growth mindset would predict success in physical fitness goal setting and tolerance to discomfort during endurance fitness testing. METHODS: Eligible participants (n = 51, 60% male, 21.45 ± 1.7 years old) were drawn from wellness classes at Slippery Rock University. Participants completed questionnaires on grit, self-control, and growth mindset at baseline and six weeks later at follow-up. Pre and post measures also included a FitnessGRAM push-up test to failure, the level of discomfort in the upper body during the push-up test, and various other upper body fitness tests. Participants set a strength goal and trained for six weeks performing a variety of upper body exercises twice per week, consisting of strength training and plyometric exercises. RESULTS: Significant improvements were seen in push-up endurance scores (24.9 ± 10.2 vs 28.6 ± 9.0, p<0.01) and discomfort tolerance during the push-up test (7.3 ± 1.7 vs 8.9 ± 1.4, p<0.01). No significant changes were noticed in grit (3.6 ± 0.4 vs. 3.7 ± 0.6, p=0.86), self-control, or growth mindset scores. A weak correlation (r=0.30, p=0.03) was noticed between baseline grit levels and baseline push-up scores. No other associations were found between grit and improvements in fitness. CONCLUSIONS: Results appeared to show that improvements in endurance, strength, and tolerance to discomfort were associated with levels of grit, growth mindset, or self-control. Although these variables have been highlighted as predictive of success, future research should continue to examine their relation to goal setting in health and fitness.
RESULTS: The SL resulted in lower average RPE for round 1 (SL: 12.8±1.7 vs. Traditional: 13.8±1.7; p<0.05) and round 2 (SL: 14.2±1.6 vs. Traditional: 16.2±2.3, p<0.01) than the traditional turnout. In addition, round 2 of the FSSE was completed significantly faster than the traditional turnout suit (SL: 262.8±55.7 s vs. Traditional: 293.4±64.9 s; p<0.02). CONCLUSIONS: The weight of the turnout suit increases RPE, which appears to influence performance for FSSE.

Supported by Fire-Dex, LLC.

1446 Board #208 May 30 9:30 AM - 11:00 AM
The Effects of Music Tempo on an Exerciser’s Experiences During Isometric Strength Task
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(No relevant relationships reported)

PURPOSE: This study examined the effects of different music tempos on effort-related thought (rating of perceived exertion (RPE)), affect, heart rate, and performance during isometric strength exercises. Recent research on musical stimuli during exercise supports that music has multiple physiological and psychological responses during exercise including: attention, RPE, affect, and performance (e.g., Adler et al., 2015; Cronin, 2011; Crust, 2004; Dyrlund & Wininger, 2008; Karageorghis, Terry, Lane, Bishop, & Priest, 2011).

METHODS: Participants were assigned randomly to one of three conditions: silent control, fast tempo music first followed by slow tempo music, and slow tempo music first followed by fast tempo music, and performed a two different isometric strength exercises in a counter-balanced order. RESULTS: RM ANOVAs revealed non-significant differences among conditions during any of the trials, indicating that the presence of music of either slow or fast tempo failed to influence HR, P(2, 55) = 2.48, F(2, 55) = 0.023.

Abstracts were prepared by the authors and printed as submitted.
Association between Fatigability and Physical Function among the Elderly in the Geisinger Rural Aging Study

James E. Stampley1, Brett Davis2, Craig Wood2, Diane C. Mitchell1, Gordon L. Jensen1, Yi-Hsuan Liu1, Xiang Gao2, Bethann Whilden3, Marianne Yohn2, Krystal Cunningham2, Megan Lemotte1, Christopher D. Still2, Brian A. Irving1, FACSM1.

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(No relevant relationships reported)

Elevations in perceived fatigue, fatigability, likely contribute to impairments in physical function in the elderly. However, the independent and combined effects of physical and mental fatigability on physical function in the elderly is unknown.

PURPOSE: We examined the cross-sectional associations between physical fatigability, mental fatigability, and physical function among the elderly in the Geisinger Rural Aging Study (GRAS).

METHODS: Here, we included 122 (66F, 56M) elderly (≥80 years) participants from the GRAS who completed the Pittsburgh Fatigability Scale (PFS) and PROMIS Physical Function, Short-Form 20a [question pfa11 was excluded due to missing values]. We used multiple linear regression to measure the association between the PROMIS Physical Function Score (199-95) and PFS - Physical Fatigability Score (0-50, no to extreme physical fatigue) and PFS- Mental Fatigability Score (0-50, no to extreme mental fatigue) adjusted for age, sex, BMI, and number of medications used over the past two years. RESULTS: The mean (SD) Physical Function Score, Physical Fatigability Score, Mental Fatigability Score, BMI, and number of medications were 80 (11), 23 (10), 12 (11), 28 (5) kg/m² and 18 (8), respectively. Low Physical Function Scores were associated with higher Physical and Mental Fatigability Scores in crude models (r = -0.65, p<0.001 and r = -0.38, p<0.001, respectively). When Physical and Mental Fatigability Scores were included in the same model, the association between the Physical Function and the Mental Fatigability Scores was no longer significant (r = -0.07, p=0.43). Adjustment for age, sex, BMI and number of medications did not change the significant inverse association between the Physical Function and Physical Fatigability Scores (r = -0.65, p<0.001). CONCLUSION: Our results suggest that elderly individuals with lower physical function may also have higher physical fatigability independent of age, sex, BMI, and number of medications. Future studies should examine the impact of improving physical fatigability on physical function in the elderly. This study is funded by the USDA, Agricultural Research Service agreement 8050-5150-012-01A.

Cognitive decline, specifically within the domains of executive function, has been consistently associated with diminished life satisfaction and the ability to carry out activities of daily living in older adults. As the population continues to age, identifying methods of attenuating cognitive decline is important for promoting long-term survival and quality of life. Previous research has suggested that fatigability, one’s perceived exertion after a standardized walking task, is associated with declines in physical function; however, it remains unclear as to whether these effects may also extend to cognitive function.

PURPOSE: To examine whether fatigability is associated with executive function among individuals participating in the Baltimore Longitudinal Study of Aging (BLSA).

METHODS: The BLSA is an ongoing study of normative human aging. Participants included 1,068 older adults (M = 67 ± 12.7 years) seen between 2007 and 2015. At baseline and after M=4.5±1.8 years of follow-up, individuals completed a physical examination, health history assessment, standardized walking task to assess fatigue, and cognitive battery assessing several domains of executive function.

RESULTS: Multiple linear regression analyses revealed significant effects of baseline fatigability on several domains of executive function at follow-up: Digit Symbol Substitution Test (β=0.47, p=0.011), Trails Part B (β=1.85, p=0.031), and Trail Making Delta (Part B-Part A; β=1.56, p=0.038). Specifically, higher baseline fatigability was significantly associated with poorer cognitive performance at follow-up after controlling for age, sex, race, body mass index (kg/m²), years of education, years of follow-up, and number of comorbid conditions.

CONCLUSIONS: Our findings suggest that the perception of fatigue in response to a standardized walking task may act as an indicator of future cognitive decline, at least in the short-term (e.g., 5 years). More research is warranted to examine the underlying biological mechanisms contributing to this relationship as well as how future interventions may target fatigability in mid-life to potentially attenuate age-related cognitive decline. Supported by NIH Grants R21AG053198, P30AG021334, and U01AG057545.
of perceived exertion (RPE) were measured. During the final two visits, participants completed time-to-exhaustion (TTE) trials while running at a speed corresponding to 80% of their VO2max on a treadmill. For these trials, two separate conditions were utilized: 1) no music (NM); and 2) self-selected music (SSM). Bivariate correlations were used to determine the relationship between EIM and physiological variables, while paired samples t-tests were used to examine differences between TTE trials. RESULTS: A significant difference was found between TTE with NM (M=12.18±5.77) and SSM (M=14.36±5.22) (t=4.124, p<0.001). EIM was positively correlated to RPE during the TTE without music (r=0.457, p<0.05), while VO2max was negatively correlated to the difference between TTE trials (r=-0.481, p<0.05). CONCLUSION: Individuals with a higher EIM perceived greater exertion during running without music compared to running while listening to music, indicating that these individuals may experience a heightened level of motivation or inspiration while using music as an external stimulus and a diminished level of motivation when music is not utilized. Additionally, individuals with a greater VO2max experienced less of a difference between TTE trials, suggesting that individuals with greater aerobic fitness may not rely on external stimuli for motivation, regardless of EIM. Using music as an external stimulus to increase motivation may be a beneficial tool for certain individuals, whether it be in a personal training environment or a physical rehabilitation setting.

1451 Board #213 May 30 9:30 AM - 11:00 AM
Declines In Mental Energy Led To Decreases In Functional Balance
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Purpose: The purpose of this study was to determine the impact of mental task performance on fall risks and to use machine learning to predict changes in fall risk assessments.

Methods: Using a crossover-design, older adults (N=11) were recruited from the community and assigned to random allocation of days where they performed fall risk assessments (30 second chair stand test (CST), Timed-up-and-Go (TUG), and Berg Balance Scale (BBS)) prior to and after the completion of mental tasks or days where they were told to perform non-mentally and physically taxing tasks (i.e. talk, listen to music) in between the completion of fall risk assessments. A Wilcoxon Signed Rank Test was used to assess differences in fall risks and a Friedman’s rank test was used to assess changes in mood (energy, fatigue, physical and mental energy and fatigue). Using the X-box Kinect we measured variances in 25 joints. A random forest classifier was used to predict changes in functional balance.

Results: Analysis yielded statistically significant declines in feelings of energy (p<0.003), specifically mental energy (p<0.015), and a decline in the BBS (p=0.042) for participants on days when they completed mental tasks compared to days they did not. There were no significant differences (p>0.05) between other moods and fall risk assessments. We observed a significant increase (p<0.006) in joint variance during the “standing with eyes closed” part of the BBS after the subjects had performed mental tasks. In the post-hoc analysis our random-forest algorithms allowed us to predict with 79.0% accuracy whether the “standing with eyes closed” part of the BBS was performed after a decline a mental energy or not. The false positive rate was 40.0% and the false negative rate was 21.0%.

Conclusions: The results of our study suggest that declines in mental energy negatively impacts postural control. Our work was able to predict with a fair degree of accuracy when someone had a decline in mental energy based on changes in functional balance however, it was unable to predict when there was no mental work performed. This suggests that when there is no decline in feelings of energy there is no change in functional balance, and mental work leads to declines in postural control.

1452 Board #214 May 30 9:30 AM - 11:00 AM
Exercise Intensity: Do Individuals Perceive It as We Physiologically Define It?
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The ACSM defines exercise intensities using physiological measures (%VO2max, %VO2R, %HRmax, and %HR). Currently, there are no studies examining if individuals perceive the exercise intensity as it is defined by the physiological ranges for each measure. PURPOSE: To determine if individuals perceive aerobic exercise intensities as defined by ACSM physiological criteria. METHODS: Sixty-three subjects (31 females, 32 males) aged 28 ± 8.7 years; height: 172.0 ± 6.1 cm; body mass: 72.6 ± 9.5 kg; BMI: 24.5 ± 2.5 kg·m⁻²; VO2max: 43.0 ± 7.4 ml·kg⁻¹·min⁻¹; and HRmax: 177.2 ± 11.5 bpm were submitted to four trials of walking or running at self-selected intensities corresponding to the following verbal commands: Preferred, Low, Moderate and High. All trials were performed in a randomized order. Heart rate (%HRmax), ratings of perceived exertion (RPE 0-10), OMNI-Walk/run scale) and feelings of pleasure/displeasure (−5 to +5, Feeling Scale) were recorded at the end of each trial. RESULTS: Walking or running based on the Preferred-intensity verbal command elicited similar speed, %HRmax and RPE values, and pleasant feelings compared to the Moderate trial. The High trial was the most effortful and the least pleasant one. All trials elicited %HRmax values that are within the range proposed by the ACSM to promote health-related outcomes.

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<tr>
<th>Speed (m.s⁻¹)</th>
<th>Preferred</th>
<th>Low</th>
<th>Moderate</th>
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<tbody>
<tr>
<td>3.3 ± 0.6</td>
<td>2.7 ± 0.6</td>
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<tr>
<td>%HRmax</td>
<td>91.3 ± 6.3</td>
<td>81.4 ± 9.7a</td>
<td>89.9 ± 8.4a</td>
<td>96.2 ± 3.9abc</td>
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<td>RPE</td>
<td>4.5 ± 0.6</td>
<td>2.3 ± 0.4</td>
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<td>Feeling Scale</td>
<td>3.6 ± 1.0</td>
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different from Preferred; different from Low; different from Moderate. p<0.01.

Conclusion: Prescribing walking or running through verbal commands seems highly attractive due to its effectiveness and simplicity. Walking or running at the Preferred-intensity verbal command may promote health-related outcomes and elicit a positive affective experience, which might influence exercise adherence.

1453 Board #215 May 30 9:30 AM - 11:00 AM
Effect of Prescribing Exercise through Verbal Commands on Psychophysiological Responses in Walkers or Runners
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Purpose: To compare the effect of prescribing exercise intensity through verbal commands on physiological, perceptual and affective responses in habitual walkers or runners. Methods: Fifteen walkers or runners (11 men, 4 women; age: 39.9 ± 9.9 years; height: 172.0 ± 6.1 cm; body mass: 72.6 ± 9.5 kg; BMI: 24.5 ± 2.5 kg·m⁻²; VO2max: 43.0 ± 7.4 ml·kg⁻¹·min⁻¹; and HRmax: 177.2 ± 11.5 bpm) were submitted to four trials of walking or running at self-selected intensities corresponding to the following verbal commands: Preferred, Low, Moderate and High. All trials were performed in a randomized order. Heart rate (%HRmax), ratings of perceived exertion (RPE 0-10), OMNI-Walk/run scale) and feelings of pleasure/displeasure (−5 to +5, Feeling Scale) were recorded at the end of each trial. Results: Walking or running based on the Preferred-intensity verbal command elicited similar speed, %HRmax and RPE values, and pleasant feelings compared to the Moderate trial. The High trial was the most effortful and the least pleasant one. All trials elicited %HRmax values that are within the range proposed by the ACSM to promote health-related outcomes.

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Conclusion: Prescribing exercise through verbal commands seems highly attractive due to its effectiveness and simplicity. Walking or running at the Preferred-intensity verbal command may promote health-related outcomes and elicit a positive affective experience, which might influence exercise adherence.
been found across a host of chronic pain conditions. PURPOSE: The purpose of the study was to assess endogenous pain inhibitory function and its relationship with whole body and site specific lean and fat mass. METHODS: PPT of 73 participants (38F; 35M) were assessed in the vastus lateralis (VL) and brachioradialis (BR) using a pressure algometer on both sides of the body before and after submersion of their feet in an ice bath (2°C) for 1min and an isometric knee extension, time to failure task based off of 25% of their maximal voluntary contraction. The difference between post and pre measures was defined CPM response (ice bath) and EIH response (exercise condition). Whole body and site specific fat and lean tissue were assessed via DXA scan, and muscle and fat thickness were assessed in the right (R) and left (L) VL and BR using ultrasound and skinfolds. RESULTS: Both CPM and EIH responses significantly increased PPTs for all of the four measured sites (p < 0.001). BF% (r = 0.256; p = 0.029) and fat mass (r = 0.277; p = 0.018) correlated with LBR CPM but not with site specific measures (p = 0.05). RBR, RVL, and LVL CPM did not correlate with any measures of body composition (p > 0.05). An inverse relationship was found between dominant VL EIH and whole body lean mass (r = 0.259; p = 0.028), as well as limb specific lean mass (r = 0.262; p = 0.026). No relationships were found between any of the body composition measures and non-dominant VL (p > 0.05). CONCLUSION: It appears that in young, healthy adults, whole body and site specific fat mass does not influence endogenous pain-inhibitory function. However, having more lean tissue may have a negative effect on the EIH response. This may be due to larger muscle mass leading to a faster rate of fatigue, reducing exercise time which may have influenced the EIH response rather than muscle mass per se.

Carbon acid bathing elevates vasodilation and blood flow due to transcutaneous absorption of carbon acid, resulting in acceleration of fatigue recovery. On the other hand, carbonated drink intake has no effect on aerobic exercise performance in endurance athletes. However, the effect of carbonated drink intake on anerobic exercise performance remains unclear. PURPOSE: This study aimed to clarify whether carbonated sports drink intake after high-intensity exercise promotes fatigue recovery, leading to attenuation of performance decrement in athletes. METHODS: Seven male and four female athletic sprinters were enrolled in this study (20.4±0.4 years). All subjects performed wingate exercise session, as an index of anaerobic exercise capacity, (3 sets of 20-sec all-out pedaling on a cycle ergometer against a resistance equivalent to 7.5 % of body weight, with a 30-sec rest), and the same exercise session is performed once after a 25-mins break. They orally took carbonated sports drink (CSD) containing 22g of carbon acid or non-carbonated sports drink (NCSD) (500mL) during the 25-mins break in a crossover randomized trial with 3-4days between each trial. Blood lactate concentration was measured at rest and 1, 3, and 5 minutes after the first exercise session.

RESULTS: In all athletic sprinters, mean power output of the first set at the second exercise session was significantly higher in the CSD intake than the NCSD intake (P < 0.05). Additionally, in males, mean power output of the first set at the second exercise session in the CSD intake tended to be higher compared with the NCSD intake (P = 0.07), whereas, no significant difference was observed in females. Moreover, in males, lactic acid integrated value after 10 mins of first exercise session in males was significantly lower in the CSD intake than NCSD intake (P < 0.05), but there was no significant difference in females.

CONCLUSIONS: These results suggest that the carbonated sports drink intake after high-intensity exercise may promote fatigue recovery, and this effect may differ by gender. Supported by JSPS KAKENHI (#18H06423, N. Hasegawa)
CONCLUSION: These findings suggest that the combination of cooling and compression exercise may be an effective intervention method to address symptoms in veterans and other individuals living with insomnia, post-traumatic stress, chronic fatigue, and depression.

1458 Board #220 May 30 9:30 AM - 11:00 AM Whole-body Cryotherapy: Case Series Of Sleep, Pain And Anxiety In Healthy Individuals

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(No relevant relationships reported)

BACKGROUND: Whole-body cryotherapy (WBCT) takes place in an enclosed chamber at ~184 degrees Fahrenheit. WBCT is currently used to alleviate inflammation and pain in arthritis and osteoarthritis and for pain relief in fibromyalgia. However, to date, only anecdotal evidence exists on the benefits of cryotherapy to provide deep, restful sleep. PURPOSE: The purpose of this case series was to test the hypothesis that WBCT would have a positive impact on sleep, pain levels and anxiety of healthy individuals. METHODS: Surveys regarding sleep, pain levels and anxiety were administered before and after 10 WBCT sessions (max 3 minutes) to five participants (Age > 50). Sleep was assessed using the Pittsburgh Sleep Quality Assessment Index (PSQI), pain was assessed using the Borg Rate of Perceived Pain Scale, and anxiety was assessed using the Hamilton Anxiety Scale. RESULTS: One male (Age 74, BMI = 30.7 kg/m², Caucasian) and one female (Age 73, BMI = 24.9 kg/m², Caucasian) presented with pain from arthritis and while the WBCT had no impact on sleep, pain levels and anxiety of healthy individuals. CONCLUSION: These five cases demonstrate that WBCT can improve pain if the subjects present with moderate (or greater pain) and that WBCT may be able to improve sleep and anxiety in subjects that present with problems with sleep or anxiety. Future research is needed in larger samples of people with a history of pain, anxiety and/or sleep issues to continue to test the hypothesis that WBCT may have a positive impact on sleep, pain levels and anxiety.

1459 Board #221 May 30 9:30 AM - 11:00 AM Human Physiologic Thermogenic Response to Resting Cold-Water Immersion: A Thorough Calorimetric Inquiry

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(No relevant relationships reported)

PURPOSE: Navy Diver thermal protection, a primary concern in attempting or completing cold-water tasks, remains inadequate. Optimal heat distribution with minimal energy input is sought. Therefore, heating requirements that support thermal balance (TB) in various cold-water scenarios were quantified. METHODS: Nine active duty Navy personnel underwent four resting immersion scenarios in a temperature-controlled 4900-gallon water tank after donning the same full-body tubestuit calorimeter (for diver heat delivery and measurement), undergoing, and a dry suit (total 1.2 Clos). Each subject achieved TB (~32°C). TB was defined as temperature equilibrium where core and mean skin temperatures varied <0.2°F over 20 minutes time. The four scenarios were combinations of the independent variables: 1) inlet tubestuit water temperature (89°F and 102°F), and 2) immersion tank temperature (35°F or 50°F). RESULTS: Metabolic compensation continuously increased over time (Fig 1a) in the 89°F tubestuit/35°F immersion temperature water group. At the fourth quartile time point (during achievement of thermal balance, Fig 1a - Fourth), subjects in the groups of greater tubestuit heat delivery (102°F) required significantly less metabolic activity than did the coldest scenario (89°F/35°F). Distal anatomical sites showed much lower temperatures than proximal sites (data not shown). Tubestuit heat delivery (Wattage) increased significantly (Fig 1b) with both greater tubestuit temperature (102°F vs 89°F) and in colder water immersion (35°F vs 50°F). Thermal balance was achieved in all scenarios thereby allowing steady-state assessment of heat input/extraction parameters. All * indicate p<0.05. CONCLUSIONS: Given that thermal balance was achieved over the course of each ≤ 2 hr exposure, results suggest that using a lower tubestuit perfusion temperature (89°F vs 102°F) requires less Wattage provided a sufficient metabolic response is activated during the immersion.

1460 Board #222 May 30 9:30 AM - 11:00 AM Consecutive, Long-Duration Hyperoxic Immersions Effect on Skeletal Muscle Performance in Well Trained, Male Divers

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PURPOSE: The primary objective of this study was to investigate how resting, long-duration hyperoxic water immersions (WIs) at 1.35 atmospheres absolute (ATA) affected neuromuscular strength performance. We hypothesized that following five consecutive days of hyperoxic WIs, neuromuscular strength performance would be diminished post-WI and remain reduced longer than 72-hrs post-WI. METHODS: Thirteen (n=13), active male divers [31.3 ± 1.7 (24-43) yrs., mean ± SEM] completed five consecutive 6-hour resting WIs with 18-hour surface intervals while breathing 100% O2 (n=13) at 1.35 ATA. Skeletal muscle performance assessments occurred immediately before and after each WI, and 24 and 72 hours after the final WI. Performance assessments included maximum voluntary isometric contraction (MVIC) and maximal isokinetic (IK) knee extensions and elbow flexions, and maximum handgrip strength (MHG). We measured neuromuscular activation of the quadriceps, biceps brachii, and brachioradialis via surface electromyography (sEMG). RESULTS: MHG declined by 7.8% (p<0.001) WI 1 with performance returning to baseline by 24-hr post-WI. Brachioradialis neuromuscular activation increased by 42% (p<0.001) on WI 1. MVIC knee extension performance dropped by 4% (p<0.001) on WI 3 with an 11% overall decrease in quadriceps neuromuscular activation. Maximal IK knee extension dropped by 3.3% (p=0.008) on WI 5 with 9.3% (p<0.014) drop in overall quadriceps activation dropped by 7% (p<0.013) during the same period. MVIC elbow flexion performance declined by 5.1% (p<0.001) with an 18% decline in neuromuscular activation by WI 5 but returned to baseline by 72-hr post-WI. Maximal IK elbow flexion performance dropped by 8.6% (p<0.001) on WI 5 with a continual decline in biceps brachii neuromuscular activation by 24% (p<0.001) on WI 5. CONCLUSION: The decreases in neuromuscular activation and strength performance coinciding with the non-load bearing muscles affected more than the load-bearing muscles. Yet, the brachioradialis had increases in neuromuscular activation with decreases in performance. These types of hyperoxic WIs caused significant changes to neuromuscular performance after three days of WI with recovery varying with each measured variable with some decrements lasting until the 72-hr post-WI recovery period.

1461 Board #223 May 30 9:30 AM - 11:00 AM Carotid Body Chemosensitivity is Not Attenuated During Hyperbaric Hypoxia

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Water immersion causes CO2 retention, thus increasing the risk of CO2 toxicity. Hyperoxia reduces carotid body (CB) tonic activity, which reduces the ventilatory response to hypercapnia. However, it is not known if CB chemosensitivity is altered during the high partial pressure of oxygen associated with hyperbaria. PURPOSE: We tested the hypothesis that oxygen breathing would lower CB chemosensitivity more during the high partial pressure of oxygen associated with hyperbaria. METHODS: Five subjects (age: 23±2 y; BMI: 28.5±5 kg/m²) completed two, four-hour dry dives at 6.1 msw (1.6 ATA) breathing either 100% O2 or air. CB chemosensitivity was assessed using hypoxic ventilatory response (CBH) and brief hypoxic ventilatory response (CBHb) tests pre-dive, 75 and 155 min into the dives, immediately post-dive, and 60 min post-dive. CBHb consisted of
inhaling 100% N₂ for 2.6 breaths, repeated four times, with 2 min between hypoxic exposures. Cₐ₂O₁₀ consisted of inhaling 13% CO₂, 66% N₂, 21% O₂ for one breath, repeated four times, with 2 min between hypoxic exposures. CB chemosensitivity was calculated as the slope of the linear regression line of the peak minute ventilation (MV) in three consecutive breaths vs. the nadir oxygen saturation (pulse oximetry; SpO₂) or peak end tidal CO₂ tension (capnography; PETCO₂) for CBₐ₂O₁₀ and CB respectively. Data are reported as a change from pre-dive (mean±SD). RESULTS: SpO₂ was higher than 95% at all time points (p<0.01), but was not different as between conditions (p=0.24). The change in MV was not different over time (p=0.11) or between conditions (p=0.42). PETCO₂ increased during the dive at 75 (Air: 10±5 vs. O₂: 7±4 mmHg) and 155 min (Air: 8±5 vs. O₂: 5±3 mmHg; p<0.01), but did not differ between conditions (p=0.14). CBₐ₂ and CB were not different at any time point (p=0.29 and p=0.48, respectively) and were not different between 100% O₂ or air conditions (p=0.64 and p=0.32, respectively). CONCLUSIONS: These data indicate that CB chemosensitivity to hypoxia and hypercapnia is not attenuated during hyperbaric hypoxia. Therefore, the carotid body chemoreceptors do not appear to contribute to CO₂ retention in hypoxia.

PURPOSE: Divers with prolonged hyperbaric exposure may suffer from digestive dysfunctions, which relate to impairment of intestinal mucosal immune system and gut microbiota homeostasis. We studied the effects of a 4-day hyperbaric exposure on gut microbiota and intestinal antimicrobial peptides (AMPs) in mice.

METHODS: 20 male C57 Mice, 8-week old, were randomly divided into hyperbaric exposure group (HE, n=10) and control group (CON, n=10). The hyperbaric environment was established by compressed N₂/O₂ mixed gas, and sustained the ambient pressure at 500Pa for 4 days in the pressure chamber. Intestines were excised and stained with Hematoxylin and Eosin (H&E) and alcian blue-periodic acid-schiff staining (AB-PAS). Feces and intestines were collected and extract gDNA and RNA respectively. We used qPCR to assay bacterial population (Bacteroides, Clostridia, Lactobacillli, Enterobacteriobae, and Akkermansia muciniphila) of the feces. and the AMPs (Defa₅, Defb₁, Randh, Regb₁ and Regb₃) of small intestine and colon.

RESULTS: During the hyperbaric exposure, the mice did not exhibit any behavioral abnormality, including nitrogen narcosis. According to the AB-PAS staining, the mucus was reduced in colons post hyperbaric exposure. And there was no significant morphological difference between intestines and colons from the mice of HE group and CON group. By comparing with the 16S rRNA genes, results revealed a significant increase in the relative abundances of A. muciniphila (9.28±5.67) and Clostridia (3.45±0.63) in HE. The relative abundance of Lactobacillli was lower (0.40±0.24) in HE. Moreover, a distinct increase of Enterobacteriobae (23.34±8.88) was observed in HE compared with CON. Gene expressions for Defa₅ and Defb₁ in HE were decreased in small intestine, while Defb₁ and Regb₃ in HE were significantly decreased, and Defa₅ and Regb₃ increased in colon.

CONCLUSIONS: In sum, the data showed that a four-day hyperbaric exposure induced changes in the mucus of colon, the mRNA level of AMPs, and the gut microbiota composition in mice.

Exercise in acute normobaric hypoxia has been shown to delay parasympathetic reactivation after submaximal but not supramaximal exercise; however, the behavior of parasympathetic withdrawal at the onset of exercise has yet to be fully explored. PURPOSE: The purpose of this study was to evaluate trends for time-domain kinematics of parasympathetic withdrawal at the onset of high-intensity upper-body exercise during normobaric hypoxia and normoxia. METHODS: Nine recreationally-active men (21.6±1.3 y) performed a graded exercise test to determine peak power output under normobaric hypoxia (FiO₂ = 14.0±0.1%) and normoxia (FiO₂ = 20.1±0.2%) on different days, and four time to exhaustion trials randomized over two days at 90% and 110%, and 100% and 120% of peak power output, respectively, under similar conditions. A heart rate monitor recorded R-R intervals randomized at 1000 Hz that were later analyzed using commercially-available software. Root mean square of the standard deviation of R-R intervals (RMSSD) values were calculated using a time-varying method with 64-s moving windows and a 3-s shift. A piecewise bilinear fitting function was utilized to determine the vagal response to high-intensity steady-state arm cranking. Two-way (condition × intensity) repeated measures ANOVA was used to compare estimates of the initial RMSSD (y-intercept of the first linear function), rate of RMSSD decline (slope of the first linear function), time to parasympathetic withdrawal (x-value at the intersection of the first and second linear functions), RMSSD at the time of parasympathetic withdrawal (y-value at the intersection of the first and second linear functions).

RESULTS: No significant interactions or main effects were noted for initial RMSSD (p=0.05; 23.4±3.2 ms), rate of RMSSD decline (p=0.05; 0.45 ± 0.08 ms/s); time to vagal withdrawal (p<0.05; 46.1 ± 2 s), and RMSSD at the time of vagal withdrawal (p<0.05; 3.79 ± 0.67 ms). CONCLUSION: Parasympathetic withdrawal does not seem to be affected during upper-body exercise under normobaric hypoxic or normoxic conditions at exercise intensities between 90% and 120% of peak power output in male participants. Funding disclosure: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.
CONCLUSION: The purpose of this study was to investigate the effect of body composition and physical fitness of Air Force pilots on hypoxic tolerance (Time of Useful Consciousness, TUC) under hypoxic hypoxic conditions. METHODS: At the sea level, we measured the body composition and physical fitness of 99 adults who were not exposed to hypoxic environment. In the hypoxia chamber, which can simulate high altitudes, we set the altitude to 25,000 feet and measured the TUC and the maximum heart rate (HRmax(H)). Pearson’s Correlation was used to determine the relationship between TUC and other variables, and multiple regression was performed to determine the independent variables that best explain the TUC. RESULTS: TUC is positively correlated with maximum oxygen uptake (VO2max), Stroke Volume (SV), arteriovenous oxygen difference (a-Vo2 diff) and endurance (Sit-up, Push-up). The maximum heart rate on the ground (HRmax(S)), HRmax(H), body fat mass, and percent body fat were negatively correlated with TUC. A regression analysis showed that 84.5% of the TUC can be explained by body composition and physical fitness. CONCLUSION: Our results revealed that increased cardiorespiratory fitness and decreased fat could significantly impact TUC. Therefore, for Air Force pilots who are always at high altitudes and at risk for exposure to hypoxia, aerobic exercise is essential.

High altitude missions pose challenges not seen during sea level expeditions. In order for missions to be successful, it is imperative for Soldiers to maintain physical and cognitive performance. Acetazolamide (AZ) is known to decrease the effects of Acute Mountain Sickness (AMS), but reported side effects (e.g., drowsiness, peripheral parasthesias) could potentially impair manual dexterity. PURPOSE: The purpose of the study is to evaluate whether AZ treatment (250 mg bid) alters manual dexterity during 30 hours exposure to 3,500 m simulated altitude. METHODS: Six volunteers (6 males, 22 ± 3.2 y, 77.5 ± 11.5 kg, 176.2 ± 7.1 cm) took part in two separate 30 hour exposures to 3,500 m simulated altitude in the USARIEM hypobaric chamber. Volunteers received AZ (250 mg twice daily) or a placebo, in a single-blind crossover design. Prior to exposure, volunteers were trained at sea level in all procedures. Dexterity testing included the Purdue Pegboard (sum of rows completed in 30 seconds (Sit-up, Push-up). The maximum heart rate on the ground (HRmax(S)), HRmax(H), body fat mass, and percent body fat were negatively correlated with TUC. A regression analysis showed that 84.5% of the TUC can be explained by body composition and physical fitness. CONCLUSION: Our results revealed that increased cardiorespiratory fitness and decreased fat could significantly impact TUC. Therefore, for Air Force pilots who are always at high altitudes and at risk for exposure to hypoxia, aerobic exercise is essential.

Under normobaric hypoxia, aerobic capacity is inherently limited, possibly leading to changes in energy system contribution. While most of the research has focused on lower body cycling or full-body exercise, upper body differences in muscle fiber type distribution and diffusion distance may require greater anaerobic energy provisions as reflected by accumulated oxygen deficit (AOD). PURPOSE: To observe the effects of normobaric hypoxia on AOD and energy system contribution during different intensities of upper-body arm cranking exercise. METHODS: Twenty-one recreationally active men (21.4 ± 1.4 y; 175.5 ± 5.7 cm; 84.8 ± 11.7 kg) performed a graded exercise test (GXT) in normobaric normoxia (N; FiO2~20%) and normobaric hypoxia (H; FiO2~14%) to determine peak power output (PPO). Time to exhaustion (TTE) trials were later conducted at 110% and 120% PPO under both N and H. AOD (in L·min⁻¹) was calculated as the difference between predicted O2 consumption (extrapolated from a regression equation calculated from GXT) and measured O2 consumption during the TTEs, standardized to time. Anaerobic energy system contribution (%AOD) was calculated as [(actual O2 consumed/predicted O2)] × 100. AOD and %AOD were calculated in three conditions: N, H, and H using the N regression equation (H). Two-way (condition × intensity) repeated measures ANOVAs were conducted for AOD and %AOD. RESULTS: There was a significant condition × intensity interaction for AOD (p<.009) and %AOD (p<.007). At 110% PPO, %AOD was significantly greater (p<.029) in H compared to N (0.33 vs. 0.19 L·min⁻¹, respectively) but not H compared to N. At 120% PPO there were no differences in %AOD between conditions. CONCLUSION: Calculating AOD for hypoxic exercise using a regression equation derived from normoxic conditions reveals a greater anaerobic contribution relative to normoxic exercise. The greater AOD and %AOD in hypoxia compared to normoxia that was present at 110% PPO was not reproduced at 120% PPO. This may suggest a possible threshold at which hypoxia has no further effect on energy system contribution in this exercise modality.
Altitude training masks (ATMs) are frequently used during exercise to enhance physiologic adaptations, yet few studies have examined the effects of ATMs when used during recovery periods.

**PURPOSE:** To examine the effects of ATMs used only during low-intensity recovery intervals in a high-intensity interval training (HIIT) program in healthy young adults.

**METHODS:** Participants engaged in 18 HIIT over a 6-week period using a treadmill. HIIT sessions comprised of 6-8, 60-second high-intensity bouts at a relative work rate corresponding to 90% of participants’ maximal heart rate, alternating with 90-second low-intensity recovery bouts at a relative work rate corresponding to 20% VO2max. Participants were randomly assigned to an experimental group (EXP) which wore an ATM only during the low-intensity bouts or to a control group (CON) which did not use an ATM. Cardiopulmonary exercise tests (CPET) were performed before and after the HIIT.

**RESULTS:** 10 participants completed the study in the EXP group (6 females; 26±4.1 years; BMI: 22.8±2.1 kg/m²) and 10 in the CON group (7 females; 24.3±3.5 years; BMI: 24.2±1.6 kg/m²). Both groups experienced improvements in VO2max (EXP: 39.9±4.6 vs. 42.8±6.0 ml/kg/min, p=0.02; CON: 39.7±6.1 vs. 43.9±8.3 ml/kg/min, p=0.01; baseline vs. follow-up, mean±SD). The EXP group alone saw improvements after training in time to anaerobic threshold (169±31.2 vs. 213±56.2 sec, p=0.04), increased peak work rate during CPET (44±26.9 vs. 88±54.3 Watts, p=0.03), and increased minute ventilation during peak exercise (108±15.5 to 113.6±19.6 L/min, p=0.04). No other changes were observed in the CON group.

**CONCLUSIONS:** Using ATMs only during the low-intensity bouts of HIIT appears to have afforded participants with unique training adaptations not observed in standard HIIT. Conventional use of ATMs employs the masks during exertional portions of exercise training, not solely during recovery periods. These findings suggest that ATMs may serve as a valuable training adjunct even if used only during recovery periods in HIIT. Supported by: GWU SMHS Emerging Scholars Award 2016-2018.
of rest, participants performed a graded arm exercise test (GXT) to establish peak O₂ consumption. Substrate oxidation rates were derived from cardiorespiratory data averaged over the last minute or collected before and after exercise. The subjects consumed C-labeled glucose immediately before exercise, and we collected expired gas during exercise to determine O₂-excretion (calculated by CO₂/CO₂).

RESULTS: Running velocity were significantly lower in the HYPOR (9.4 ± 0.3 km) than in the NOR (10.6 ± 0.3 km) and HYPOR (10.6 ± 0.3 km). Exercise-induced blood lactate elevation was significantly augmented in the HYPOR than in the NOR and HYPOR (P < 0.001). The HYPOR showed significantly higher CHO oxidation (evaluated by VCO₂ and VCO₃) during exercise compared with other two trials (P < 0.01). In contrast, glucose oxidation (O₂-excretion) during exercise was significantly lower in the HYPOR than in the NOR (P < 0.01).

CONCLUSIONS: Endurance exercise under moderate hypoxic conditions promoted whole body CHO metabolism and exercise CHO oxidation during exercise was attenuated compared with the same exercise under normoxic condition.

### 1473 Board #325 May 30 9:30 AM - 11:00 AM Short-term Altitude Training Effects on Aerobic Performance Parameters in Collegiate Cross-country Runners

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(no relevant relationships reported)

Endurance athletes have been using altitude training for over half a century to improve sea-level performance. Live High-Train Low (LHtL), a contemporary form of altitude training, was proven best for long-distance (5000m) athletes. However, while athletes continue to use this training technique in an acute fashion (<2 weeks), no study has shown the effects of such a short-term use on aerobic performance. PURPOSE: To evaluate aerobic performance parameters, i.e., aerobic capacity (VO₂peak) and ventilatory threshold (VT), after 6 days of LHtL altitude training in collegiate cross-country runners.

METHODS: Fourteen male NCAA cross-country runners (age: 19.07±0.92 y.o.) with initial VO₂peak of 73.13 ± 5.65 mL/kg/min participated in the study. VO₂peak and VT were evaluated using a metabolic cart at sea-level, pre- and post-training. Runners from sea level were trained to high altitude where they lived at 1322m above sea-level for 6 days. Six training sessions were performed at altitudes ranging from 881.25±148.87m to 1047.70±237.29m above sea-level with training sessions averaging a duration of 75.25±7.04 mins, speed of 13.02±1.60 kmph and distance of 16.42±2.95 km.

RESULTS: There was no significant effect of either absolute (P=0.325) or relative VO₂peak (P=0.643). A significant main effect of time was found for VO₂peak of absolute VT (P=0.001) which changed from 3.35±0.92 L/min to 3.89±0.55 L/min, and VT relative to VO₂peak (P=0.001), which changed from 74.29±8.04% of VO₂peak to 87.57±3.48% of VO₂peak. Consequently, there was a significant main-effect of time for heart rate at VT (P=0.025), which changed from 168.50±14.87 bpm to 176.07±11.02 bpm. CONCLUSION: Although there was no significant change in VO₂peak, short-term LHtL training had a positive effect on VT in trained cross-country runners. This is possible due to the hemodilution resulting from return to sea level combined with the preserved ventilatory adaptations from altitude training.

### 1474 Board #236 May 30 9:30 AM - 11:00 AM Exogenous Glucose Oxidation During Endurance Exercise in Hypoxia

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(no relevant relationships reported)

The exercise under hypoxic condition augmented carbohydrate (CHO) metabolism during exercise (Sumi et al. 2018). However, detailed CHO oxidation pattern during exercise under hypoxic condition remain unclear.

PURPOSE: The purpose of the present study was to evaluate the effect of endurance exercise under moderate hypoxic condition at the same energy expenditure or exercise intensity on exogenous glucose oxidation.

METHODS: Nine active healthy males completed three trials on different days, consisting of 30-min running at each exercise intensity of the following: 1) 65% of normoxic VO₂peak under the normoxic condition (FIO₂ = 20.9%, NOR), 2) 65% of hypoxic VO₂peak under the hypoxic condition (FIO₂ = 14.5%, HYPOR), 3) 65% of normoxic VO₂peak under the hypoxic condition (FIO₂ = 14.5%, HYPOR). Venous blood samples were collected from the tail vein before and after exercise. The subjects consumed C-labeled glucose immediately before exercise, and we collected expired gas during exercise to determine O₂-excretion (calculated by CO₂/CO₂).

RESULTS: There was no significant effect of altitude on blood lactate levels. However, exogenous glucose oxidation during exercise was attenuated compared with the same exercise under normoxic condition.
RESULTS: The results showed that the high intensity RE decreased peak torque and increased muscle pain in both groups. Circulating creatine kinase (CK), myoglobin and interleukin 6 (IL-6) also increased immediately after RE in normoxia subjects. CK, myoglobin and testosterone/cortisol ratio (T/C ratio) of hypoxia-hypoxia group were lower than those of normoxia group 24 and 48 h after RE. However, IL-6 of hypoxia-hypoxia group was higher than that of normoxia group 24 and 48 h after RE. No differences were found in thiobarbituric acid reacting substance (TBARS) levels or peak torque levels between normoxia and hypoxia-hypoxia groups.

CONCLUSIONS: Systemic hypoxia-hypoxia preconditioning could reduce muscle damage induced by high intensity RE. These effects may be due to increased anti-inflammatory cytokine secretion.

1477 Board #239 May 30 9:30 AM - 11:00 AM
The Integrative Physiological and Neuromuscular Effects of High Altitude Cycling In World Class Endurance Athletes
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PURPOSE: Six pro endurance athletes (3 men, 3 female) participated in a study investigating the effects of cycling at high altitude on physiological & neuro-muscular systems.

METHODS: Athletes were tested in three locations using identical procedures and equipment. Baseline testing took place in Santa Monica, CA. Then, the entire lab’s equipment was transported to two additional study locations (Death Valley and Mammoth Mountain, CA). Each athlete completed a 5-stage, 3-min/stage ramp exercise trial. Athletes performed the ramp test in duplicate at each test site (morning and afternoon). Respiratory-metabolic measurements, regional oxygen saturation (SMO2), substrate oxidation rates, and EMG activity were recorded continuously. Blood samples were taken the last 15-secs of each stage. Data were analyzed using repeated-measures ANOVA models and Turkey Post-Hoc test to identify specific areas of significance when appropriate.

RESULTS: The mean workload across all 5 stages was 227 ± 60 watts (Stage 1 = 117 watts; Stage 5 = 287 watts). Compared to sea level, the over-all mean SMO2 saturation at the 227 watts mean was 24.5% lower at altitude (p = 0.04) while deoxy hemoglobin was 18.5% higher (p=0.04). Correspondingly, lactate concentrations were 27.2% greater, but this difference did not reach significance. However, lactate concentrations during stage 5 were 34% greater at altitude compared to sea level (p = 0.035). At sea level, quadriceps (Quad) muscle activation accounted for 58% of the total force produced while cycling at altitude quad work was reduced to 51%. Lactate concentrations had an inverse relationship with EMG Quad activity (p<0.03) and direct relationship with hamstring force activation (p = 0.03). RER values indicated greater CHO oxidation rates at altitude across all stages combined (Sea level: 2.127 gm/min; Altitude: 2.954 gm/min, p = 0.01). For stages 4 & 5, despite higher respiratory rates, over-all ventilation volumes declined cycling at altitude lowering oxygen uptake by 10.2% and 19.4% respectively despite being at the same workload compared to sea level.

CONCLUSIONS: These results indicate cycling at altitude requires greater physiological-metabolic response to maintain neuro-muscular function at cycling work rates up to 80% of max effort.

1478 Board #240 May 30 9:30 AM - 11:00 AM
Effect of Acetazolamide on Hand and Finger Strength During 30 Hours Exposure to 3500m Altitude
Beau R. Yurkevicius, Adam C. Nixon, Karleigh E. Bradbury, Katherine M. Mitchell, Billie K. Alba, Kirsten E. Coffman, Robert W. Kenefick, FACSM, Nisha Charkoudian, FACSM, USARIEM, Nutick, MA. (Sponsor: Nisha Charkoudian, FACSM) (No relevant relationships reported)

Activities that require rapid ascent to altitude, such as those that commonly occur in military, mountain rescue, and recreational settings, often require substantial hand and finger strength.

METHODS: Six male volunteers (22.2 ± 3.2 yrs, 77.5 ± 11.5 kg, 176.2 ± 7.1 cm) participated in two separate 30 hour altitude exposures (3500 m, 20°C, 20% RH) in the USARIEEM hypobaric chamber. Participants were given either a placebo or 250 mg AZ twice a day for 3.5 days (2 sea-level days + the 30 hour altitude exposure) in a randomized, single-blind crossover design. During each altitude exposure, strength tests were performed which comprised of maximal hand grip and finger pinch (palmar, key, tip) strength tests.

RESULTS: No volunteers reported sensations of peripheral paraesthesia. There was no difference between altitude exposures in any of the measures of hand and finger strength (placebo vs. AZ; hand grip: 43 ± 7 vs. 43 ± 8 kg; palmar pinch: 11 ± 2 vs. 12 ± 2 kg; key pinch: 1 ± 1 vs. 11 ± 1 kg; tip pinch: 8 ± 1 vs. 8 ± 1 kg; p > 0.05 for all).

CONCLUSIONS: Our results suggest that 500 mg/day AZ treatment does not influence hand and finger strength during a 30 hour exposure to 3500 m altitude. Future studies could evaluate if higher doses of AZ, that may induce more paraesthesia, would influence hand and finger strength differently.

Future studies could evaluate if higher doses of AZ, that may induce more paraesthesia, would influence hand and finger strength differently.

1479 Board #241 May 30 9:30 AM - 11:00 AM
The Effect Of Moderate Hypoxia On Skeletal Muscle Cell Growth And Related Protein Expression
Koki SAKUSHIMA1, Maki YOSHIKAWA1, Takeshi HASHIMOTO, FACSM2, Rytsmeikan University, Kyoto, Japan. 3Ritsumeikan University, Siga, Japan. (Sponsor: Takeshi Hashimoto, FACSM) Email: saku00812@gmail.com (No relevant relationships reported)

PURPOSE: Skeletal muscle atrophy is one of the adaptations of hypoxic environment. However, previous studies showed resistance training under hypoxic environment (10% oxygen concentration) causes greater muscle hypotrophy than normoxic environment (Nishimura et al., 2010). Because direct effect of hypoxia on skeletal muscle cell growth remains unknown, in vitro studies to investigate cell responses to hypoxia are needed. Although some studies reported that severe hypoxia (i.e., 1% to 5% oxygen concentration) attenuated cell growth (Marie Csete et al., 2001; Gustafsson et al., 2005), we hypothesized that moderate hypoxia (e.g., 10% oxygen concentration) might ameliorate muscle cell growth. The purpose of this study was to examine the effect of 10% oxygen environment on skeletal muscle cell growth and related protein expressions.

METHODS: C2C12 skeletal muscle cells were divided into two groups: control group cultured in 20.9% oxygen environment (CON) while hypoxia group cultured in 10% oxygen environment (HYP) during differentiation. We analyzed expressions of myogenesis-related proteins Myogenin, using Western blotting. As well, we analyzed mTOR signaling. We also conducted immunocytochemical analyses to assess myotube diameter and Differentiation Index (DI), an indicator of muscle differentiation (Oishi et al., 2015). The lactate concentration in the medium was measured every day.

RESULTS: The myotube diameter in the HYP was significantly greater than that in the CON (p < 0.05). The DI was significantly higher in the HYP than in the CON (p < 0.05). The protein expression of myogenin was significantly higher in the HYP than in the CON (p < 0.05). The expression level of phosphorylated mTOR was significantly higher in the HYP than in the CON (p < 0.05). The lactate concentration was higher in the HYP than in the CON (p < 0.05). Myotube atrophy was observed 8 days after the differentiation in the CON, while moderate hypoxia maintained myotube thickness.

CONCLUSIONS: These findings suggest that hypoxic hypoxia environment may enhance skeletal muscle cell growth and hypertrophy. Supported by Grant-in-Aid for Scientific Research from the Japanese Ministry of Education, Cultture, Sports, Science, and Technology (Grants 26702029, 18K19762).

1480 Board #242 May 30 9:30 AM - 11:00 AM
Effects of Chronic Continuous Exposure to Low Dose Carbon Monoxide on Hemoglobin Mass and Performance
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Reported Relationships: W.F. Schmidt: Receipt of Intellectual Property Rights/Patent Holder; Walter Schmidt is a managing partner of the company 'Bleutec GmbH', but he is unaware of any direct or indirect conflict of interest with the contents of this abstract.

Inhalation of carbon monoxide (CO) blocks the oxygen binding sites of the hemoglobin molecule and may produce similar effects as exposure to altitude. While single CO-doses and short-term application which are used in medicine and science do not exert measurable effects on erythropoiesis and performance, no data exists about chronic administration.

PURPOSE: To determine the effect of chronic low dose CO-application on hemoglobin mass and performance. METHODS: For three weeks, eleven male healthy and moderately trained subjects inhaled a CO-bolus five times the day to increase their HbCO concentration in blood by approx. 5%. Eleven matched subjects
received a placebo. Hemoglobin mass (Hbmass), serum erythropoietin concentration [EPO], ferritin, and basic hematological parameters were determined before and weekly during and until two weeks after the CO-inhalation period. An incremental step test until exhaustion on a cycle ergometer was performed before, at the end and one week after the CO administration period. RESULTS: During and after the intervention period, there were significant interactions between time and groups for Hbmass (p=0.001), ferritin (p=0.005), EPO (p=0.001), percentage (%) and immature reticulocytes (IRF) between trials and groups. A tendency for an interaction was found for max power and VO2max (p=0.1). In the CO-group, Hbmass continuously increased from 919 ± 96g to 962 ± 78g in week 3, (p=0.001) and persisted for the following three weeks. Whole blood and plasma volume did not change. Reticulocytes (%) and IRF increased after one week (ref= 1.21.0 ± 1.10.25%; p=0.01; IRF from 5.1 ± 7.6% to 7.6 ± 7.2%, p=0.05). [EPO] tended to increase after one week (p=0.07) and was suppressed in the post period (p=0.01). Ferritin markedly decreased during the inhalation period (from 106 ± 37ng/ml to 72 ± 37ng/ml, p=0.001). VO2max tended to increase from 4230 ± 280 ml/min to 4350 ± 350 ml/min (p=0.1) immediately after the inhalation period and showed a significant relationship to the change in Hbmass (r2=0.29, p=0.05). In the placebo group no effect was observed.

CONCLUSIONS: Chronic continuous exposure to low dose carbon monoxide increasing HbCO by ~5% significantly increased erythropoietic activity and showed a positive effect on performance.

1481 Board #243 May 30 9:30 AM - 11:00 AM
High Intensity Interval Training And Acute Altitude Exposure In A Masters Athlete: A Case Study
Katherine Woolley, Thomas Martin. Quinnipiac University, Hamden, CT.

This study involved an experienced, 64 year-old male mountaineer who trained at sea-level and climbed Mount Kilimanjaro (5,895 m). High Intensity Interval Training (HIIT) is a time-saving mode of exercise consisting of bursts of all-out effort and active recovery which has shown to improve cardiovascular fitness and strength. Hypoxia induces Acute Mountain Sickness (AMS) which poses many health risks to individuals of all ages. PURPOSE: To assess the effects of a HIIT protocol on a Masters climber and investigate physiologic changes due to altitude exposure and incidence of AMS. METHODS: The six-week training program consisted of six alternating rounds of 85-90% max HR progressing from 90-120 seconds followed by 3 minutes active recovery. Subject was tested at: baseline, post-training/pre-climb, and post-climb. For baseline and post-training body composition, pulmonary function, hematology, cognitive function, reaction time, VO2 max, and muscle strength were measured. Post-climb all measures were repeated except VO2 max and strength. While climbing, physiologic and GPS data were collected. At each basecamp, resting SpO2, HR, Lake Louise Score (LLS), reaction time, cognitive function (Stroop test), and coordination tests were performed. The LLS is the standard for diagnosing AMS. RESULTS: Subject retired and returned healthy. HIIT increased VO2 max (36.4 to 47.1 ml/kg/ min), muscle symmetry, and FEV1/FVC increased 0.86%, body fat decreased from 7.2 to 8%. Subject experienced mild AMS on days two and three of the ascent. Reaction time increased by 1 second, and the Incongruent Stroop test time increased 57 seconds at high camp compared to baseline. On average, SpO2 and HR dropped 3.2% and 8.5bpm respectively overnight at camp, HR, and RR increased with altitude. Upon return, serum Potassium and Creatine Kinase were elevated (5.4, 268), and FEV1/FVC decreased 4.1%, body fat decreased to 3.6%. CONCLUSIONS: HIIT is a safe and effective way to train a Masters athlete for the rigor of high altitude. These findings are in line with previous research using electrical stimulation in hypoxia which induce greater reduction in arterial stiffness than those in normoxia.

1483 Board #245 May 30 9:30 AM - 11:00 AM
Functional Inspiratory Muscle Training Improves The Strength of Inspiratory Muscles During Load Carriage In Cold-hypoxia
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PURPOSE: Load carriage (LC) exceeding 20kg elicits respiratory muscle fatigue (RMF) in sea level thermo-neutral conditions. Sub-maximal physical activity in cold-hypoxia has shown to elicit RMF. Inspiratory muscle training (IMT) combined with LC has failed to reduce RMF. Functional IMT (FIMT) may activate non-respiratory roles of the diaphragm and respiratory muscles resulting in adaptations beyond that of static IMT. METHODS: Loaded (18.2kg) walking trials were completed pre, mid and post training (trial 1, 2 and 3, respectively). Participants (n=15) performed a 6km loaded walk at 30% VO2max over 4 stages 0 - 6km in 0.5 increments at 5, 5% and 10% gradient in cold-hypoxia (4300m in -10°C). Following trial 1, participants were randomly assigned to control (Con)- or experimental (Exp)- to undertake 4 weeks of IMT using a pressure threshold training device. The Exp performed 2 x 30 breaths daily at 50% maximal inspiratory pressure (Pim) and Con performed 60 daily breaths at 15%Pim. FIMT (5 exercises designed to engage core muscles, 3 involved LC) was then performed 3 times weekly at the same intensities as IMT. RESULTS: Inspiratory muscle fatigue was prevalent following trial 1 (p<0.001). Relative to baseline (269.9 ± 15.7 cmH2O) trends were identified for greater Pim in Exp post-IMT (145.5 ± 20.5 cmH2O, p=0.066) with no changes in Con. FIMT showed no further significant increase in Pim (p=0.104). Pim values post-6km in Exp were significantly greater than Con and higher than pre-6km pre-intervention values (p=.007). However, PAP was unchanged in Exp (p=0.214). No significant relationship between exercise and protocol were observed between AP vs baseline Pim and VO2max vs AP. CONCLUSION: Four weeks of IMT and FIMT strengthened inspiratory muscles by 23%. Despite no reduction in RMF, Pmax values were significantly greater post-6km in Exp and higher than pre-6km pre-intervention values. Protocols employing more progressive training loads may reduce RMF. Due to the higher intensity and prolonged nature of LC in cold-hypoxia, respiratory muscle endurance may be more dominant than strength. Thus, requiring further investigation.

1484 Board #246 May 30 9:30 AM - 11:00 AM
Comparing Physiological Responses to Single and Double Leg Submaximal Cycling in Normoxia and Hypoxia
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INTRODUCTION: It has been well established that exercise intensity as well as exercise performance declines at altitude. However, it has yet to be determined how hemofar blood flow and muscle oxygenation kinetics (total tissue saturation, oxy- and deoxygenated hemoglobin, as well as total hemoglobin) are influenced by altitude during submaximal and maximal performances. Furthermore, it has yet to be determined if the utilization of small muscle mass exercise, which allows for greater blood flow to the active muscle, will allow an individual to generate the same muscle oxygenation kinetics in hypoxic conditions that is achieved during larger muscle mass activities in normoxia. PURPOSE: Thus, the purpose of this study was to determine if muscle oxygenation was compromised at altitude during submaximal bouts of exercise and whether reducing the active muscle mass exercise could be used to offset any observed decrement due to increases in blood flow. Abstracts were prepared by the authors and printed as submitted.
CONCLUSIONS: The results suggest that elevated hemoglobin saturation and femoral blood flow during the single leg condition in hypoxia are similar to that observed during double leg cycling in normoxia and may prove to be a viable training modality that would offset the main disadvantage of living at altitude by enabling an individual to exercise at the same level of intensity achieved at normoxia.

C-42 Free Communication/Poster - Microgravity/Space Physiology
Thursday, May 30, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

1485 Board #247 May 30 9:30 AM - 11:00 AM
Impact Of Long-acting Reversible Contraceptives On Bone Density During Simulated Microgravity
Heather C. M. Allaway, Sarah E. Little, Harry A. Hogan, Susan A. Bloomfield, FACSM. Texas A&M University, College Station, TX. (No relevant relationships reported)

Hormonal contraception is routinely used by premenopausal women, including female astronauts, to suppress ovarian function and menstrual cycling. Combined oral contraceptive pill (COC, ethinyl estradiol and progestin) use leads to a suppression of bone turnover and reduced bone mineral density (BMD) gain with long-term exercise. Long-acting, reversible contraceptives (LARC, progestin-only) provide many practical benefits, including reversibility and reduced risk of unintended pregnancy in comparison to COC use. The current study evaluated the impact of LARC (implant) use on bone health in female astronauts.

METHODS: Virgin female Sprague-Dawley rats (n=24; 25-30 weeks) were singly housed and randomly assigned to placebo and LARC implants, via a slow-release etonogestrel implant, and randomly assigned to 4 placebo and 4 LARC animals, n=6 per group. Animals were subsequently randomized to 6-8 weeks of bed rest, with half of the animals then exposed to 6 weeks of hypobaric microgravity (HUM) or normobaric normoxia (NORM).

RESULTS: There was a time*loading group interaction (p<0.01) for body weight and HU femur BMC, such that over time the HU animals had a significant increase in BMC compared to the ambulatory controls. No difference was found in the amount of oxygenated hemoglobin when comparing the single leg trial in hypoxia to the double leg trials in normoxia (p=0.36) and hypoxia (p=0.13).

CONCLUSIONS: The space environment includes weightlessness and galactic cosmic radiation (GCR), both of which can have a negative impact on bone parameters. In particular, acute exposures to space-relevant doses (2 Gy or less) of simulated GCR lead to a rapid acceleration of bone resorption activity and suppression of bone forming osteoblasts, resulting in diminished bone mineral density (BMD), strength and altered microarchitecture. A key mechanism driving these changes may be a radiation-induced increase in pro-inflammatory cytokines, such as TNF-α. Consuming a diet rich in omega-3 fatty acids has been associated with attenuated reductions in bone parameters in astronauts, mice and elderly humans with corresponding reductions in circulating inflammatory cytokines.

PURPOSE: To test the hypothesis that a diet high in omega-3 fatty acids will mitigate radiation-induced bone loss and reduce inflammatory cytokines in bone osteocytes and serum.

METHODS: Adult (30- to 50-week-old) female Lgr5-EKGF C57BL/6 mice (n=4-6 per group) were acclimated to a corn oil/cellulose (COC) or fish oil/pectin (FOP) diet for 3 weeks. Animals were subsequently randomized to total body low dose high-energy radiation (0.1, 0.25, 0.5 Gy of 1000 MeV/n 56Fe at 25 Gy/min at Brookhaven National Lab) or non-irradiated control (sham) and euthanized 8 weeks later. MicroCT (ScanCo, Switzerland) analyses were performed to assess bone geometry and microarchitecture at the mid-shaft and distal end of the femur. Significance was assessed using an a of 0.10.

RESULTS: There was a significant main effect of diet on mid-shaft femur periosteal diameter (P<0.001) and endocortical diameter (Endo. Dm.) (P<0.001). The FOP diet led to larger Peri. Dm. (P=0.051) for all) and Endo. Dm. (P=0.041 for all) than did the COC diet at all doses. We could not detect an impact of 56Fe on cortical area or cancellous bone volume at the distal femur. Irradiation with 0.25 and 0.5 Gy in the FOP mice showed significant increases in distal femur volumetric BMD (P=0.014, P=0.063) and trabecular thickness (P=0.058, P=0.028), as compared with sham FOP mice.

CONCLUSIONS: Though we did not detect a significant impact of radiation on bone parameters, these early data analyses suggest some modest benefits from a diet high in omega-3 fatty acids on cortical and cancellous bone parameters.

1487 Board #249 May 30 9:30 AM - 11:00 AM
Circulating MicroRNA Expression and Serum Biomarker Changes After 30 Days of Head-Down Bed Rest
Samuel R. Buchanan1, Carl Ade2, Brenna Baker2, Debra Bemben, FACSM1, The University of Oklahoma, Norman, OK; 2Kansas State University, Manhattan, KS. (Sponsor: Debra Bemben, FACSM)
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Microgravity is known to have negative effects on bone health. Circulating microRNAs (c-miRNAs) are non-coding RNA molecules assessed in blood that have potential as biomarkers of osteoporosis and may be beneficial for tracking changes in bone status. PURPOSE: To examine selected c-miRNAs and serum markers of inflammation and bone turnover responses to a 30 day six-degree head-down bed rest protocol at an ambient 0.5% CO2. METHODS: 11 adults (6 males, 5 females), 25-50 years, participated in the study at the Institute for Aerospace Medicine in Germany. Participants had fasted blood draws collected 3 days before, and on the final day of bed rest. Serum samples were assayed for relative expression of miR-21-5p, -125b-5p, and -126-3p using qPCR. Bone markers (Bone ALP, P1NP, TRAP 5b, sclerostin), inflammation markers (TNFs, IL-6), and Vitamin D were measured using ELISA. RESULTS: Only miR-21-5p increased relative expression pre to post (p=0.02). TNFα and calcium increased, and all bone marker concentrations increased pre to post, except Bone ALP. Baseline relative expression of miR-21-5p was correlated with pre calcium (r=0.745, p<0.01), miR-100-5p with sclerostin (r=0.627, p=0.04), pre IL-6 (r=0.661, p=0.03), and Vitamin D (r=0.645, p=0.03) and miR-125b-5p with osteocalcin (r=0.864, p<0.01). Log2 fold changes in miR-125-5p and absolute change in TRAP 5b were negatively correlated (r=-0.782, p<0.01), and Log2 fold changes in vitamin D were positively correlated (r=0.609, p=0.047). CONCLUSION: 30 days of 6-degree head-down bed rest significantly increased bone turnover as evidenced by increases in both P1NP and TRAP5b. Baseline c-miRNAs significantly correlated with multiple measures of bone

ACSM May 28 – June 1, 2019
Orlando, Florida

(No relevant relationships reported)
Microgravity is known to have detrimental effects on muscle tissue, leading to atrophy and a decline in performance. Although underlying mechanisms are not clear, microRNAs (miRNA) may play a role as they have regulatory effects on skeletal muscle gene expression. **PURPOSE:** To determine the effects of a 30-day six-degree head-down bed rest protocol on lower body muscular performance. Relationships between circulating miRNAs and changes in muscle variables were also examined. **METHODS:** 11 healthy subjects, 5 males and 6 females, were recruited for this study. The intervention involved a 30-day, six-degree head-down bed rest platform to simulate International Space Station flight. Maximal muscular performance was assessed for isokinetic knee extension (IsokKE), isometric knee flexion (IsokKF), and root mean squared (RMS) EMG within a 500 ms window centered on the time of peak torque. Surface EMG was simultaneously recorded for flexor and extensor gastrocnemius muscles during each isometric contraction.

**RESULTS:** All muscular performance measures decreased (p<0.05) after bed rest (absolute changes: IsokKE = -36°, IsokKF = -0°, RMS EMG = -38%). Pre bed rest miR-100-5p, -125b-5p, -126-3p were correlated with absolute change in relative power (r=-0.45±0.19kW, RelJP Power -5.23±1.88W/kg). Pre bed rest miR-100-5p relative activation required to produce similar levels of torque when compared to pre-flight values. Knee extension decreased by 35.25%, 23.52% and 35.71% while flexion decreased by 25.65%, 11.37% and 0% for 90, 60 and 45 degrees, respectively. Knee flexion declined slightly at both 90 and 60 degrees (30.84% and 23.68%, 22.97% and 34.2% at 90, 60 and 45 degrees, respectively. **CONCLUSIONS:** These findings suggest that the long-term HDBR decreased anterior cerebral arterial and venous blood flows, while posterior cerebral arterial and venous blood flows were well maintained. The heterogeneous blood flow response of the cerebral arteries may be associated with cerebral venous outflow but its physiological mechanism remains unclear.
During head out water immersion (HOWI), the hypercapnic ventilatory response (HCVR) is augmented and cerebrovascular reactivity to CO$_2$ (CVR) is attenuated; possibly due to water pressure exerted on the chest wall, central hypervolemia, and/or hypocapnia. Waist water immersion with acute hypocapnia (WWI+CO$_2$) causes central hypervolemia without water pressure on the chest wall. However, it is unknown if HCVR and CVR are different during WWI+CO$_2$ vs. HOWI. PURPOSE: We tested the hypotheses that the HCVR is augmented and CVR is attenuated during WWI+CO$_2$ and HOWI. METHODS: Twelve subjects (age: $24.1\pm3$ y, BMI: $25.1\pm3$ kg/m$^2$, 6 women) completed one hour of thermonutral ($35\pm0$°C) waist water immersion. The HCVR and CVR were calculated as the slope of the linear regression line of MV vs. PETCO$_2$ and MCAv vs. PETCO$_2$, every 30 s throughout the test. Data are reported as a change from baseline (mean±SD).

RESULTS: PETCO$_2$ increased from baseline during WWI+CO$_2$ and HOWI at every time point (p<0.01) and was matched between conditions (p=0.26). MV increased from baseline during WWI+CO$_2$, at 60 min (p<0.05) but did not change during HOWI at any time point (p=0.38). MCAv increased from baseline during WWI+CO$_2$ at every time point and during HOWI at 10 min and 30 min (all p<0.01). The HCVR did not change from baseline during WWI+CO$_2$ at any time point (all p>0.35) but increased from baseline during HOWI at 10 min time point (0.59±0.34, 30 min: 0.58±0.46, 60 min: 0.63±0.45 L/min/mmHg, p<0.01). The HCVR was lower during WWI+CO$_2$ vs. HOWI at 10 min, 30 min, and 60 min (p<0.01). CVR decreased from baseline during WWI+CO$_2$ and HOWI at every time point (p<0.01) but was not different between conditions at any time point (p=0.16). CONCLUSIONS: The elevated HCVR during HOWI is likely caused by water pressure exerted on the chest wall. However, reductions in CVR during HOWI are likely caused by central hypervolemia and/or hypocapnia.
**Uric acid (UA) is a biomarker of inflammation that has been linked to obesity, hypertension, metabolic syndrome (MetS) and other factors associated with cardiometabolic risk (CMR). UA levels are often elevated in minority populations and tend to increase in response to poor lifestyle behaviors (i.e. diet, inactivity, sleep). Multiple definitions exist for MetS—some of which include UA—but it is really the clustering of CMR factors in adolescence that is crucial for identification of disease risk and prevention. However, little is known about the relation between UA across the CMR spectrum in adolescents. PURPOSE: To investigate the relations between CMR classification, sex, physical activity, and sleep on UA among adolescents. METHODS: At age 16, subjects (Caucasian=45.9%; Male: N=47, BMI=24.6±7.7; Female: N=67, BMI=23.9±9.3) came to the lab for a fasted blood draw, anthropometric measures and assessment of physical activity (PA) and sleep [Godin and Pittsburgh Sleep Quality Index (PSQI), respectively]. CMR biomarkers were assessed using multiplex assays and ELISAs. Serum UA was assessed using a commercial EIA. A linear mixed model was used to investigate UA by CMR profile (low, dyslipidemia, high) and sex, controlling for BMI and PA, and sleep. RESULTS: Similar to previous studies in adolescents, the mean UA level was higher for males (7.11±1.19) compared to females (5.59±0.85). While men had a higher mean UA concentration, females had a higher UA after adjusting for BMI, PA, and sleep (p=0.056). More specifically, females in the low (p<0.001) and dyslipidemia risk (p<0.001) groups had higher UA compared to their male counterparts. Also, BMI was significantly associated with UA regardless of group or sex (p<0.047). CONCLUSIONS: These findings suggest that 1) subjects in the dyslipidemia profile had higher UA after controlling for BMI, PA and sleep compared to subjects in either the low or high CMR profiles and 2) while males may have higher mean UA concentrations on average, females have higher UA concentrations after adjusting for BMI, PA, and sleep. Future studies should track UA levels across adolescence and investigate whether or not the relation between CMR profiles and UA levels changes from adolescence in to adulthood. Funded by NIH R01HD78346**
CONCLUSIONS: These findings demonstrate that maximal aerobic exercise differentially mediates the intrinsic apoptotic pathway and autophagic activity in human PBMCs isolated from obese compared to normal-weight individuals, suggesting the importance of autophagy as a critical molecular process in promoting cell survival against exercise-induced apoptosis.

1999  Board #261 May 30 10:30 AM - 12:00 PM  
Exercise Training Modulates Metabolic Inflammation In Kidney of Diabetic Db/db Mice 
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(No relevant relationships reported)

PURPOSE: Chronic inflammation and metabolic dysregulation may eventually cause tissue damage in type 2 diabetes. We examined the protective effects of moderate intensity aerobic exercise on kidney function in diabetic db/db mice.

METHODS: Functional and morphological alterations and metabolic and inflammatory signaling were examined in type 2 diabetic db/db mice with or without exercise training (5.2min/min, 1/day, and 5days/week for a total of 5weeks).

RESULTS: Exercise training prevented weight gain (-7.0%) in db/db Ex mice, but it did not reduce glucose and insulin levels. Exercise lowered serum creatinine, urea, and triglyceride levels in db/db Ex mice. Reduced kidney size (0.37 vs 0.4g, P=0.036) were observed in db/db Ex mice compared with untrained db/db mice. Mechanistically, preventing loss of SIRT1 (+62%, P=0.048) through exercise was linked to reduced acetylation of NF-κB (+48%, P=0.002) in kidney of db/db Ex mice. Exercise increased citrate synthase (+132%, P=0.038) and mitochondrial complex 1 activity (+80%, P=0.004) subunits of mitochondrial complexes (I, II, and V) and PGC1α (+24%, P<0.039) at protein level in kidney of db/db Ex mice compared with non-exercise db/db mice.

CONCLUSIONS: Moderate exercise training modulates metabolic dysfunction and inflammatory process, thereby attenuating the progression of diabetic nephropathy in type 2 diabetes mellitus.

C-44  Free Communication/Poster - Concussion I  
Thursday, May 30, 2019, 7:30 AM - 12:30 PM  
Room: CC-Hall WA2

1500  Board #262 May 30 10:30 AM - 12:00 PM  
Static Cerebral Autoregulation Is Not Altered in Symptomatic Concussed Athletes During Acute Central Hypervolemia 
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(No relevant relationships reported)

Dynamic cerebral autoregulation is impaired in concussed individuals. However, less is known regarding static cerebral autoregulation in symptomatic concussed athletes during a central hypervolemic challenge that increases blood pressure. PURPOSE: We tested the hypothesis that static cerebral autoregulation during a central hypervolemic challenge is impaired in symptomatic concussed college athletes (CA) vs healthy controls (HC). METHODS: Seven CA (age: 19±2 y, 5 females) and ten HC (age: 21±2 y, 6 females) completed one study visit. After 5 min of resting baseline, 20 mmHg of lower body positive pressure (LBPP) was applied for 5 min using an airtight chamber. Beat to beat blood pressure (photoplethysmography) and middle cerebral artery blood velocity (MCAv; transcranial Doppler) were recorded continuously. Beat to beat MAP (CA: 90±6 vs HC: 92±11 mmHg; P=0.32), MCAv (CA: 58±19 vs HC: 62±11 cm/s; P=0.30), and PI (CA: 0.3±0.2 vs HC: 0.4±0.1; P=0.12) were different at baseline. The change in MAP was not different between CA (12±6 mmHg) and HC (8±6 mmHg; P=0.12). The change in MCAv was greater in CA (CA: 4.8±4.6 vs HC: 4.3±3.7 cm/s; P=0.01). There were no differences in the change from baseline for (CA: 0.1±0.2 vs HC: 0.1±0.5 mmHg; P=0.49) or coherence (CA: -0.0±0.1 vs HC: -0.0±0.1; P=0.40). The increase in CVR was attenuated in CA (CA: 0.0±0.2 vs HC: 0.3±0.3 mmHg/cm/s; P=0.04). The decrease in PI was greater in CA (CA: -0.1±0.0 vs HC: 0.0±0.1; P=0.02).

CONCLUSION: These data indicate that indices of static cerebral autoregulation are not different between CA and HC during an acute increase in MAP. The blunted increase in CVR and greater decrease in PI appears to allow for a rise in MCAv during an acute increase in MAP in CA.
Prior concussion history is posited to influence many outcomes. Understanding how concussion history affects quality of life may identify student-athletes needing interventions, and those predisposed to other conditions. PURPOSE: To examine how prior concussion history influences college athletes’ pre-season baseline health-related quality life (HRQOL). METHODS: Student-athletes (n = 1599) from six Canadian and US college institutions and 24 college sports, completed a comprehensive concussion baseline assessment including an HRQOL evaluation (PROMIS-29, Neuro-QOL Fatigue, and Neuro-QOL Cognition Scales). The primary predictor was concussion history and covariates included age, sex, BMI, and contact sport participation. Primary outcomes were Anxiety, Physical Function, Depression, Sleep Disturbance, Social Role/Activities, Pain Intensity, Pain Cognition, and Neuro-related Fatigue raw scores. Linear regression models clustered on study site using generalized estimating equations examined the association between concussion history and HRQOL outcomes. RESULTS: Analysis was limited to 1509 (94%) participants with complete outcome and covariate data (538 females (35.6%); median age = 19 years (range: 18-27); 553 (36.7%) with 1+ prior concussions; 1154 (76.5%) played a contact sport). Concussion history, adjusted for age, sex, BMI, and contact sport participation, were associated with greater anxiety, sleep disturbance, depressive feelings, fatigue, and worse cognition function. However, these differences were mostly minor. Clinically meaningful mean differences (MD) suggest those with multiple concussions report worse cognitive function (MD=−1.2; 95%CI: −2.4, −0.1 for 3+ vs 0 concussions; MD=−1.1, 95% CI=−2.3, 0.1 for 2 vs 0 concussions) and greater neuro-related fatigue (MD=+0.9, 95% CI=0.1, 1.7 for 2 vs 0 concussions). CONCLUSIONS: After controlling for covariates, these data suggest that following primary recovery, those with prior concussions may exhibit increased cognitive and fatigue related complaints. These residual effects may confound incident concussion assessments, particularly when pre-season baseline measures are not available. Supported in part by a grant from the National Football League.

Near-point of convergence (NPC) is the distance an individual can view a target without diplopia. The assessment of NPC distance is an important component of the Vestibulo-Ocular Motor Screening VOMS for sport-related concussion (SRC). The VOMS requires that the NPC distance is obtained by the patient and recorded by the clinician. However, some clinicians anecdotally report obtaining a more accurate and consistent measurement than patients due to more training and experience. Measurement differences between these two administration methods are important to investigate, as a NPC distance less than 5 cm is predictive of SRC. No study to date has compared patient and clinician measurements of NPC distance following concussion. PURPOSE: To examine differences between patient and clinician measurements of post-concussion NPC distance. METHODS: One hundred and two patients (17.80±7.43 years) seeking care for a medically diagnosed SRC participated in this study. For the patient measurement, the patient focused equations on a 14-point font target (i.e., fixation stick) and slowly moved the target toward the center of the patient’s eyes until the patient reported double vision. For the clinician measurement, the clinician slowly moved the target toward the patient until the patient reported double vision and recorded the NPC distance. The NPC distance was recorded as the average of three trials. Paired-samples t-tests were performed to examine differences in NPC distance between patient and clinician administration. Chi-square analyses were performed to compare the number of cases exceeding clinical cutoffs (>5 cm) between the two administration methods. Statistical significance was set at p<.05. RESULTS: There were no significant differences between patient and clinician administered NPC distance measurements (t[102]=−1.66, p=.10). The number of NPC distance measurements that exceeded clinical cutoffs (>5 cm) were not significantly different between patient (n=28) and clinician administrations (n=31) (z[21]=2.04, p=.04). CONCLUSIONS: Patients can accurately administer NPC distance despite not having the training and experience of clinicians. All 28 patients that exceeded clinical cutoffs during patient administration also exceeded clinical cutoffs during clinician administration.

Purpose: The purpose of this study is to investigate long-term changes in eye-tracking patterns in previously concussed individuals (>1-year post-injury) compared to non-concussed controls. METHODS: This case control study will include 40 total participants, but currently includes 12 participants with (n=5 concussed, 3.00±1.79 concussions, 4.92±2.43 years post-injury, 22.80±6.62 cm, 71.49±19.9 kg) and without (n=7, 27.00±4.06 years, 177.8±9.40 cm, 77.69±12.83 kg) a concussion history were evaluated. Participants were excluded if they only had a previously undiagnosed concussion, were currently playing contact sports, did not have normal or corrected to normal vision without glasses. Participants completed two eye-tracking tasks: an anti-saccade task consisting of 5 test blocks, 40 trials each and a circle tracking task consisting of 13 trials. The anti-saccade task measured saccadic and anti-saccadic movements, while the circle tracking task measured smooth pursuit eye movements. In both groups, results were analyzed using independent T-tests. Results: The mean reaction and processing times in the saccade task in formerly concussed subjects was significantly different from controls (p=0.02 and p<0.01). The control group had a 7.41% slowdown in reaction time and 12.1% slower processing time compared to the concussed group. Other anti-saccade task variables (i.e. movement time, number of correct saccades, number of trials where saccade ended outside of the target zone, percent of accurate saccades, distance from target block, distance from target block for correct trials) and circle tracking (i.e. horizontal root mean squared error (RMSE), vertical RMSE, horizontal RMSE, mean velocity) were mostly not significant (p>0.05). Conclusions: Counter to work on the acute effects of concussion, the preliminary findings of this study indicate that concussion may not have a long-term effect on eye-tracking reaction and processing time. Additional work in this area with larger samples is warranted.

Purpose: The purpose of this study is to examine the effect of school socioeconomic status (SES) and sport on the baseline performance of adolescent athletes on the King-Devick test (KD), modified Balance Error Scoring System (mBESS), and Post Concussive Symptom Inventory (PCSI). METHODS: A retrospective cohort study was conducted on athletes’ baseline concussion assessments completed as part of a concussion surveillance program. Testing included a history and risk factor questionnaire, KD, mBESS, and PCSI. Schools and sports clubs were classified as high SES (private <50% free/reduced lunches) vs. low SES (public >75% free/reduced lunches). Sports were categorized as collision, contact, and non-contact. An ANCOVA was performed for each outcome while controlling for age. RESULTS: Analysis was conducted on 377 athletes (63% M), average age 15.9±1.5 years (range 12.1-19.2). Two schools and 1 club were classified as high SES (n=162); 5 schools (n=215) were classified as low SES. For KD score, only a significant school × sport interaction was observed (p=0.01) with age as a significant co-variate (p<0.01). Only a significant main effect of school was observed for the mBESS (p=0.02), while a significant main effect of school (p=0.01) and school × sport interaction (p=0.02) was observed for PCSI. Age was not significant for either mBESS or PCSI (p=0.47). CONCLUSIONS: This study examines the influence of school SES and sport on baseline KD, mBESS, and PCSI. KD scores were slower in contact and non-contact athletes of high SES schools compared to low SES school athletes. Additionally, low SES school contact and non-contact athletes reported higher baseline PCSI scores.
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There were no between-subjects or within-subjects main effects for total, somatic, affective, or cognitive-migraine-fatigue symptom clusters (Wilks’ $\lambda = .99$, $p = .02$, $\eta^2 = .02$). Affective symptoms were significantly higher ($t(53.99) = -1.75, p = .08$) before and after CNT. There was a significant difference for affective symptoms between healthy and concussed athletes ($t(117.7, p < .01)$. Wilks’ $\lambda = .67, \eta^2 = .30, p = .30$). There were also no significant group $\times$ time interactions for total symptoms (Wilks’ $\lambda = .99, F[1,142] = .20, p = .64, \eta^2 = .02$), somatic (Wilks’ $\lambda = .99, F[2,142] = .30, p = .74, \eta^2 = .04$), affective (Wilks’ $\lambda = .99, F[2,142] = .89, p = .39, \eta^2 = .04$), or cognitive-migraine-fatigue symptom clusters (Wilks’ $\lambda = .99, F[2,141] = .41, p = .67, \eta^2 = .01$).

CONCLUSIONS: The administration of CNT during recovery from SRC does not increase concussion symptoms. Sports medicine professionals should administer CNT to concussed athletes even when symptomatic, to more accurately identify neurocognitive impairment, which will help determine targeted treatment options.

**Results:** The change in TG time from pre-injury to post-injury was significantly higher for the concussion group relative to the control group during both ST (Concussion: 1.6±2.6 seconds, Controls: -1.0±0.8 seconds, $p<0.001$) and DT (Concussion: 2.0±3.8 seconds, Controls: -0.9±1.7 seconds, $p=0.001$) TG trials. There were no significant interactions (ST: $p=0.17$, DT: $p=0.23$) or main effects for sex (ST: $p=0.63$, DT: $p=0.91$).

**Conclusions:** There were no sex-specific differences in TG performance acutely post-concussion. However, all concussed participants, regardless of sex, performed significantly worse on TG than male and female controls after injury relative to baseline, while controls did not demonstrate such a change. These results suggest that TG can appropriately identify postural control impairments following concussion; however, there do not appear to be differences in performance between males and females.

**Purpose:** To prospectively examine changes in post-concussion symptom reporting to groups based on the time elapsed from injury until their first clinical visit: 0-7, 8-14, or >14 years with a medically diagnosed SRC completed the Post-Concussion Symptom Scale (PCSS) before and after completing a CNT (e.g., The Immediate Post-Concussion Assessment and Cognitive Testing: ImpACT). Changes in total PCSS symptoms and symptom clusters (somatic, affective, and cognitive-migraine-fatigue) were examined with a series of paired samples $t$-tests. Participants were also assigned to groups based on time elapsed from injury until their first clinical visit: 0-7, 8-14, or >14 years.

**Methods:** Forty-eight concussed collegiate student-athletes (30 females) and twenty-five healthy controls (13 females) completed TG tests during pre-season and again acutely post-concussion. Participants walked heel-to-toe down a 3-meter line, turned, and returned as quickly as possible, completing four single-task (ST) and dual-task (DT) TG trials. During DT trials, they simultaneously answered mini-mental style questions. The best ST and DT times were recorded. A 2x2 (group$\times$sex) ANOVA was used to examine TG change between pre-injury and post-injury tests (positive value—slower/worsening; negative value—faster/improving).

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**Purpose:** To examine sex differences in TG performance among female and male high school and collegiate athletes.

**Methods:** Participants were also assigned to groups based on the time elapsed from injury until their first clinical visit: 0-7, 8-14, or >14 years with a medically diagnosed SRC completed the Post-Concussion Symptom Scale (PCSS), which consists of 22 total symptoms and a total symptom severity score ranging from 0-132. The PCSS was broken into two symptom factors: cognitive-migraine-fatigue (headache, dizziness, fatigue, drowsiness, sensitivity to light/noise, feeling slowed down, fogginess, difficulty concentrating/remarking) and affective (sadness, nervousness, feeling more emotional). A 2 sex (male, female)$^2$ group (concussed, healthy)$^3$ time ($\leq$72 hours, return-to-play, >one-month) repeated measures ANOVA was used to analyze sex differences in symptom factors throughout recovery between concussed and healthy athletes.

**Results:** There were no significant sex differences between testing sessions at $\leq$72 hours (M=2.0±3.8 seconds, SD=0.8, $p=0.42$), return-to-play (M=16.09 days, SD=11.7, $p=0.95$), and >one-month (M=59.72 days, SD=21.4, $p=0.65$). There was no significant within-subject interaction for sex$^3$group/time for the cognitive-migraine-fatigue or affective symptom factors. There was a significant between-subjects sex$^3$group interaction for the cognitive-migraine-fatigue symptom factor ($F_{(2,141)}=5.52, p=0.02, \eta^2=0.03$). Simple main effects analysis revealed concussed females (M=7.39, $\eta=0.57$) reported significantly higher severity for the cognitive-migraine-fatigue symptom factor than concussed males (M=4.83, $\eta=0.48$, $p=0.001$), yet no sex differences were observed between healthy athletes ($p=0.82$). There was no significant between-subjects sex$^3$group interaction for the affective post-concussion symptom factor.

**Conclusions:** Concussed females reported greater symptom severity for the cognitive-migraine-fatigue symptom factor compared to concussed males, which may direct targeted concussion management approaches between female and male athletes.
PURPOSE: The purpose of our study was to examine patient-parent agreement on measures of concussion symptom frequency after pediatric sport-related concussion, and identify differences in patient-parent agreement between child and adolescent age groups.

METHODS: We conducted an analysis of data collected from a prospective registry of patients with concussion in a sports medicine clinic. Patients and their parents completed the Health and Behavior Inventory (HBI) at each clinic visit. Wilcoxon signed rank tests were used to assess for potential differences in symptom frequency ratings. Spearman rho correlations and Fisher’s r to z transformation were used to assess linear agreement for total HBI score between parents and children (ages 6-12 yrs), compared to parents and adolescents (ages 13-18 yrs). Multiple regression analyses were used to evaluate the association between parent-reported and patient-reported HBI ratings with return to play (RTP) time and symptom duration.

RESULTS: A total of 267 patients (24% children, 28% females, evaluated 8.9±5.2 days post-concussion) were included in the analysis. For total HBI score, the agreement between children and their parents was high (rs=0.88; 95% CI=0.80-0.95). Adolescents also highly agreed with their parents (rs=0.78; 95% CI=0.71-0.85).

Conclusion: Parent and adolescent agreement were significantly higher than adolescent-parent agreement (p<2.21; p=0.03). Additionally, combined child and adolescent patient HBI ratings were significantly associated with symptom resolution time (β=0.296; 95% CI=0.091-0.501; p=0.005) and RTP time (β=0.487; 95% CI=0.009-0.965; p=0.046), whereas parent HBI ratings were not.

CONCLUSIONS: Overall, there was strong agreement between patients and their parents on the HBI, though children demonstrated significantly higher agreement with their parents compared to adolescents. Additionally, patient-reported HBI scores were more predictive of symptom duration and RTP time than parent-reported HBI scores. Clinicians may find this useful when setting expectations regarding concussion symptom duration and RTP timing for parents and their families. Significant reporting discrepancies between patients and their parents may also be a relevant factor for clinicians to consider during acute post-concussion evaluations.
Hypertension is one of the cardiovascular diseases responsible for more deaths worldwide. Although isometric exercise (IE) has been showing promising results to treat hypertension, the physiological mechanisms underneath blood pressure (BP) responses are still warranted, being oxidative stress (OS) and nitric oxide (NO-), major responses are still warranted, being oxidative stress (OS) and nitric oxide (NO-), major factors involved in acute and chronic pathophysiology of this disease. PURPOSE: The aim of this study was to investigate the OS, NO- responses to IE in normotensive (NTG) and hypertensive (HTG) individuals. METHODS: After body composition and muscular strength assessment, twenty-four adult men (14 hypertensive and 10 normotensive). Individuals were submitted to 3 sessions of IE in Bench and Leg press exercises. The sessions in each exercise consisted in: i) assessment of maximal voluntary isometric contraction (MVIC); ii) 8 sets x 1’ contraction at 30% MVIC; iii) control session (CS). Blood samples were collected at rest, immediately after the session and 60-min post-exercise. NO- were obtained through the Griess reaction method. OS parameters (uric acid, TBARS, TEAC, GSH, catalase) were measured with 2’ rest pause; i) control group (n=48) for 20 weeks. Participants in the SWM group trained 3-4 days/week, progressing in duration from 25 to 45 min. Participants’ carotid to radial PWV (cPWV), BP, AIS, muscular strength and cardiorespiratory capacity were measured at baseline and after 20 weeks of their assigned intervention. RESULTS: There was a significant group x time interaction (P<0.05) following SWM compared to no intervention (23%), coronary artery bypass grafting (14%), heart valve surgery (14%), heart transplant (4%), heart failure (6%), and other (6%). Data are presented as mean±SD and analyzed with ANOVA, chi-square and fisher’s exact test when appropriate. RESULTS: There was no difference in age between groups at enrollment. As expected, men weighed more, had more lean mass, were taller, had larger WC, and higher waist to hip ratio (WHR; p<0.05) at baseline. Women had higher body fat % and gynoid fat % (p<0.05). After CR, weight did not change significantly in men or women; however, BC changed significantly as presented in the table. Specifically, in men compared to women, CR resulted in greater reductions in fat mass and body fat %, with greater increases in lean mass (p<0.05). Men also demonstrated greater reductions in android fat mass % and WHR (p<0.05). Conversely, women had a significant reduction in gynoid fat mass % but no change in android fat mass % or WHR (p>0.05). Fat mass index was reduced in both groups and significantly between the sexes (p<0.05). CONCLUSIONS: CR participation significantly reduced BC in men and women; however, men demonstrate greater reductions compared to women. Additionally, the distribution of BC improvements appears to differ between sexes suggesting sex specific CR programming may be appropriate.
PURPOSE: Cardiovascular disease (CVD) accounts for an estimated 31% of deaths worldwide (WHO, 2017). Current strategies to manage CVD include medical therapy and invasive procedures, with cardiac rehabilitation (CR) offered as a secondary treatment. According to the UK National Audit of CR (2017) only 51% of referred patients complete a programme, which lasts a median of 9 weeks. In addition, the current outcomes from CR are underwhelming and research has found it is not yet effective at reducing the risk of MI or revascularization and all-cause mortality (Cochrane review, 2016). The current study investigates the effectiveness of an alternative approach to CR using a novel 4 Pillar model of exercise delivery and nutritional guidance, on reducing key modifiable risk factors in a cardiac population.

METHODS: 120 patients (4 MI, 24 MI + PCI, 7 MI + CABG, 15 CABG, 48 PCI, 27 invasive procedures, with cardiac rehabilitation (CR) offered as a secondary treatment. According to the UK National Audit of CR (2017) only 51% of referred patients complete a programme, which lasts a median of 9 weeks. In addition, the current outcomes from CR are underwhelming and research has found it is not yet effective at reducing the risk of MI or revascularization and all-cause mortality (Cochrane review, 2016). The current study investigates the effectiveness of an alternative approach to CR using a novel 4 Pillar model of exercise delivery and nutritional guidance, on reducing key modifiable risk factors in a cardiac population.

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RESULTS: Fontan patient’s BMIs fall on average 18.0±1.5 vs. 17.7±1.3 mL.min⁻¹.kg⁻¹ (P<0.001) across trials. 27% of subjects experienced moderate-to-severe nausea and/or vomited after ingesting the singular measure may not account for the diminished muscle size or function that may necessary and sufficient to set up this trial, including determining the optimal dose of KNO3 to utilize.

METHODS: A double-blind, crossover design, six patients with HFpEF (5 men, 1 woman; age: 49±4 y; EF: 32±3%) were studied 2-3 h after acute ingestion of either 10 or 20 mmol KNO3. On each occasion, VO2 was measured during an incremental treadmill exercise test (modified Naughton protocol) and muscle function was determined using isokinetic dynamometry.

RESULTS: The increase in peak VO2 (Δ = 430±51 vs. 218±19 µmol/L; P<0.002). However, plasma NO2 increased to a similar degree in both trials (A = 0.219±0.078 vs. 0.169±0.044 µmol/L; P=0.67). Presumably as a result, VO2 peak did not differ between treatments (i.e., 18.0±1.5 vs. 17.7±1.3 mL.min⁻¹.kg⁻¹; P=0.74). There was also no difference in maximal knee extensor power (4.52±0.56 vs. 4.25±0.59 W/kg; P=0.69) across trials. 27% of subjects experienced moderate-to-severe nausea and/or vomited after ingesting the higher dose KNO3 vs. only 9% after the lower dose.

CONCLUSION: There was no difference in the efficacy of 10 vs. 20 mmol KNO3 in influencing VO2 peak or muscle power in patients with HFpEF. The higher dose, however, was associated with a greater frequency of gastrointestinal distress. Based on this preliminary data, it appears that 10 mmol KNO3 is the preferred dose for a larger multicenter trial.

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acidity metabolism of patients with PAD and identify changes as the disease progresses. METHODS: Blood samples were acquired from 24 Stage II PAD patients (PAD-II: 2.1±0.9 yrs, 47.2±14.8 µM; p=0.004), tryptophan (HC: 50.9 ± 13.9 µM, PAD-II: 53.8 ± 17.9 µM, CLI: 32.7 ± 9.4 µM; p=0.011), ornithine (HC: 68.5 ± 15.7 µM, PAD-II: 61.3 ± 17.0 µM, CLI: 54.6 ± 26.1 µM; p=0.065), proline (HC: 202.3 ± 54.2 µM, PAD-II: 202.3 ± 63.7 µM, CLI: 169.3 ± 54.5 µM; p=0.01), tryptophan (HC: 50.8 ± 13.9 µM, PAD-II: 53.8 ± 17.9 µM, CLI: 32.7 ± 10.9 µM; p=0.001), and tyrosine (HC: 62.7 ± 15.6 µM, PAD-II: 58.3 ± 18.2 µM, CLI: 47.2 ± 14.8 µM; p=0.004). CONCLUSION: The metabolite fingerprint of amino acid metabolites of CLI is considerably different from PAD-II and HC. Perturbations in amino acid metabolism may contribute to CLI pathology and may serve as a diagnostic/prognostic tool to alter the management of CLI.

INTRODUCTION: Bariatric surgery effectively reduces weight and some comorbidities in obese patients; however, surgery incurs in severe muscle waste and functionality impairments, warranting the investigation of therapeutic strategies to mitigate these outcomes. PURPOSE: To examine the effects of exercise training on various sarcopenic fiber cross-sectional area (FCSA), strength and functionality in women undergoing bariatric surgery. METHODS: Sixty-two obese women were randomly allocated to receive either bariatric surgery (RYGB: BMI=47.8) or bariatric surgery plus exercise training (RYGB+ET: BMI=49.7). Patients were assessed at baseline (PRE), three (POST3), and nine months (POST9) after surgery for FCSA, lower- and upper-limb 1RM, and timed-up-and-go (TUG) and timed-stands (TST) test. The 6-month exercise intervention started at POST3 for RYGB+ET, while RYGB followed standard care. RESULTS: Type I and II ICSA was decreased in both RYGB (-21 and -27%) and RYGB+ET (-22 and -27%) at POST3 (all p<0.001). RYGB+ET increased types I and II ICSA from POST3 to POST9 (23%, p=0.0053 and 32%, p=0.0055), whereas no changes were observed in RYGB (4% and 1%, respectively; both p>0.05). Importantly, type I and II ICSA were significantly greater in RYGB+ET than in RYGB at POST9 (both p<0.001). Lower- (RYGB=32% and RYGB+ET=24%, both p=0.0001) and upper-limb 1RM (RYGB=26% and RYGB+ET=29%, both p=0.0001) were reduced at POST3. Exercise increased lower- and upper-limb strength (49%, p<0.0001 and 11%, p=0.0024, respectively). In contrast, no differences were observed in RYGB (1% and 4%, respectively; both p>0.05). Importantly, type I and II ICSA were significantly greater in RYGB+ET than in RYGB at POST9 (p<0.001). No effects of surgery were observed in either TUG or TST (all p>0.05). RYGB+ET increased TUG and TST scores from POST3 to POST9 (11%, p=0.0001 and 26%, p=0.0001, respectively), while no significant differences were observed in RYGB (2% and 3%, respectively, both p>0.05). TST were significantly greater in RYGB+ET than in RYGB at POST9 (p<0.001). CONCLUSIONS: Our data suggest that a 6-month exercise training program is effective in countering the loss of muscle mass, strength and functionality that occur after bariatric surgery. CriticalCare.gov: NCT02441361

Patients with peripheral artery disease (PAD) develop a myopathy in their ischemic limbs which is characterized by myofiber degeneration, mitochondrial dysfunction and impaired leg function. Degenerated myofibers have cytoskeletal abnormalities the best described of which is a disorganized accumulation of desmin filaments. Purpose: We hypothesized that the levels and organization of desmin in the myofibers of the gastrocnemius of PAD patients improve after revascularization and correlate with increases in mitochondrial respiration and calf muscle strength.

Methods: Gastrocnemius biopsies were collected from 32 PAD patients (61.6 ± 5.2 yrs, 31.0 ± 9.0 kg/m²) before and six months after revascularization. Accumulation and organization of desmin protein in myofibers were determined by quantitative fluorescence microscopy and desmin gene transcripts were quantified by RT-PCR in biopsy homogenates. The effects of revascularization on these parameters and their association with ischemic window, mitochondrial function determined by respirometry, and calf muscle strength determined by isokinetic testing with the Biodex system were evaluated. Data were analyzed in SPSS 21 using paired t-test and Pearson correlation with a level of significance at p<0.05. Revascularization reduced the abnormal accumulation of desorganized desmin protein and gene transcripts in the PAD gastrocnemius. The ischemic window (∆=529 mm Hg x min; p<0.05), and calf muscle strength (∆=8.33 ± 19 N*m) were significantly improved after revascularization. After revascularization, the decreased desmin expression was associated with a more structured appearance of the protein, suggesting a return to the normally filamentous structure. These changes in desmin correlated with improved mitochondrial function (∆=-0.406; p<0.05) and increased calf muscle strength (∆=0.313; p<0.05).

Conclusions: Revascularization improves the levels and organization of the desmin protein in myofibers of patients suffering from peripheral artery disease. Importantly, type I and II fCSA were significantly greater in RYGB+ET than in RYGB where no changes were observed in RYGB (4% and 1%, respectively; both p>0.05). Additionally, lower-limb 1RM was reduced at POST3. Exercise increased lower- and upper-limb strength (49%, p<0.0001) and upper-limb 1RM (RYGB=-26% and RYGB+ET=-29%, both p<0.0001) at POST3 (all p<0.0001). RYGB+ET increased standard care.

The spectrum of symptoms of peripheral artery disease (PAD) is classified according to the Fontaine classification. Patients presenting with intermittent claudication are classified in Stage II, and in the latest stages of PAD referred to as critical limb ischemia (CLI), patients exhibit rest pain with or without ulcers and gangrene. Although systemic risk factors for PAD have been established, an aortic approach may represent an innovative method to comprehensively investigate the molecular basis of PAD pathogenesis. PURPOSE: To determine the metabolomics profile of amino

Patients with peripheral artery disease (PAD) develop a myopathy in their ischemic limbs which is characterized by myofiber degeneration, mitochondrial dysfunction and impaired leg function. Degenerated myofibers have cytoskeletal abnormalities the best described of which is a disorganized accumulation of desmin filaments. Purpose: We hypothesized that the levels and organization of desmin in the myofibers of the gastrocnemius of PAD patients improve after revascularization and correlate with increases in mitochondrial respiration and calf muscle strength.

Methods: Gastrocnemius biopsies were collected from 32 PAD patients (61.6 ± 5.2 yrs, 31.0 ± 9.0 kg/m²) before and six months after revascularization. Accumulation and organization of desmin protein in myofibers were determined by quantitative fluorescence microscopy and desmin gene transcripts were quantified by RT-PCR in biopsy homogenates. The effects of revascularization on these parameters and their association with ischemic window, mitochondrial function determined by respirometry, and calf muscle strength determined by isokinetic testing with the Biodex system were evaluated. Data were analyzed in SPSS 21 using paired t-test and Pearson correlation with a level of significance at p<0.05. Revascularization reduced the abnormal accumulation of desorganized desmin protein and gene transcripts in the PAD gastrocnemius. The ischemic window (Δ=529 mm Hg x min; p<0.05), and calf muscle strength (∆=8.33 ± 19 N*m) were significantly improved after revascularization. After revascularization, the decreased desmin expression was associated with a more structured appearance of the protein, suggesting a return to the normally filamentous structure. These changes in desmin correlated with improved mitochondrial function (∆=-0.406; p<0.05) and increased calf muscle strength (∆=0.313; p<0.05).

Conclusions: Revascularization improves the levels and organization of the desmin protein in myofibers of patients suffering from peripheral artery disease. Importantly, type I and II fCSA were significantly greater in RYGB+ET than in RYGB where no changes were observed in RYGB (4% and 1%, respectively; both p>0.05). Additionally, lower-limb 1RM was reduced at POST3. Exercise increased lower- and upper-limb strength (49%, p<0.0001) and upper-limb 1RM (RYGB=-26% and RYGB+ET=-29%, both p<0.0001) at POST3 (all p<0.0001). RYGB+ET increased standard care.

The spectrum of symptoms of peripheral artery disease (PAD) is classified according to the Fontaine classification. Patients presenting with intermittent claudication are classified in Stage II, and in the latest stages of PAD referred to as critical limb ischemia (CLI), patients exhibit rest pain with or without ulcers and gangrene. Although systemic risk factors for PAD have been established, an aortic approach may represent an innovative method to comprehensively investigate the molecular basis of PAD pathogenesis. PURPOSE: To determine the metabolomics profile of amino
Changes in the hormonal milieu with menopause are associated with increases in both total body fat and abdominal fat storage (AFS), both of which are related to an adverse metabolic profile and increased cardiovascular disease risk. Physical activity (PA) is a common intervention to ameliorate adipose fat accumulation during all life-stages. PURPOSE: To examine differences in the protective effect of physical activity on total adiposity and fat patterning in pre- and post-menopausal women. METHODS: A total of 1018 women (pre-menopausal 425; post-menopausal 593) participated in the study. Each participant completed anthropometric measurements and a physical activity survey using the HealthSnap platform, which encompasses a streamlined health evaluation with lifestyle recommendations. Patients were stratified by age to predict menopausal status (pre-menopausal <35 yrs; post-menopausal ≥45 yrs). BMI was computed as kg/m2 and AFS was determined using a waist-to-hip ratio above 0.85. PA was defined as MET-minutes equivalent to >75 minutes of vigorous activity, or >150 minutes of moderate activity, per week. RESULTS: As expected, in both groups of pre and post-menopausal women, a significant association was observed between PA and BMI (RR=1.8, CI: 1.24-2.70 and RR = 2.18, CI: 1.67-2.80; p<0.001, respectively). In contrast, PA was only associated with AFS patterning in post-menopausal (RR=1.45, CI: 1.24-1.70; p<0.001) but not pre-menopausal women (RR= 1.034, CI: 0.83-1.30; p=0.74). CONCLUSIONS: PA is protective against BMI in both pre and post-menopausal women. Moreover, however, previous data often employs the body mass index (BMI) approach to classify obesity, whereas waist circumference (WC) may be a better indicator considering the redistribution of adiposity and spinal compression associated with natural aging. PURPOSE: The purpose of this study was to examine the differences in grip strength (HGS), jump power (JPOW), and muscular strength (BP1RM) between non-obese and obese older women (≥50 years) when stratified by age and sex. With the exception of the BBT (p=0.35), women classified as non-obese performed significantly better for the BP1RM, VJ, JPOW, HGS, TUG, and BBT. Independent samples t-tests were used to determine mean differences between non-obese and obese women and Pearson’s correlation coefficients examined the relationships between WC and performance measures. RESULTS: According to the physical activity scale for the elderly questionnaire, 38/41 women met the recommended amount of physical activity when stratified by age and sex. With the exception of the BBT (p=0.35), women classified as non-obese performed significantly better for the BP1RM (p=0.04, ES: 0.25), VJ (p=0.01, ES: 0.71), JPOW (p=0.02, ES: 0.54), HGS (p<0.001, ES: 1.3), and TUG (p<0.001, ES: 0.94). Additionally, WC was inversely, but significantly correlated with HGS (r = −0.51, p=0.01) and TUG (r = −0.48, p<0.01) values. CONCLUSION: These data suggest that neuromuscular and functional measures may be further reduced when accompanied with obesity in older women. Remarkably, these differences were still observed with no differences in physical activity.
CONCLUSIONS: These data suggest that Tai Chi training reduces visceral fat, waist circumference and blood triglyceride.
Supported by Health and Medical Research Fund 12131841

1527 Board #289 May 30 10:30 AM - 12:00 PM
Functional Evaluation and VO2-kinetcs in Obese Patients Before and After Sleeve Gastroctomy
Daniel Neunhaeuserer1, Sara Ortolan1, Alessandro Patti, Andrea Gasperetti1, Francesco Savalla2, Francesca Battista1, Stefano Gobbo1, Silvia Bettini2, Anna Belligoli1, Andrea Ermolao1.
1Sport and Exercise Medicine Division, Padova, Italy. 2Internal Medicine 3, Padova, Italy.
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(No relevant relationships reported)

Sleeve gastrectomy (SG) has become an important therapeutic option for patients with severe obesity, showing a positive impact on patients’ comorbidities. Even though poor cardiorespiratory function is a powerful predictor of mortality, functional evaluation has been given little attention after SG.

PURPOSE
To investigate the effects of SG on functional capacity six months after surgery, with specific analysis of peripheral oxidative muscle metabolism by determination of VO2-kinetics.

METHODS
In this longitudinal observational study 36 patients (age 44±11 years, 78% females) with severe obesity (BMI 43.95±5.67 kg/m2) were evaluated one month before (pre-SG) and six months after SG (post-SG). A maximal cardiopulmonary exercise test was performed on treadmill with an initial 5 min constant, moderate load exercise and a subsequent incremental Bruce protocol. VO2-kinetics during constant load exercise were analyzed by mono-exponential function. Furthermore, muscle strength was evaluated by isometric handgrip strength test. Patients’ physical activity level was assessed by the Global Physical Activity Questionnaire (GPAQ).

RESULTS
As expected, a significant weight loss (-31.14±9.45 kg, p<0.001) and a reduction of waist circumference (-15.35 cm, p<0.001) were observed post-SG, associated with severe obesity (BMI 43.95±5.67 kg/m2) were evaluated one month before (pre-SG) and six months after SG (post-SG). A maximal cardiopulmonary exercise test was performed on treadmill with an initial 5 min constant, moderate load exercise and a subsequent incremental Bruce protocol. VO2-kinetics during constant load exercise were analyzed by mono-exponential function. Furthermore, muscle strength was evaluated by isometric handgrip strength test. Patients’ physical activity level was assessed by the Global Physical Activity Questionnaire (GPAQ).

CONCLUSIONS
These data suggest that Tai Chi training reduces visceral fat, waist circumference and blood triglyceride.

1528 Board #290 May 30 10:30 AM - 12:00 PM
Athletic Obesity and Long-Term Health
Justin B. Ethington. Utah Valley University, Orem, UT.
Email: justin.ethington@hotmail.com
(No relevant relationships reported)

PURPOSE: Obesity in athletes is closely correlated with many comorbidities such as hypertension, dyslipidemia, osteoporosis, diabetes mellitus, left ventricular hypertrophy, and lower self-esteem; all of which can lead to decreased quality of life both during an athlete’s career and after. It is the objective of this systematic review to compare the long and short-term health risks associated with athletes who are clinically overweight or obese.

METHODS: Studies were obtained using online databases such as PubMed, Google Scholar, and Scopus. Search terms included obese, obesity, athletes, body composition, health risk, anthropometry, adult, American Football, rugby, professional, athletes, BMI, female, women, overweight, BF%, body image, samo wrestling, unhealthy, left ventricular hypertrophy, health, retired, and NFL. To be included in this review, articles needed to meet a list quality assessment.

RESULTS: Active collegiate and professional level athletes, regardless of their BMI, are shown to have healthier BF% than those of comparable BMI. These findings are consistent with linemen, rugby players, and lightweight sumo wrestlers. However, when comparing football players and non-athletes of comparable BMI it was concluded that linemen had an even greater risk for developing CVD and metabolic syndrome (metsyn) than non-athletes. Little information could be found on the effects of obesity among female athletes. Retired Athletes who were obese due to the nature of their professional sport and maintained obesity status were more likely to have sustained cognitive impairment during their career and cardiovascular diseases (CVD). Furthermore, a significant increase in mortality due to CVD has been directly linked to athletes who retire from a career in professional football.

CONCLUSIONS: In conclusion, athletes that compete at a high level generally have a healthier body fat percentage (BF%) and cholesterol vitals than comparable non-athletic populations. However, due to their excessive amount of muscle mass, these athletes are susceptible to high BP and other cardiovascular risks putting them at greater risk for LVH. This is consistent with observations that athletes who maintain high BMI after their career will develop and sustain cardiovascular-related diseases and other severe health risks.

1529 Board #291 May 30 10:30 AM - 12:00 PM
Mechanical Assistance During Unloaded Pedaling Improves the Dynamic Range of the Metabolic Response in Obesity
Tolulope Popoola1, William Stringer1, Tomohiko Kisaka2, Kathy Sietsema1. 1Los Angeles Biomedical Institute (LABIOMED) at Harbor-UCLA Medical Center, Torrance, CA. 2Hiroshima University, Hiroshima, Japan. (Sponsor: Harry Rossiter, PhD, FACSM)
Email: teepopoola@yahoo.com
Reported Relationships: T. Popoola: Industry contracted research; MITSUBISHI ELECTRIC ENGINEERING Co., LTD.

PURPOSE: Obese individuals have a greater oxygen uptake (VO2) than lean individuals for a given work rate during cycling exercise due to higher resting metabolic rate and metabolic cost from lifting heavier legs against gravity. This can result in the majority of the total increase in VO2 occurring early in the exercise test, resulting in short test duration and obscuring the gas exchange details. We hypothesized that mechanical assistance of pedaling early in exercise could reduce the initial increase in VO2 of obese subjects, and increase the VO2 range.

METHODS: 20 obese (O, BMI 40.2±6.1 kg/m2) and 10 lean otherwise normal subjects (L, BMI 24.9±2.2) were tested. Subjects performed 2 symptom-limited ramp incremental tests on a cycle ergometer capable of providing variable degrees of mechanical assistance to pedaling (Ergo-strength, Mitsubishi Electrical Engineering, Osaka, Japan). Ventilation and pulmonary gas exchange were measured breath by breath (Vyair, Yorba Linda, California). During warm up, in random order, the subjects performed either unmodified cycling (UM) or mechanical assistance (MC) to pedaling. After warm up, each subject performed a progressively increasing test to exhaustion.

RESULTS: The MC protocol resulted in a lower initial VO2 compared to UM in 19 of 20 O subjects and 8 of 10 L subjects, with average differences of 165±125 ml/min (p < 0.0001) and 101 ml/min +/- 94 (p < 0.008) for O and L, respectively, by paired T-tests. Peak VO2 did not differ systematically within subjects by protocols (p=NS).

<table>
<thead>
<tr>
<th>All Values</th>
<th>L/min except DVO2/ DWR/ ml/ min/W</th>
<th>VO2 atRest</th>
<th>Warm Up/ UM</th>
<th>Warm Up/MC</th>
<th>DVO2 / DWR/ UM</th>
<th>DVO2 / DWR/ MC</th>
<th>Peak VO2/ UM</th>
<th>Peak VO2 MC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obese</td>
<td>0.352±0.07</td>
<td>0.706±0.20</td>
<td>0.541±0.17</td>
<td>10.3±1.4</td>
<td>11.2±1.1</td>
<td>2.086±0.56</td>
<td>1.974±0.56</td>
<td>2.267±0.66</td>
</tr>
<tr>
<td>Lean</td>
<td>0.290±0.05</td>
<td>0.501±0.01</td>
<td>0.409±0.08</td>
<td>9.3±1.7</td>
<td>9.6±1.5</td>
<td>2.897±0.92</td>
<td>2.267±0.66</td>
<td>2.267±0.66</td>
</tr>
</tbody>
</table>

CONCLUSIONS: Mechanical assisted cycling during the initial phase of an incremental exercise test was effective in modulating the initial increase in VO2 with unloaded cycling, and increases the VO2 testing range in obese and normal weight subjects. This may be a significant proportion of the entire response in a patient with exercise limitation, and therefore useful in exercise testing and training. Funding: MITSUBISHI ELECTRIC ENGINEERING Co., LTD.

Supported by Health and Medical Research Fund 12131841
Rhythmic Auditory Stimulation (RAS) uses the physiologic effects of auditory rhythm to facilitate movements that are inherently rhythmical, such as walking. There is a strong sensorimotor connection between the brain and the motor system while walking to rhythmic cues that occurs without cognitive learning efforts. **Purpose:** To determine if cadence and Six-Minute Walk Distance (6MWD) are increased while walking to RAS-tempo enhanced music as compared to walking to music-without tempo enhancement (MC) or no-music (NM) in individuals with Chronic Obstructive Pulmonary Disease (COPD). **Methods:** Three: 6-Minute Walk Tests (6MWT) were completed in random order under three conditions (RAS, MC, NM). Tempo for the RAS walk was matched to the individual’s usual cadence which was determined by a one-minute manual step count. Cadence was measured manually for 60-seconds between minutes 1-2, 3-4, and 5-6 for all 6MWT conditions. The tempo of the music for the RAS walk was increased 5-10 beats per minute higher than usual cadence. **Results:** Twenty-five older adults (age=71±5yr) with moderate to severe COPD (47±15.0% FEV1 % predicted), with 56±27 years of smoking were enrolled. The mean usual cadence was 103±8 steps/min in one minute. When comparing RAS to NM, cadence was consistently significant at all minute intervals 1-2 (110±105), 3-4 (110±107), and 5-6 (110±107) respectively. When comparing cadence of NM to MC, and RAS to MC no consistent significant increases were found. Participants matched their cadence to the elevated tempo of the RAS music during the entire 6MWT (110±12 steps). Individuals walked 12m further during the 6MWT with RAS (463±72 m) compared to NM (451±81 m), t (24)=-2.63, p=.015) or MC (451±80 m); t (24)=-2.26, p=.033). **Conclusions:** Best method for prescribing cadence through music tempo in individuals with COPD has not been established. Individuals walked further and were able to match and sustain elevated cadence during the RAS walking condition. This observation may support the premise that beat perception mechanisms can be neurologically entrained. RAS music may be a useful tool in pulmonary rehabilitation to increase walking distance in individuals with COPD. Supported by RR&D, Veterans Administration

**C-47 Free Communication/Poster - Pulmonary/ Respiratory**

**Board #292 May 30 10:30 AM - 12:00 PM Using Rhythmic Auditory Stimulation to Increase Cadence in Individuals with Chronic Obstructive Pulmonary Disease**

Alison Hernandez, Eileen Collins, David X. Marquez, FACSM, Alana Steffen, Cynthia Fritschii, Lauren T. Quinn, ULF Bronas. Northwestern University, Chicago, IL. *University of Illinois at Chicago, Chicago, IL. Email: alison-hernandez@northwestern.edu (No relevant relationships reported)

**Board #293 May 30 10:30 AM - 12:00 PM Ventilatory Efficiency Among Patients with Pulmonary Hypertension With Varying Levels Of Adaptation To Exercise Training**

Zoe Morris, Lisa Chin, Leighton Chan, Randall Keyser, FACSM. George Mason University, Fairfax, VA. *National Institutes of Health, Bethesda, MD. (No relevant relationships reported)

The 6-minute walk test (6MWT) is universally accepted as a measure of functional capacity in patients with pulmonary hypertension (PH). While aerobic exercise training (AET) has generally been shown to improve exercise tolerance and 6MWT distance in patients with PH, some patients have been observed to adapt differently to AET, with minimal or even negative changes in 6MWT distance being reported. **Purpose:** To determine differences in ventilatory efficiency, defined as peak ventilatory equivalents for O2 uptake (VE/VCO2), peak ventilatory equivalents for CO2 output (VE/CO2), end-tidal CO2 (PETCO2) and tidal volume (TV), in patients with high (HI, >42 meters), low (LI, 0-42 meters) and negative (NEG, <0 meters) change in 6MWT distance after AET. **Methods:** Subjects were 25 females (age 54±11 years; BMI 31±7 kg/m²) enrolled in the NIH Exercise Therapy for Advanced Lung Disease Trial. Participants completed 24-30 supervised treadmill exercise sessions, over 10 consecutive weeks, at a training intensity of 70% to 80% of heart rate reserve. The three-weekly sessions were 30-45 minutes in duration. A cardiopulmonary exercise test and 6MWT was completed before and after the 10-weeks of training. Ten of the 25 subjects were classified as HI (range = 47-143 meters), 11 were classified as LI (range = 4 - 37 meters) and 4 were classified as NEG (range = -17-35 meters). **Results:** After AET, peak values in VE/VCO2 (p=0.02), VE/VECO2 (p=0.002), PETCO2 (p=0.016) and TV (p=0.016) were improved for the HI versus NEG group. Peak values for VE/VCO2, (p=0.003) and TV (p=0.041) were improved for the LI versus NEG group. **Conclusion:** Previous studies suggest that reduced ventilatory efficiency (VE/VECO2) is associated with a poor prognostic outcome in patients with PH. To our knowledge this is the first study to look at changes in ventilatory efficiency after AET, specifically in HI, LI and NEG subsets. Findings from this study suggest that reduced ventilatory efficiency may also contribute to reduced functional capacity in patients with PH, contributing to the etiological basis for the association between 6MWD and mortality in these patients. Funding NIH IRP [1 Z01 CL06068-05 CC].

**Board #294 May 30 10:30 AM - 12:00 PM Is the EVH Test Best For Diagnosing Exercise Induced Bronchoconstriction In Swimmers?**

Michael G. Leahy, Caitlin M. Geary, Michael S. Koehle, Donald C. McKenzie, James Brotherhood, Carl P. Peters, Andrew W. Sheel, FACSM. University of British Columbia, Vancouver, BC, Canada. (Sponsor: Dr. Andrew William Sheel, FACSM) Email: mick.leahy@ubc.ca (No relevant relationships reported)

Competitive swimmers have high rates of exercise induced bronchoconstriction (EIB), which may be associated with repeated exposure to chlorinated pool water. The escape voluntary hyperpnea (EVH) test is often used in a laboratory setting to provoke a reduction in lung function associated with EIB. However, swimmers experience EIB symptoms in warm, humid and chlorinated environments. The relationship between EVH testing environment and the development of EIB from swim exercise is unclear. **Purpose:** To compare the provoking effects of inspired air and high-intensity exercise in inducing EIB in swimmers to laboratory-based EVH methods. **Methods:** 15 collegiate swimmers (n=5 male, n=10 female; 21±2 years) completed three days of testing in random order. On day one, subjects performed an EVH test in a laboratory (EVH-L). On a separate day, swimmers performed a modified EVH test, while breathing chlorinated pool air (EVH-Cl). On a third day subjects completed a swimming challenge, performing consecutive 200 and 400 m freestyle efforts at 85 % of their season’s best time (Average achieved 200 and 400 m time; 2:18.52/7.79 and 4:55.22/20.38, respectively) and age predicted heart rate maximum. Lung function was measured at baseline, as well as 3, 5, 10, 15, and 20 minutes following EVH testing and swim exercise. **Results:** Greatest achieved fall of forced expired volume in one second (FEV1) was significantly different between all three methods (p<0.05). EVH-L elicited a -9.7±6.4 % fall compared to the EVH-Cl test, -6.9±2 % (p<0.05) and swim effort, -3.0±15.6 % (p<0.05). A greater Pearson’s correlation in FEV1, fall index between EVH-L vs. EVH-Cl (r =0.78, p<0.05) was seen compared to EVH-L vs. Swimming (r =0.20, p>0.05) and EVH-Cl vs. Swimming (r =0.50, p<0.05). A greater reduction in forced expired flow between 25 and 75 % lung volume (FEF25-75) was induced by the EVH-L (-16±8.7 %) compared to the EVH-Cl (-8.2±14.9 %) (p<0.05) and swimming test (-1.3±15.6 %) (p>0.05). **Conclusion:** The EVH-L elicits a greater bronchoconstrictive response, compared to EVH-Cl and swimming. There is little relationship in reduction of lung function between the EVH-L test and swimming. Funding: Natural Sciences and Engineering Research Council of Canada.
peak exercise via the Borg breathlessness scale. We examined the association between $E_{LV}$ (rest and peak exercise) and peak dyspnea, adjusting for age, body mass index, smoking and airway obstruction (FEV/FVC).

RESULTS:
Demographics were similar between groups, but spirometry was reduced in veterans (veterans vs. controls; FEV: 95.2±18.3 vs. 114.3±14.7% predicted; FVC: 101.0±13.6 vs. 116.0±13.3% predicted; p < 0.01, Hedges’ g = 1.11 - 1.17). Peak exercise capacity was similar in the groups ($V_{O2max}$; veterans: 36.1±10.5 vs. 36.1±10.5 mL/kg/min; p = 0.67) but veterans endorsed greater dyspnea (5.6±1.8 vs. 3.6±1.0 Borg units; p = 0.016). $E_{LV}$ was similar at rest (0.59±0.04 vs. 0.57±0.02; p = 0.67, but not at peak exercise (0.59±0.04 vs. 0.56±0.03, p = 0.01, g = 0.83). In our adjusted model, larger $E_{LV}$ at rest ($\beta$ = 22.8, 95% CI 4.7, 40.9, p = 0.016) and immediately post-exercise ($\beta$ = 19.2, 95% CI 3.1, 35.3, p = 0.016) were associated with greater dyspnea at peak exercise.

CONCLUSION:
In our sample, increased RBC deformability measured at rest and immediately post-exercise was independently associated with exertional dyspnea. Future studies are necessary to confirm these findings and investigate mechanisms of altered RBC rheology in the context of dyspnea.

Funding: VA RR&D (1I21RX001079; MJF)

1534 Board #296 May 30 10:30 AM - 12:00 PM
Respiratory Resistance And Reactance (FOT) Classifications In Chronic Obstructive Pulmonary Disease And Healthy Control Patients.
Jesse Schwartz, Courtney Wheatley, Bruce Johnson. Mayo Clinic, Scottsdale, AZ.

(No relevant relationships reported)

Forced oscillation technique (FOT) is a method of measuring lung obstruction of central airways (resistance, R) and elastic properties/distal airway ventilation (reactance, Xrs), which is different from spirometry since it is performed during tidal breathing, utilizing various sound frequencies (5, 11, and 19 Hz) to separate regions of the lungs and isolates breathing cycles (inspiration and expiration).

PURPOSE: To evaluate FOT metrics of lung mechanics and obstruction within a chronic obstructive pulmonary disease (COPD) population based upon severity (mild [MLD], moderate [MOD], and severe [SEV]).

METHODS: Seventeen COPD, and fourteen healthy (H) patients (age: 69.5±5.8 vs. 49.3±17.6 yr. *, height: 169.9±11.3 vs. 164.1±11.0 cm, weight: 77.8±18.8 vs. 83.3±12.4 kg, COPD vs. H respectively, *p<0.05) completed spirometry and FOT measurements. COPD participants completed the St. George Respiratory Questionnaire (SGRQ) and severity was classified based on GOLD spirometry (MLD, MOD, and SEV). RESULTS: In those with MOD & SEV COPD, total Rrs and Xrs at all frequencies, except respiratory Rrs, were significantly different (p<0.05) from H, but only Rrs was different for MOD participants. Rz: 3.9±1.1 to 3.3±1.3, 5.9±2.5cmH2O/L/s; Xrs: -1.1±0.9 to -1.4±0.6, -4.8±3.2cmH2O/L/s; Rz: 0.3±0.7 to 2.4±0.9, 5.3±1.0cmH2O/L/s; X5: -1.0±0.3 to -2.0±0.7, -1.5±0.7cmH2O/L/s; R19: 0.59±0.04 vs 0.56±0.03. Hedges’ g = 0.67, but significance was accepted at 0.05 level. The study was approved by the Regional Institutional Review Board (IRB).

CONCLUSION: FOT metrics made distinctions between COPD MOD & SEV and H, as well as MLD and H for mixed respiratory tract obstruction. However, no distinctions between COPD severities could be made. Obstruction increased with severity highlighting that more heterogeneous total membrane airway obstruction (frequency dependent) is observed with mild severity patients, followed by more homogeneous obstruction as severity increased. Elastic properties and efficiency of ventilation decreased (became more negative) with increased COPD severity as airflow to and from distal airways become more limited due to hyperinflation from loss of alveolar support and elastic recoil.

1535 Board #297 May 30 10:30 AM - 12:00 PM
Asthma and EIB Testing Among Collegiate Athletes in Indoor Winter Sports.
Matthew J. Garver1, Dustin W. Davis3, Molly A. Jennings1, Taylor K. Dinyer1, Alex Rickard1, Steve Burns1, Brian J. Hughes1, Dave M. Burnett2, 1University of Central Missouri, Warrensburg, MO. 2University of Kentucky, Lexington, KY. 3University of Kansas Medical Center, Kansas City, KS.

(No relevant relationships reported)

Pulmonary conditions, such as asthma and exercise-induced bronchoconstriction (EIB), influence airway diameter, and these conditions may be impacted by seasonal patterns. Systematic, team-wide screening among collegiate athletes is infrequent, and evidence shows a range of incidence rates and prevalence. The purpose of this study was to investigate prevalence of asthma, undiagnosed asthma, and EIB in collegiate athletes practicing and performing in indoor arenas for winter sports. METHODS: Data collection occurred between mid- and late-fall. The testing protocol began with baseline spirometry; athletes expired maximally and were encouraged to achieve a 6-second plateau. Values were taken in duplicate. Subjects failing to achieve a forced expiratory volume in one second (FEV1) at or over 70% of a predicted value were noted and removed. Athletes followed with performance of a bout of exercise intensifying to 80-90% of predicted maximal heart rate. Confirmation of appropriate exercise intensity was verified with maximal ventilation values (35*FEV1, 70.5 and 35*FEV1, 70.6). Athletes continued at target heart rate for 4 minutes. Athletes repeated maximal spirometry efforts post-exercise at 2, 5, 10, 15, and 20 minutes. All tests were reviewed by a registered respiratory therapist, and a drop in FEV1 > 10% from baseline was considered positive for EIB. RESULTS: Sixty athletes (wrestling or basketball, males=48, females=12) volunteered for testing. Four athletes confirmed previous diagnosis of asthma. Among the 56 tested, 54 obtained a minimum of 70% of predicted FEV1 at pre-test (2 wrestlers were noted and removed). Among the 54 undergoing the exercise protocol, 11 (of 54=20.4%) tested positive for EIB as they failed to maintain 90% of their pre-exercise FEV1 (mean drop 14.2±2.3%) at one of the post-exercise time points. In 3 subjects, one from each sport, results were not conclusive. CONCLUSIONS: Evidence of reduced pulmonary function was present in athletes across the sports spectrum. Over 20% of the athletes experienced undiagnosed asthma or underlying EIB, which may have been exacerbated by seasonal patterns. Awareness and systematic testing of these pulmonary conditions in collegiate athletes would support health and potentially effect performance outcomes.

1536 Board #298 May 30 10:30 AM - 12:00 PM
Chronic Respiratory Assessment Over Time Following Participation In Norseman Extreme Triathlon.
Trine Stensrud1, Maria Mathiassen2, Jørgen Melau1, Hege N. Østgård1, Jonny Hidstål2, Julie Stang1, Østgård1, Jonny Hisdal4, Julie Stang1.

1Norwegian School of Sport Sciences, Oslo, Norway. 2Telemark Hospital Trust, Skien, Norway. 3Vestfold Hospital Trust, Tonsberg, Norway. 4Oslo University Hospital, HF, Oslo, Norway.

Email: trine.stensrud@nih.no

(No relevant relationships reported)

Patients with acute respiratory failure (ARF) show changes in skeletal muscle structure and strength. PURPOSE: The purpose of this study was to examine the relationship between muscle thickness (MT), echogenicity, and strength in patients with ARF.

METHODS: Thirteen (6 females/7 males) patients with ARF participated in the study. Knee extensor (KE) strength was measured via a hand-held dynamometer and quadriceps images were obtained via ultrasonography at hospital discharge. The ultrasound images were used to obtain MT and standard deviation echogenicity of the rectus femoris, vastus lateralis (VL), and vastus medialis. Partial correlations, controlling for age BMI and fluid intake, were used to describe the relationships between the muscle strength and echogenicity. R² values were obtained for the standard deviation of echogenicity, and holding constant the correlation between the BMI and fluid intake (r = 0.69, P = 0.029). Mean ± standard deviation for KE extensor, and MT and standard deviation of echogenicity were 19.1 ± 8.0 kg and 19.8 ± 5.4 units. No other correlations between strength and ultrasound measures were found to be significant. CONCLUSION: This study shows the potential of muscle weakness to be significantly correlated with skeletal muscle weakness in patients with ARF. As such, it may be helpful in identifying muscle weakness in these patients when they are unable or unwilling to perform voluntary strength testing.

1537 Board #299 May 30 10:30 AM - 12:00 PM
Participation In Norwegian Extreme Triathlon; The Effect On Lung Function And Oxygen Saturation.
Trine Stensrud1, Maria Mathiassen2, Jørgen Melau1, Hege N. Østgård1, Jonny Hidstål2, Julie Stang1, Østgård1, Jonny Hisdal4, Julie Stang1.

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(No relevant relationships reported)

PURPOSE: Primary: To examine changes in lung function, forced expiratory volume in one second (FEV1) and forced vital capacity (FVC), and oxygen saturation (SpO2) from before to after participation in Norwegian extreme triathlon, consisting of 3.8 km open water swim, 180 km cycling and 42 km running. Secondly: To assess possible relationships between the physiological variables and respiratory symptoms and training volume. METHODS: In a quasi-experimental non-controlled study, 57 recreational triathletes (45 males and 12 females) aged 40.3 (9.0) years (mean (SD)) measured lung function by maximal expiratory flow volume loops (FEV1 and FVC) and SpO2, by pulse oximetry the day before the race, 8-10 minutes after finishing the race and the day after the race. Weekly training volume and respiratory symptoms were recorded with a modified AQUA-questionnaire at baseline. Anova for repeated measures was used to test for differences in lung function and SpO2, and statistical significance was accepted at 0.05 level. The study was approved by the Regional Ethical Committee.
RESULTE: Twenty-six participants (46%) developed exercise-induced bronchoconstriction (EIB) defined as ≥10% reduction in FVC, from baseline immediately after the race and 16 participants (28%) had still EIB the day after the race. FVC and FEV1 were significantly reduced immediately after the race (mean: 8.9% and 11.8% respectively) and the day after the race (mean: 6.2% and 7.5% respectively). Thirty-five participants (61%) developed mild to moderate exercise induced arterial hypoxemia (EIAH) defined as ≥2% reduction in SpO2 from baseline. Further, oxygen saturation was significantly reduced immediately after the race (mean: 4.6%) and the day after the race (mean: 2.4%), respectively. There were no significant correlation between changes in lung function and SpO2, respiratory symptoms or training volume (p>0.05). CONCLUSIONS: Our results demonstrated that 46% of the participants developed EIB and 61% developed EIAH after Norseman extreme triathlon. The reduction in lung function may be due to fatigue in the respiratory muscles. Further investigation is needed to confirm our results as well as examine the mechanisms in age group triathletees.

C-48 Exercise is Medicine®/Poster - EIM - Cancer, Diabetes, Metabolic Syndrome, Obesity

THURSDAY, MAY 30, 2019
Room: CC-Hall WA2

1539 Board #301 May 30 10:30 AM - 12:00 PM
Selective Effectiveness Of 10wk-exercise Protocols On Mets Reduction
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(Please note: metabolic syndrome (Mets).)

MetS is recognized as a pervasive condition whose abnormalities result from a mismatch between contemporary environment and our ancient tailored genome. Hence, diet and physical exercise are considered the pillars in the implementation of effective strategies against MetS.

Table: Resistance-training induced regional body composition changes in females with obesity vs. normal weight obesity

<table>
<thead>
<tr>
<th>Group</th>
<th>BMI (±SD)</th>
<th>%BF (±SD)</th>
<th>%∆LTfat (±SD)</th>
<th>%∆RTfat (±SD)</th>
<th>%∆LAfat (±SD)</th>
<th>%∆RAfat (±SD)</th>
<th>%∆LLfat (±SD)</th>
<th>%∆RLfat (±SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obese</td>
<td>34.1±3.3</td>
<td>49.2±2.9</td>
<td>4.6±3.2</td>
<td>2.4±2.9</td>
<td>4.6±3.2</td>
<td>2.4±2.9</td>
<td>4.6±3.2</td>
<td>2.4±2.9</td>
</tr>
<tr>
<td>Normal Weight</td>
<td>22.2±1.8</td>
<td>35.1±4.5</td>
<td>1.9±1.3</td>
<td>1.9±1.3</td>
<td>1.9±1.3</td>
<td>1.9±1.3</td>
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</table>

PURPOSE: The responses of MetS subjects to different types of physical exercises was investigated in a dynamic cohort study ("Move for Health" program) based on spontaneous demand for healthy lifestyle with supervised exercises and dietary counseling.

METHODS: Demographic, socio-economic and physical activity was recorded from IPAQ (version 8) and, dietary quality (HEI) and food intake, from a 24h questionnaire recall. Anthropometry and fast-blood analysis were used for MetS diagnosis (NCEP-ATP III). After clinical selection and baseline assessments they were spontaneously assigned to structured protocols involving supervised exercises of strength (PhC, n=43) or combined with endurance (walking exercises) (PhM, n=116), hydro-gymnastics (PhY, n=50) and treadmill high-intensity exercises (PhHt, n=63), applied during 10 weeks. Nutritional counseling was conducted weekly. Protocols were compared statistically using SAS vs 9.3 for p<0.05.

RESULTS: Sample of 55.5 ± 108 yrs old (n=302), predominantly female (88%), presented adequate physical activity (91%), cardio-respiratory fitness (63%) and strength (78%), referring themself as in good health (67,8%). At baseline, groups were similar in anthropometry, fitness and MetS (averaging 48,7%). Altered components of MetS ranked from waist circumference (72.9%) to triglycerides (37.9%). After 10-wk of exercises, increased aerobic capacity was found in all groups and, strength only in PhC and PhM. MetS reduction averaged 16.9%, mainly and significantly in PhY (25.4%) and PhM (12.7%). Among the MetS components, a major decreasing to exercise protocols was found in hyperglycemia (20.6%) and hypertension (15.9%).

CONCLUSIONS: The reduction of MetS occurred in different types of physical exercises with higher responsiveness in PhY and PhM having hyperglycemia and hypertension as its most responsive components.Support CNPq and CAPES.

Diabetes is present in 9.4% of American adults. Insulin is used in Type 1 and Type 2 cases, but without lifestyle change, it can hasten the progression of the disease. Limited data supports an association between diabetes and fall risk in older adults, with greater risk found among insulin-treated patients. Little is known about different insulin classes.

PURPOSE: To evaluate the effect of insulin classes on incidence of falls in older adults.

METHODS: We conducted retrospective and prospective analyses of 615 hospital patients age ≥65 years who sustained a fall in 2015. Data was extracted from their first fall-related admission that year, including demographic reports, health history, injury characteristics, relevant diagnoses, and home medications. We exported the number of previous falls since 2010 and used logistic and Poisson regressions to test the effect of insulin on the odds of experiencing falls and the total number experienced. We then tracked patients forward until August 2016 and tested the effect of insulin on return visits for new fall-related admissions.

RESULTS: Patients were trained at 80% of their 1-repetition maximum.

Results: Non-parametric tests showed a statistically significant difference in %∆LTfat (P<0.05) and %∆RTfat (P<0.05) in the resistance training obesity group when compared to control. No statistically significant changes were found in NWO group.

Conclusion: Resistance training has shown to induce significant changes in the obesity group by reducing LTfat content. However, no changes were detected in the NWO group. Future research should include larger sample size to facilitate the detection of regional body composition changes and to help understand the differential impact of resistance training in women with obesity and NWO.
**1541** Board #303 May 30 10:30 AM - 12:00 PM
The Effects of Traditional Chinese Exercise on Sugar Metabolism And Physical Fitness
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**Purpose:** Exercise therapy of traditional Chinese medicine (TCM) has a long history in treating diabetes. Few evidence to date have shown its effects on the glucose metabolism and muscle fitness. We evaluated the effects of TCM exercise therapy and sedentary lifestyle on sugar metabolism and physical fitness in both female individuals with prediabetes and type II diabetes mellitus (T2DM).

**Methods:** Thirty-three diabetic subjects and 33 prediabetic subjects were randomly divided into the exercise therapy group (diabetic: ED, prediabetic: EP) or sedentary group (diabetic: CD, prediabetic: CP) as a 2:1 ratio. ED and EP groups were given the same traditional exercise for moderate intensity, 50min, 3 times a week. Hemoglobin a1c (HbA1c), fasting insulin, oral glucose tolerance test (OGTT), peak oxygen uptake (VO2peak), grip strength, back strength, and sit-ups (muscle endurance) were taken at the pro and post of 12-week exercise. Responses were compared between prediabetics and diabetics.

**Results:** Compared with CP and CD group, HbA1c decreased by 0.156 mmol/L (P < 0.05) and 0.45 mmol/L (P < 0.01) with EP and ED, respectively. Fasting insulin decreased by 4.61 cycles U/mL in EP group, and 13 of them returned to normal blood glucose, both fasting and postprandial ones, according to the OGTT test. The VO2peak, muscle strength and endurance of the diabetic groups were significantly lower than those of the prediabetic groups (P < 0.001). VO2peak of the exercise groups increased significantly (EP: +6.55%, ED: +33.43%, P < 0.001). Muscle fitness improvements were significantly (P=0.05) on the grip strength (ED=+1.75kg,CD=-0.44kg), back strength (ED=+8.47kg,CD=-0.27kg), and sit-ups (ED=3.50 more,CD=0.18 less) in diabetic groups but not obvious in prediabetic groups.

**CONCLUSIONS:** The development of Baduanjin exercise went through five periods: ① The Northern Song Dynasty from 960 to 1127 AD was the formation period of movements; ② It became popular in the Southern Song Dynasty from 1127 to 1279 AD and was first recorded in the book “Yijianzhi”. And it became mature from the Southern Song Dynasty to Yuan Dynasty of 1280; ③ It was widely spread and promoted in the Ming and Qing Dynasties from 1368 to 1912; ④ After the foundation of the People’s Republic of China in modern times, a lot of books in regard to Baduanjin exercise were published. The fitness qigong management center of General Administration of Sport of China organized the compilation and creation of the exercise, which was named “fitness qigong ‘Baduanjin exercise’. The nationwide fitness program was carried out actively and the exercise was promoted around the world. (2) After practicing Baduanjin exercise for 3-6 months, FBG and HbA1C can be significantly reduced. BP, TG and blood lipid levels such as LDL-C,HDL-C can be adjusted. The SNCV and MNCV can be enhanced. Psychological index scores such as HAMD, SDS, SAS, DSQL and so on of diabetes patients with depression or anxiety can be improved.

**CONCLUSIONS:** The development of Baduanjin exercise went through five stages. As an exercise therapy, it can improve glucose and lipid metabolism and diabetic neuropathy. The level of mental health can be enhanced. Therefore, it deserves to be widely promoted and co-developed internationally to gain more benefits.

**Fund support:** The Technology Research Project of the fitness qigong center of General Administration of Sport of China (QG2017038)

**1542** Board #304 May 30 10:30 AM - 12:00 PM
Combined Metformin and Exercise Treatment Improves Glucose Control and Insulin Sensitivity in Type-2 Diabetes Patients
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**BACKGROUND:** The antidiabetic medicine, Metformin, and exercise are cornerstones in the treatment of type-2 diabetes. However, there is conflicting evidence about the benefits of combining both interventions. **PURPOSE:** To compare free-living ambulatory glycemic control and insulin sensitivity among the separated and combined effects of metformin and exercise.

**METHODS:** Twelve middle-aged (55.5 ± 1.4 years) adults, diagnosed with type-2 diabetes and obesity (BMI 32.0 ± 2.1 kg/m²) undergoing pharmacological treatment with metformin (>1 year) participated in the study. All participants underwent 4 trials in a randomized order: i) taking their habitual doses of metformin (MET), ii) after 48-hours of metformin withdrawal, which was replaced by two (45 min) daily bouts of high-intensity interval training (EX), iii) combining medicine and exercise (MET+EX), and iv) a Control trial withdrawing from metformin (48-hours) and exercise (CONT). Ambulatory glycemic control was inferred from interstitial fluid glucose concentration (IFG), which was frequently monitored during 72 h (FreeStyle Libre, Abbott, USA) in each experimental condition. In addition, after an overnight fasting, a blood sample was collected 24 h after each experimental condition for the assessment of glucose and insulin concentration and subsequent calculation of insulin sensitivity (i.e., HOMA-IR). RESULTS: During the 72 hours of IFG monitoring an average of 109 + 11 readings per trial were obtained (i.e., 15 readings per hour). IFG in EX (7.3 ± 1.9 mmol/L) was similar than CONT (7.3 ± 1.9 mmol/L; P=0.604). However, in MET (6.9 ± 1.6 mmol/L) and MET+EX (6.6 ± 1.3 mmol/L) IFG was significantly lower than CONT (P<0.001 and P=0.05, respectively). IFG peaks (i.e., IFG > 11.1 mmol/L) were more frequent in CONT than in the rest of the trials. However, IFG peaks frequency was lower in MET+EX than in MET (P=0.025) and EX (P=0.030). Finally, insulin resistance (i.e., HOMA-IR) was lower than CONT in MET+EX (P=0.031) and in MET (P=0.001) but not in EX alone. **CONCLUSIONS:** The combination of metformin and exercise reduces the occurrence of IFG peaks thus improving glucose control in a sample of type-2 diabetes individuals in a free-living situation. Monitoring of IFG seems adequate to track the effects of both, exercise and pharmacological treatment (metformin).

**1543** Board #305 May 30 10:30 AM - 12:00 PM
A Review Of Intervention Of Baduanjin For Diabetes And Complications
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**PURPOSE:** The traditional Chinese guidance technique–fitness qigong ‘Baduanjin exercise’, which means the eight-section brocade exercise in English, has the functions of body building. It is widely used in diabetic patients as exercise therapy, we systematically reviewed the history and role of Baduanjin exercise applied to diabetes and its complications.

**METHODS:** The source and historical evolution of Baduanjin exercise were systematically analyzed based on ancient Chinese literature. Health benefits of Baduanjin exercise intervention in diabetes and its complications were summarized based on clinical research literature.

**RESULTS:** The development of Baduanjin exercise went through five periods: ① The guidance technique in ancient times about 2000 BC was its origin; ② The Northern Song Dynasty from 960 to 1127 AD was the formation period of movements; ③ It became popular in the Southern Song Dynasty from 1127 to 1279 AD and was first recorded in the book “Yijianzhi”. And, it became mature from the Southern Song Dynasty to Yuan Dynasty of 1280; ④ It was widely spread and promoted in the Ming and Qing Dynasties from 1368 to 1912; ⑤ After the foundation of the People’s Republic of China in modern times, a lot of books in regard to Baduanjin exercise were published. The fitness qigong management center of General Administration of Sport of China organized the compilation and creation of the exercise, which was named “fitness qigong ‘Baduanjin exercise’. The nationwide fitness program was carried out actively and the exercise was promoted around the world. (2) After practicing Baduanjin exercise for 3-6 months, FBG and HbA1C can be significantly reduced. BP, TG and blood lipid levels such as LDL-C,HDL-C can be adjusted. The SNCV and MNCV can be enhanced. Psychological index scores such as HAMD, SDS, SAS, DSQL and so on of diabetes patients with depression or anxiety can be improved.

**CONCLUSIONS:** The development of Baduanjin exercise went through five stages. As an exercise therapy, it can improve glucose and lipid metabolism and diabetic neuropathy. The level of mental health can be enhanced. Therefore, it deserves to be widely promoted and co-developed internationally to gain more benefits.

**Fund support:** The Technology Research Project of the fitness qigong center of General Administration of Sport of China (QG2017038)

**1544** Board #306 May 30 10:30 AM - 12:00 PM
Relationships Between Exercise Level, Beliefs About Exercise, And Exercise Promotion Among Cardiologists And Oncologists
Heather Leach1, Keli LeBreton1, Barry Braun, FACSM1, Steven Schuster2, Patrick Greene3. Colorado State University, Fort Collins, CO. 1University of Colorado Health, Aurora, CO.
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**PURPOSE:** This study examined the relationships between cardiologists’ and oncologists’ exercise levels, beliefs about exercise for their patients, and frequency of discussing exercise and recommending it. **METHODS:** A survey was distributed to oncologists and cardiologists via Qualtrics. Questions and responses were: (1) “I believe exercise is safe for most of my patients, most of my patients are capable of exercise, exercise is effective for improving my patients’ well-being, and exercise can reduce likelihood of disease recurrence, or increase chances of survival in my patients (strongly disagree to strongly agree).” (2) “How often do you discuss exercise with your patients?” (none/few, some, most/all visits), (3) “What percent of patients have you recommended should exercise in the past month?” (none/few, some, most/all), and (4) “How do you provide information about exercise” (referral as a yes/no option). Self-reported exercise was categorized at meeting exercise guidelines or not. Fisher’s Exact (FE) tests with Cramer’s V were used to compare the proportion of responses in each category between questions. **RESULTS:** Of 154 surveys distributed, 58 (n=25 cardiologists, n=33 oncologists) were returned (37.7% response rate). Respondents were M=45.7±11.3 years old and 63.6% male. Those who agreed (vs. neutral/disagree) with “…exercise can reduce likelihood of disease recurrence…” were more likely to refer patients to an exercise program (FE=5.588, p=0.040, V=0.324). Cardiologists who agreed with the same statement were more likely to discuss exercise at most/all patient encounters.
Conclusion

A 12-week Baduanjin exercise training program led to improvements in the quality of life and sleep quality of breast cancer patients receiving AIs.

1547 Board #309 May 30 10:30 AM - 12:00 PM Evaluating The Translation Of Dutch Exercise Oncology Trials Into Clinical Practice Using The RE-AIM Framework

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PurposE: Implementation of exercise programs for cancer patients is challenging. This study evaluated the potential for implementation of exercise programs from Dutch exercise oncology trials.

Methods: Three randomized controlled trials (PACES, REACT, PACT), examining effects of exercise during or following chemotherapy treatment with curative intent, were evaluated using the 5 dimensions of the RE-AIM framework: Reach, Effectiveness, Adoption, Implementation, and Maintenance.

Results: Reach: Participation rates were 37-45%. Compared to non-participants, participants were higher educated, less fatigued or distressed, and had higher scores on behavioral variables. Effectiveness: No serious exercise-related adverse events occurred. Significant benefits of exercise were found for physical fitness, fatigue, and quality of life. A significant benefit on chemotherapy completion was found in one study but not in another. Adoption: To enable twice weekly exercise session attendance close to patients’ homes, local physiotherapists (PTs) were educated about exercise supervision for cancer patients. Generally, the PTs felt sufficiently capable to deliver exercise programs, but less capable to support behavioral change. Implementation: 61-89% of participants had high attendance at the supervised sessions. Education, additional radiotherapy, BMI, fatigued and self-efficacy predicted adherence in some studies. Basic insurance does not cover the program, but some additional coverage policies do. Some evidence for cost-effectiveness of the programs was found.

Maintenance: Exercise-induced improvements in physical fitness and quality of life post cancer treatment, and benefits from exercise during chemotherapy on physical activity and function maintained, whereas maintenance of fatigue benefits were inconsistent across studies. Sustainability of program delivery is ensured by incorporation of the exercise protocols in post-graduate oncology education for PTs. A quality control system has been implemented via OncoNet.

Conclusions: The exercise programs have high potential for successful implementation in clinical oncology practice, but reach and adherence should be monitored, and lack of reimbursement is currently a barrier. Future studies should focus on improving maintenance of benefits.

1548 Board #310 May 30 10:30 AM - 12:00 PM Effects of Different Volumes of Combined Training in Breast Cancer Survivors: A Pilot Study

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Purpose: We aimed to assess the effects of different volumes of eight-week combined training on neuromuscular, cardiorespiratory, fatigue and quality of life parameters in breast cancer patients in stages I-III who have finished treatment, such as surgery, chemotherapy and radiotherapy. METHODS: Ten women (57.1 ± 9.6 years) were placed into either a group based on a single set (SS) protocol or a group following multiple sets (MS) protocol for prescribed resistance exercises. The eight-week combined training included resistance and aerobic exercise within the same training sessions, which were performed twice a week. Resistance exercises were performed with sets of maximal repetitions and along the training the number of repetitions decreased. The intensity of aerobic exercise was based on the anaerobic threshold, monitored by relative heart rate (first weeks) or velocity of the anaerobic and aerobic thresholds (last weeks). Before and after the intervention, the following variables were evaluated: maximal dynamic and isometric strength of knee extensors, maximal isometric electromyography (EMG) activity of vastus lateralis, muscle thickness of quadriceps, peak oxygen uptake, fatigue and quality of life. The training-related effects were assessed using a Generalized Estimating Equations and Bonferroni post-hoc test (p<0.05). RESULTS: The maximal dynamic strength of knee extensors (SS: 32.10 ± 45.70 vs. MS: 23.33 ± 13.59%, p<0.001), muscle thickness of quadriceps (SS: 14.60 ± 4.64 vs. MS: 25.50 ± 19.30%, p<0.001), peak oxygen uptake (SS: 8.67

1545 Board #307 May 30 10:30 AM - 12:00 PM Effects of Exercise on Sexual Function in Men with Advanced Prostate Cancer.

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Purpose: To report the effects of a 12-week modular multimodal exercise program (M3EP) comprising of resistance, aerobic and flexibility training on sexual health and function in men with advanced prostate cancer. METHODS: Prostate cancer patients (70.0 ± 8.4 yr; body mass index 28.7 ± 4.0 kg·m−2) with bone metastases (rib/thoracic spine, additional radiotherapy, BMI, fatigue and self-efficacy predicted adherence in some studies. Basic insurance does not cover the program, but some additional coverage policies do. Some evidence for cost-effectiveness of the programs was found. Maintenance: Exercise-induced improvements in physical fitness and quality of life post cancer treatment, and benefits from exercise during chemotherapy on physical activity and function maintained, whereas maintenance of fatigue benefits were inconsistent across studies. Sustainability of program delivery is ensured by incorporation of the exercise protocols in post-graduate oncology education for PTs. A quality control system has been implemented via OncoNet.

Conclusions: The exercise programs have high potential for successful implementation in clinical oncology practice, but reach and adherence should be monitored, and lack of reimbursement is currently a barrier. Future studies should focus on improving maintenance of benefits.

1546 Board #308 May 30 10:30 AM - 12:00 PM Baduanjin’s Impact on Quality of Life and Sleep Quality in Breast Cancer Survivors Receiving: An Intervention Study

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Purpose: To investigate the impact of Baduanjin, a traditional Chinese exercise intervention, on quality of life and sleep quality in breast cancer survivors receiving aromatase inhibitors (AIs).

Methods: A 3-month intervention study was conducted in 68 breast cancer survivors who were receiving treatment with aromatase inhibitors (AIs). All patients were instructed to participate in 12 weeks of Baduanjin exercise training, which involved three 90-minute sessions per week. Group 1 attended ≥2 sessions per week (n=33), while group 2 attended <2 sessions per week (n=35). Questionnaires measuring quality of life (QOL) and sleep quality were completed at baseline and 3 months after the intervention. Quality of life was assessed using the European Organization for Research and Treatment of Cancer Quality-of-Life Questionnaire Core 30 (EORTC QLC-C30). Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI).

Results: The indexes of quality of life, which included functional scores, general health and symptom relief, significantly improved in group 1 (p<0.05) and had a larger effect size compared to group 2 (P value for group difference <0.05). Compared with group 2, group 1 had a higher score on the functional scales (p<0.05), while the functional scale scores for group 2 worsened. The overall PSQI score in group 1 decreased by 4.85 points (47.92%) (p<0.01) and was lower than that of group 2 (P for group difference < 0.05).

Conclusion: A 12-week Baduanjin exercise training program led to improvements in the quality of life and sleep quality of breast cancer patients receiving AIs.
FEASIBILITY OF EXERCISE PREHABILITATION DURING NEOADJUVANT CHEMOTHERAPY IN OESOPHAGO-GASTRIC CANCER SURGERY

Janine Zystra1, Andrew R. Davies1, Jim Pate2, Gemma Tham1, Nick Maisey1, Cara R. Baker1, Mark Kelly1, James Gossage1, Mike Browning1, Greg Whyte1. 1Guy’s and St Thomas’ NHS Foundation Trust, London, United Kingdom. 2Centre for Health and Human Performance, London, United Kingdom. 3Maidstone and Tunbridge Wells NHS Trust, London, United Kingdom. 4Liverpool John Moores’ University, Liverpool, United Kingdom. Email: janine.zystra@gstt.nhs.uk

(Purpose: To determine the feasibility and potential benefits of patients diagnosed with operable gastro-oesophageal cancer undertaking a structured-exercise cancer prehabilitation program (prehab) during neo-adjuvant chemotherapy (NAC) versus patients on a standard care pathway.

Methods: Patients were enrolled in a prospective, cohort-controlled trial. Prehab was based on World Health Organisation (WHO) “recommended levels of physical activity for adults over the age of 18”. Cardiopulmonary exercise tests (CPEX) were performed at 4 time-points: 1. Baseline. 2. Pre-NAC. 3. Post-NAC. 4. After surgery. Participants wore wearable tracker devices. CPEX variables analysed included anaerobic threshold (AT) and peak oxygen uptake (VO2peak). Clinical and pathological data variables were recorded.

Results: At time of writing, 25 male and female patients, aged 25 - 78 years, had participated in the study; 22 had undergone surgery. Mean baseline AT in the prehab group was 17.57 ± 3.35SD (range 10.77 - 20.94; n=20) mL/kg/minute, compared to 15.19 ± 3.57SD (range 11.10 - 22.90; n=12) mL/kg/minute in the control group. Mean baseline VO2peak achieved was 27.55 ± 6.35SD (range 15.18 - 36.83) mL/kg/minute and 23.39 ± 4.06SD (range 18.75 - 29.94) mL/kg/minute, respectively. Mean values of AT and VO2peak between the groups pre-surgery were of little scientific value. However, VO2peak in individual patients showed a trend towards improvement in the prehab cohort. Post-surgery values decreased markedly in both groups:
Mean AT prehab decreased to 13.46 ± 2.29SD (range 10.54 - 19.91) mL/kg/minute versus 13.10 ± 2.60SD (range 10.18 - 18.4) mL/kg/minute in control group.
Mean VO2peak reduced to 20.33 ± 4.94 (range 14.01 - 26.81) mL/kg/minute compared to 19.56 ± 2.74SD (range 18.04 - 24.76) mL/kg/minute respectively.

Conclusions: Cancer prehabilitation during NAC is feasible. Recovery of peak oxygen uptake shows an improvement trend in patients undergoing prehab during and after NAC. Post-surgery mean AT and VO2 values confirm physiological stress in patients undergoing high-risk, intra-thoracic and intra-abdominal oesophagectomy.
PURPOSE: Most childhood acute lymphoblastic leukemia (ALL) survivors develop chronic treatment-related adverse effects several years after the end of therapy. A regular practice of physical activity and a good cardiorespiratory fitness have the potential to reduce the risk of chronic diseases and to improve quality of life. It is currently unknown whether a good cardiorespiratory fitness or the regular practice of physical activity is enough to induce a preventive action on late adverse effects. The first aim of this study was to evaluate the association between a good cardiorespiratory fitness and major long-term health outcomes. The second aim of this study was to assess the association between the respect of physical activity guidelines and major long-term health outcomes.

METHODS: 247 ALL survivors underwent a cardiopulmonary exercise test. They calculated the odds ratio to obtain the preventive fraction in order to evaluate the potential to reduce the risk of chronic diseases and to improve quality of life. It is currently unknown whether a good cardiorespiratory fitness or the regular practice of physical activity is enough to induce a preventive action on late adverse effects. The first aim of this study was to evaluate the association between a good cardiorespiratory fitness and major long-term health outcomes. The second aim of this study was to assess the association between the respect of physical activity guidelines and major long-term health outcomes.

RESULTS: Despite their young age, 88% of the survivors presented at least one adverse health outcome, and 46% presented 3 or more adverse health outcomes. Their cardiorespiratory fitness had a median VO2 peak reaching 84% of predicted value, which was lower than expected. In the analyses regarding cardiorespiratory fitness, statistically significant preventive fractions were observed for obesity (30%), low HDL-cholesterol (21%) and depression (26%). In the physical activity level analyses, statistically significant preventive fractions were observed for obesity (55%), depression (81%) and low bone mineral density (60%).

CONCLUSIONS: Our results indicated that a good cardiorespiratory fitness and physical activity level induced a preventive action for most health outcomes studied and was associated with a lower late adverse effects prevalence in ALL survivors. This study provides additional evidence regarding the benefits of physical activity for cancer survivors.

Although growing evidence suggests a link between physical activity (PA) behavior and sleep quality in adolescents, a causal relationship between these two variables has yet to be elucidated. Methodological differences in data collection (subjective vs. objective) has been highlighted as a limiting factor in data interpretation. In fact, the majority of the literature includes subjective or combined with objective data, with only two studies comparing objective measures of both PA and sleep in adolescents within the same analysis. PURPOSE: To objectively examine PA behavior and sleep activity in adolescents using accelerometers. METHODS: 7 males and 3 females, age: 10±1 yrs., BMI: 20±5 were recruited for this study. PA and sleep were monitored by Actigraph wGT3x accelerometers worn on participants’ non-dominant wrist to assess sedentary (SED), light-intensity (LPA), and moderate-to-vigorous (MVPA) physical activity (i.e. obesity, metabolic health, cardiac health, cognitive health and mood, bone health). RESULTS: On average participants accumulated 435±15 min/day of sleep equal to 7.3±0.3 hours per night. Participants also accumulated 473±24 min/day of MVPA, 371±29 min/day aSED, and 141±18 min/day LPA. There was not a significant difference between TST and MVPA per day (p=0.22). Participants spent the majority of their day sleeping (33% time/day) or engaged in MVPA (31%) followed by aSed (26%), and the fewest proportion of their day engaged in LPA (10%; p<0.01). We observed a negative association between LPA and TST (p=0.01). However, we observed a positive association between LPA and sedentary activity (aSed) and TST (p=0.03). No other significant associations were observed between TST, sedentary activity, and sleep quality in adolescents.

Conclusions: Outcomes of this analysis suggest that adolescents accumulate less than the recommended 8-10 hours of sleep per night and parameters of sleep disturbance may be linked to engaging in higher amounts of light-intensity physical activity.
behaviors with accuracy (errors of omission or commission) or reaction times. Body fat percentage (IRR 1.06, 95%CI: 1.01, 1.12, p=0.026) and total lean mass (kg) (IRR 0.90, 95%CI 0.80, 0.97, p=0.013) were associated with omission errors of inattention. 

CONCLUSION: In this sample of adolescents, total sleep time was associated with body fat and lean mass. Body composition was associated with inattention. Novel interventions that integrate sleep strategies to improve health and cognitive performance in adolescents should be explored.

1556  Board #318  May 30 10:30 AM - 12:00 PM  
What Affects the Sleep of Youth? Results from the 2017 Youth Risk Behavior Surveillance Survey 
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Background/Purpose: Sleep plays a critical role in metabolism, memory, learning, and other vital functions. Sleep deprivation is associated with an increased risk of developing diabetes, cardiovascular disease, and many other complications. However, evidence has shown that youth are sleeping less than before. Understanding what influences sleep time is extremely important in designing interventions to help to improve the sleep time and sleep quality of youth. The aim of this study was to examine the influencing factors of sleep for youth age from 12 to 18 yr.

Methods: The data were derived from the 2017 Youth Risk Behavior Surveillance System (YRBSS) and a total of 14,765 youth responded to the survey. Descriptive analysis was used to explore the sleep patterns and Pearson’s Chi-squared test was applied to examine the gender and race/ethnicity difference. Logistic regression was implemented to explore the impact of health-related behaviors such as physical activity (PA), playing video games (GAME), smoking (SMOKE), and drinking alcohol (DRINK) on sleep time.

Result: Only 23.88% female and 25.78% male reported having 8 or more hours of sleep on an average school night. Significant disparities exist among demographic subgroups of youth defined by gender ($\chi^2 = 5.70, p = 0.02$) and race ($\chi^2 = 30.13, p = 0.00$). Results of logistic regression were displayed in the table below:

<table>
<thead>
<tr>
<th>Factor</th>
<th>Odds Ratio</th>
<th>SE</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.79</td>
<td>0.02</td>
<td>0.00</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>1.08</td>
<td>0.06</td>
</tr>
<tr>
<td>Race</td>
<td>Black</td>
<td>0.94</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td>1.14</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>Asian</td>
<td>0.62</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>Pacific Islander</td>
<td>0.58</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>Native American</td>
<td>0.69</td>
<td>0.22</td>
</tr>
<tr>
<td>Obesity</td>
<td>Non-obese</td>
<td>1.22</td>
<td>0.10</td>
</tr>
<tr>
<td>PA</td>
<td></td>
<td>1.04</td>
<td>0.01</td>
</tr>
<tr>
<td>GAME</td>
<td></td>
<td>0.91</td>
<td>0.01</td>
</tr>
<tr>
<td>SMOKE</td>
<td></td>
<td>1.07</td>
<td>0.03</td>
</tr>
<tr>
<td>DRINK</td>
<td></td>
<td>0.83</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Comparing with Hispanic youth, White youth tended to have longer sleep time ($p = 0.03$) while Asian youth had significantly less sleep time ($p = 0.00$). Youth who were non-obese and physically active were more likely to have 8-hour sleep, while those who played video games and consumed alcohol tended to sleep less.

Conclusion: About 75% of the youth did not meet the 8-hour sleep needs and promote physical activity and reduce alcohol consumption may help to increase the sleep time of youth.